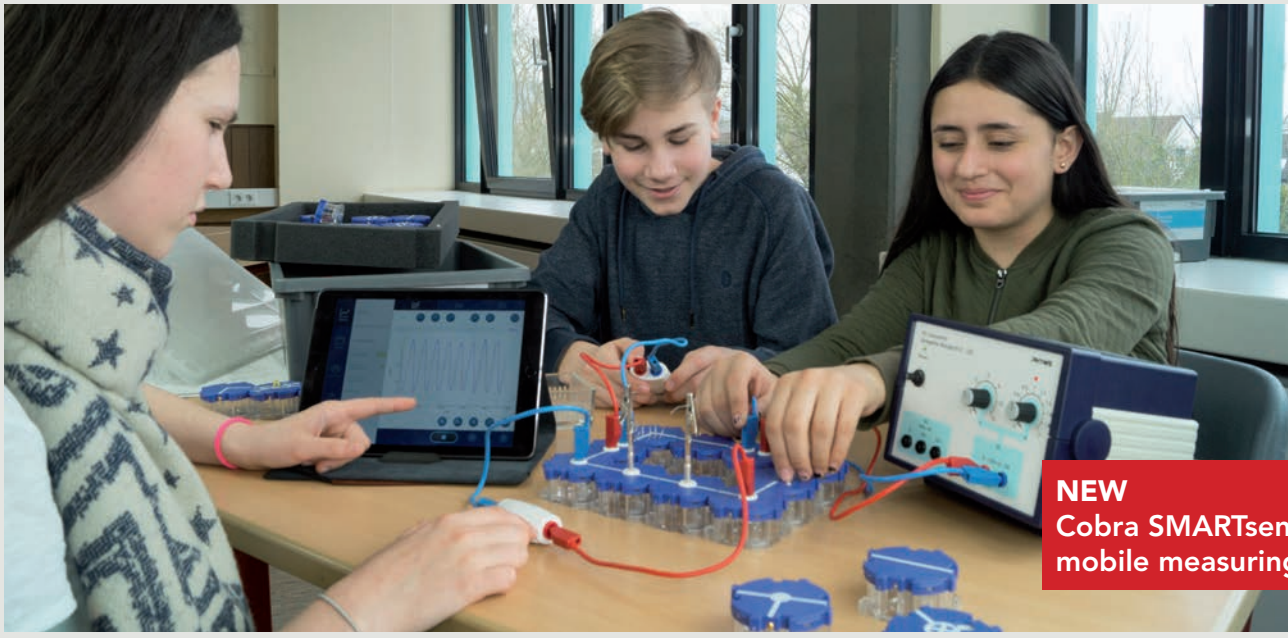
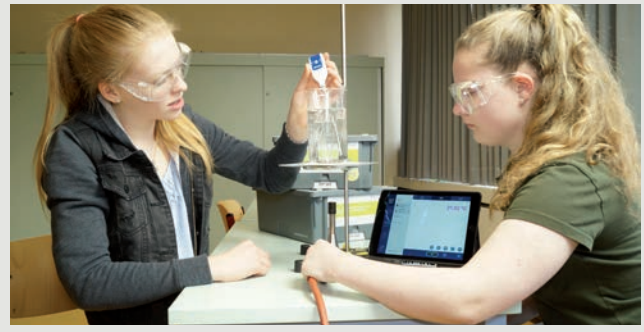
May 2018

PHYWE
excellence in science



NEW
Cobra SMARTsense – mobile measuring

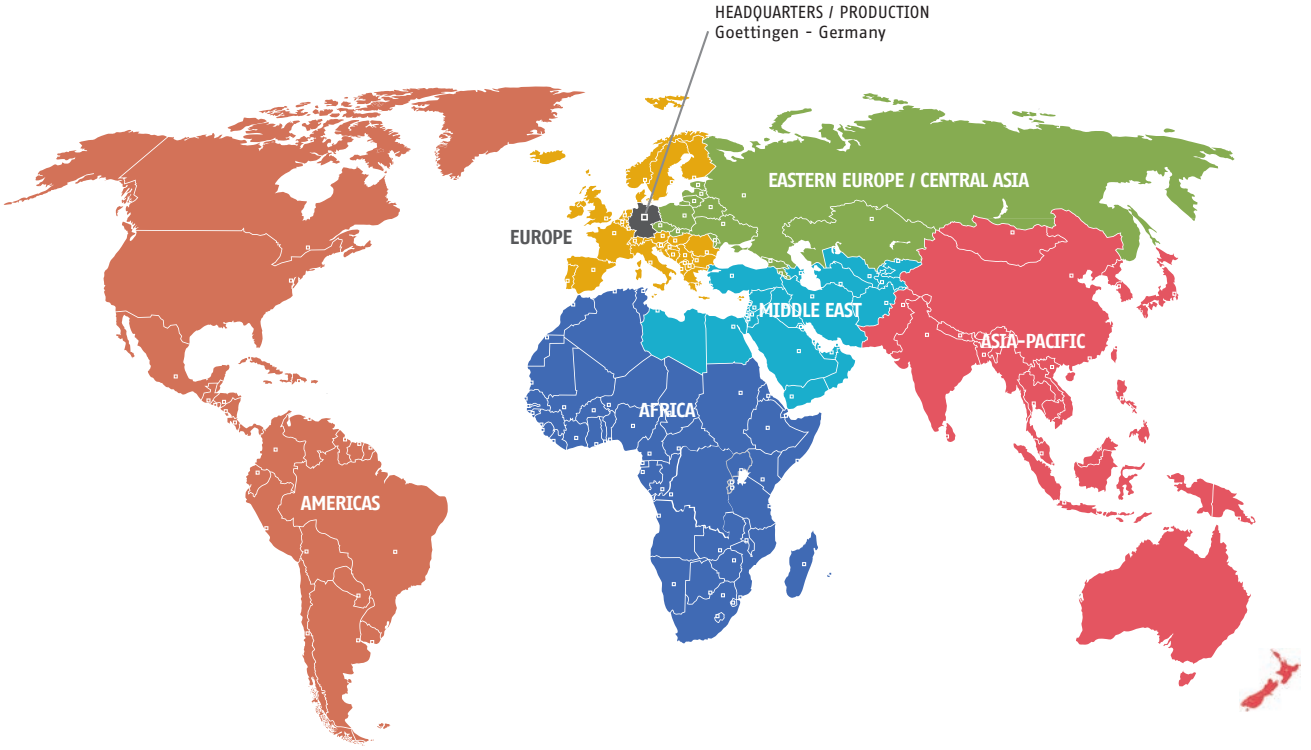


Digital Education for Natural Sciences in Schools

STEM | Physics | Chemistry | Biology

Global network

Your partner is never far away!



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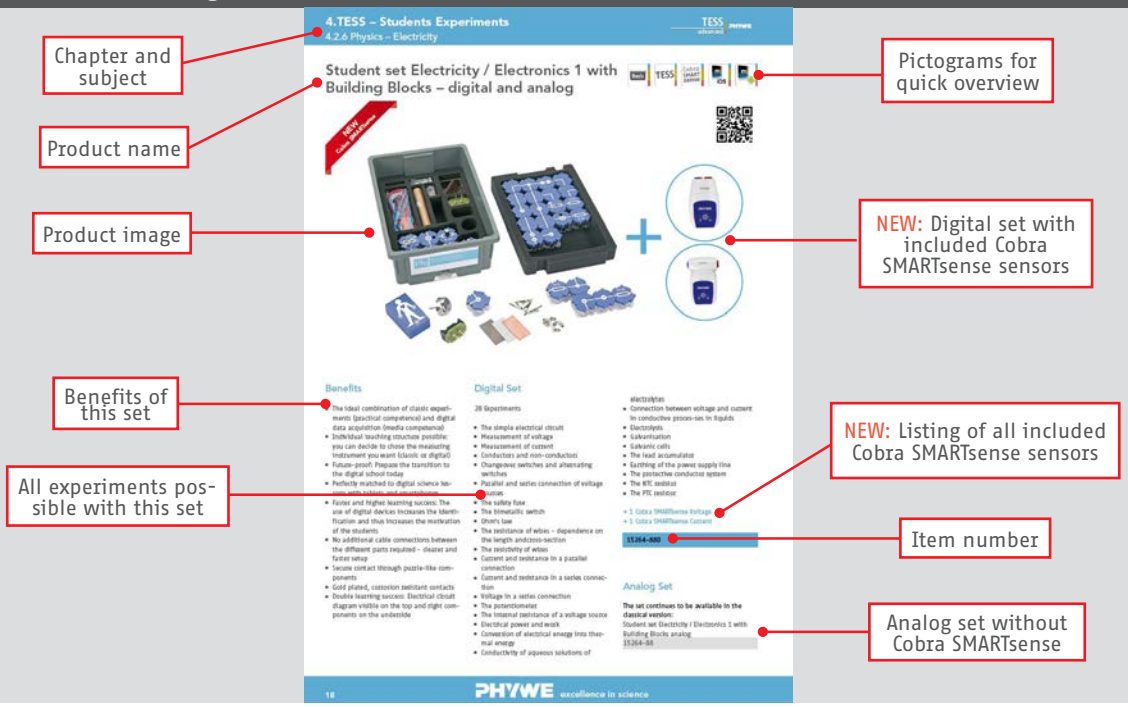
Please do not hesitate to call us. We would be pleased to assign you a personal contact.

Chapter Quick Access:

How to use this catalog



Product Pictograms: At a glance!

NEW: Sets and experiments with digital measurement via Cobra SMARTsense

Free for iOS on App Store

Sets and experiments which allow easy measuring via measureAPP

Free for Android on Google Play

Nobel price winner experiment

Sets and experiments with digital measurement via Cobra4

Student experiments sets (Training-Experiment-System for Students)

Base set, required for supplementary sets

Sets and experiments which require a computer

Teacher experiment sets for demonstrations

Supplementary set requiring a base set

The future is digital, education too!

Digital learning is currently the hot topic in education in schools worldwide. As Product Manager for Digital Education, I am in permanent contact with numerous schools which are now treading the path of digitalization. Many communities and school boards provide their schools with tablet computers. However, they tend to forget to include digital content. With our curriculum-compliant concept and our innovative solutions we have transferred all our PHYWE student and demonstration experiments into the digital world! With our brand new Cobra SMARTsense sensors we bring digital data acquisition to every student workplace: easy, networked, inexpensive!

If you have questions about your digital class, just send me a mail to: digital-education@phywe.de

Alexander Goldmann
Product Manager
Digital Education

Dr. Jan-Gerrit Lonnemann
Product Manager
School

Teaching sciences at school

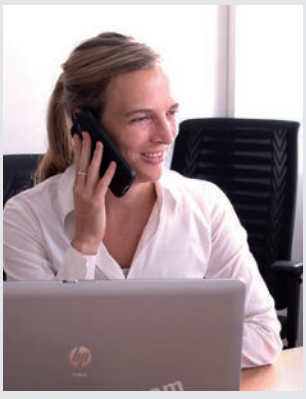
Natural sciences form the basis for many important professional fields as well as degree courses at universities. As Product Manager at PHYWE for schools I experience again and again that the importance of science education is underrated. To counter this trend, PHYWE offers you solutions to prepare and perform perfect experiment-based science classes which inspire students and offer enormous variety. Since all PHYWE solutions harmonize with one another, you can start small and build on that any time later on.

If you have questions concerning school issues, please contact me at: school@phywe.de

Service at PHYWE – premium solutions and instruments require first-class service

Every day my team thinks about how to make your work life easier with our PHYWE solutions. This includes good repair service as a matter of fact. However, we do not stop there. Moreover, we strive to extend our service portfolio with additional unique services. Do you know about our placement and inventory services which allow you to keep an eye on your complete inventory? With the curricuLAB LabManager you never have to search for an item in your inventory any more and you know at a click of the button which experiments you can perform.

If you have questions about service at PHYWE, please contact me anytime at service@phywe.de



Katinka Seever
Product Manager
Service

Cobra SMARTsense and measureAPP –

Digital data acquisition directly integrated in the digital lessons!

+

=

Your easy entry into digital education

Cobra SMARTsense | PHYWE

measureAPP | PHYWE

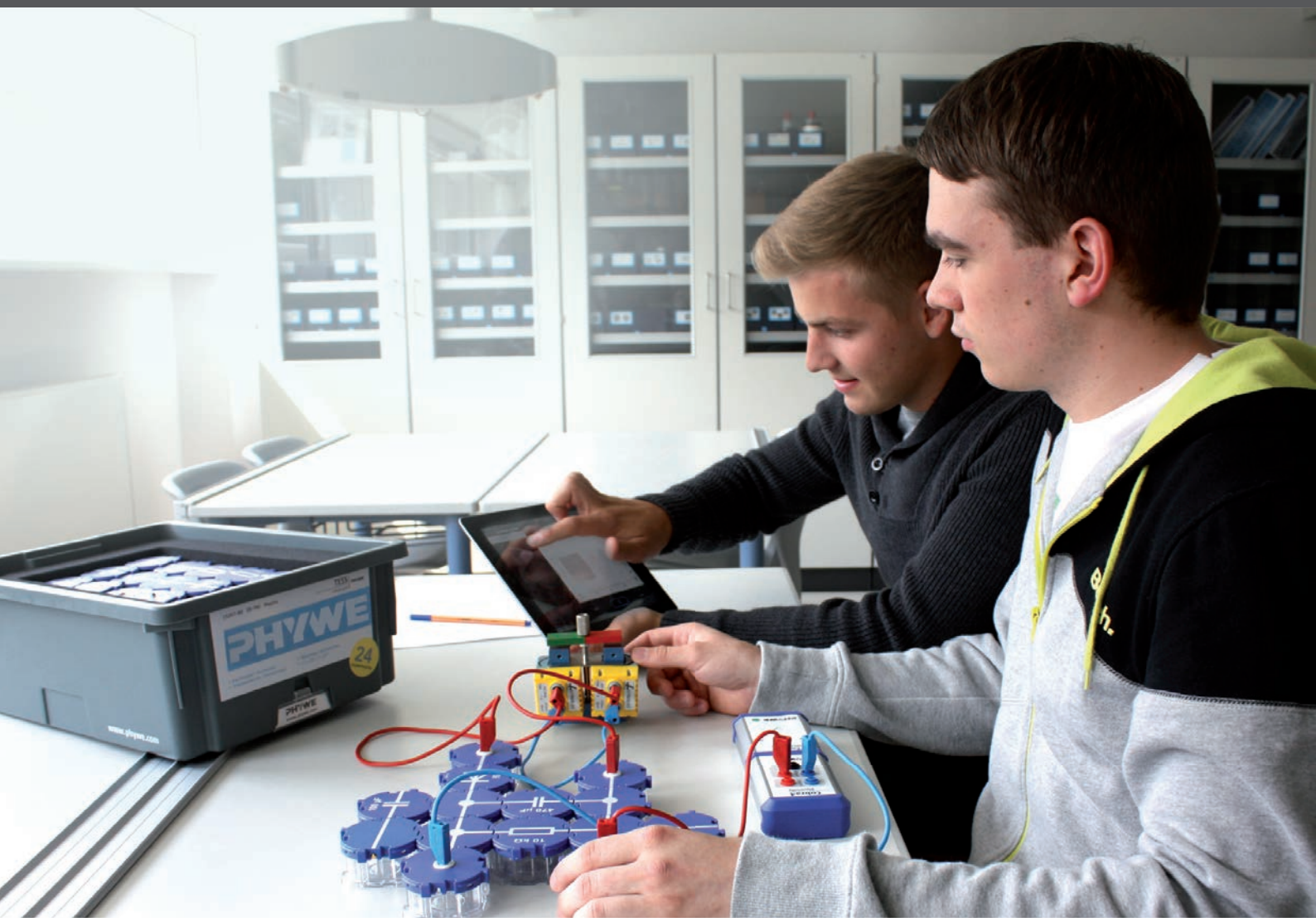
- Plug & Play – Switch on and start measuring – it's simple and intuitive
- measureAPP detects Cobra SMARTsense fully automatic
- Unrivalled price-performance ratio – Cobra SMARTsense is up to 60% less expensive than standard interface systems

Download measureAPP for free now and try it yourself!

Download on the App Store

Free download:

ANDROID APP ON Google play



2. Digital Education with curricuLAB®

2.1 Introduction to curricuLAB®

2.2 curricuLAB® modules

Digital Education with curricuLAB® –

the management and experimentation platform

curricuLAB® PHYWE

Excellent. **E**xperimentation. **N**etwork. Digital teaching and learning platform for natural sciences

curricuLAB® ActivityManager PHYWE

Excellent lessons
Print, edit or create experiments and worksheets online according to your curriculum

curricuLAB® ActivityManagerPRO PHYWE

Excellent **N**etwork
Share experiments, data and worksheets with your colleagues and students

curricuLAB® measureAPP PHYWE

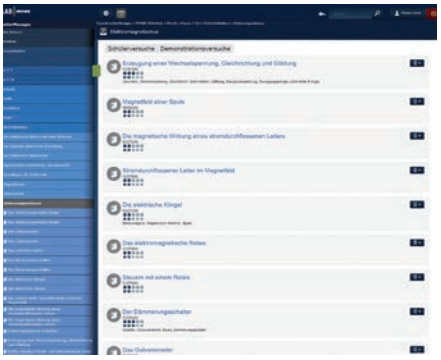
Excellent results.
Modern Datalogging with tablet or smartphone

curricuLAB® measureLAB PHYWE

Excellent results.
Precise measurements with all PCs of your network

curricuLAB® LabManager PHYWE

Excellent preparation.
Equipment inventory well organized



curricuLAB® ActivityManager PHYWE

curricuLAB® ActivityManager (online), site licence

- Access to more than 2,400 curricula-compliant experiments made by PHYWE with all related information
- Interactive instructions for student and demonstration experiments, prepared under didactic aspects
- All experiments can be edited and filled, combined and shared with own multimedia content (comments, documents, videos, pictures, etc.)
- Create teaching modules in groups and courses for your lessons and share them with your colleagues
- Manage your own calendar
- Use any type of device for planning your lessons, in particular laptops, tablets or smartphones

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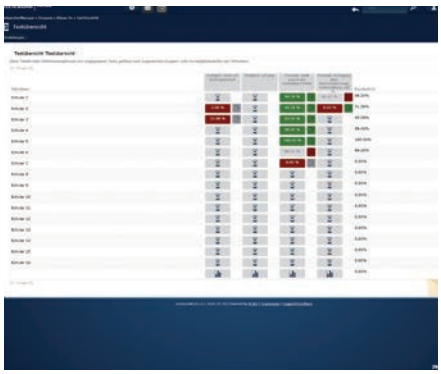


curricuLAB® ActivityManagerPRO PHYWE

curricuLAB® ActivityManagerPRO (server), site licence

- The ideal solution for networked natural sciences laboratory courses with tablets and also with computers
- Contains all functionalities of the ActivityManager and more:
- Create groups for your laboratory courses
- Central storage and use of teaching contents, including working with your colleagues
- Interactive instructionsand reports for student experiments prepared under didactic aspects
- Share experiments, data and worksheets in real time with your colleagues and students
- All relevant results can be saved and evaluated by the teacher
- Quick overview of the students learn progress
- Delivery includes the deployment of an installation package for the ActivityManagerPRO including the entire Phywe content as well as the database logic
- NOT included is the installation of the server and / or the installation of the ActivityManagerPRO on the server!
- System requirements for the installation (server):
- CORE i5 quad-core, 8 GB RAM, 256 GB SSD, Internet with at least 50 MBit, intranet with at least 100 MBit network. The following operating system is recommended: Ubuntu 14.04 LTS

14570-62

curricuLAB® measureAPP

- Excellent performance
- Intuitive operation
- Particulary suitable for student experiments
- Already available in six languages: German, English, French, Italian, Spanish, Russian and Polish
- Usable with all Cobra4 sensors via Wireless/USB-Link
- NEW: Directly connect to all Cobra SMARTsense sensors via Bluetooth!

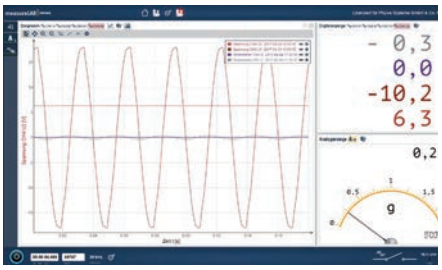
curricuLAB® PHYWE measureAPP

Available on the App Store

GET IT ON Google Play

curricuLAB® measureLAB

measureLAB is the next step in the evolution of PHYWE measure:



- Experiments are preconfigured in software: reduces preparation time
- Software oscilloscope
- Automatic identification of all Cobra interfaces and sensors
- Datasharing for demonstration experiments: Transfer of measurement data from teacher computer (measureLAB) to student tablet (free measureAPP)
- Remote operation mode: students can use their own computers in the teaching lab
- Operating system-independent, therefore future-proof: Windows, Linux (2018), MacOS
- Minimum system requirements: Core 2 Duo 2GHz, 4 GB RAM, screen resolution 1280 x 720 Pixel

curricuLAB® PHYWE measureLAB

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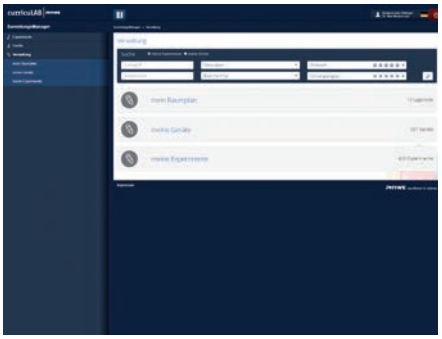
curricuLAB® LabManager (online), site licence



- Inventory of new and already existing equipment
- Curricula-compliant overview of more than 2.400 PHYWE experiments, including all experiment descriptions as PDF
- Approximately 6,000 items linked to suitable experiments - optimum use of your equipment
- All operating instructions for all PHYWE devices and experiments included
- Can be combined with the PHYWE allocation and inventory service
- Hazard assessments and safety data sheets
- List of hazardous substances at the push of a button

curricuLAB® PHYWE LabManager

14590-61

PHYWE hardware interface/sensor systems, a comparison –

for all applications, devices and operating systems

Cobra SMARTsense

Cobra SMARTsense: 20 sensors to measure using a mobile device

Cobra4 System with more than 50 measurement parameters (30 measurement sensors)

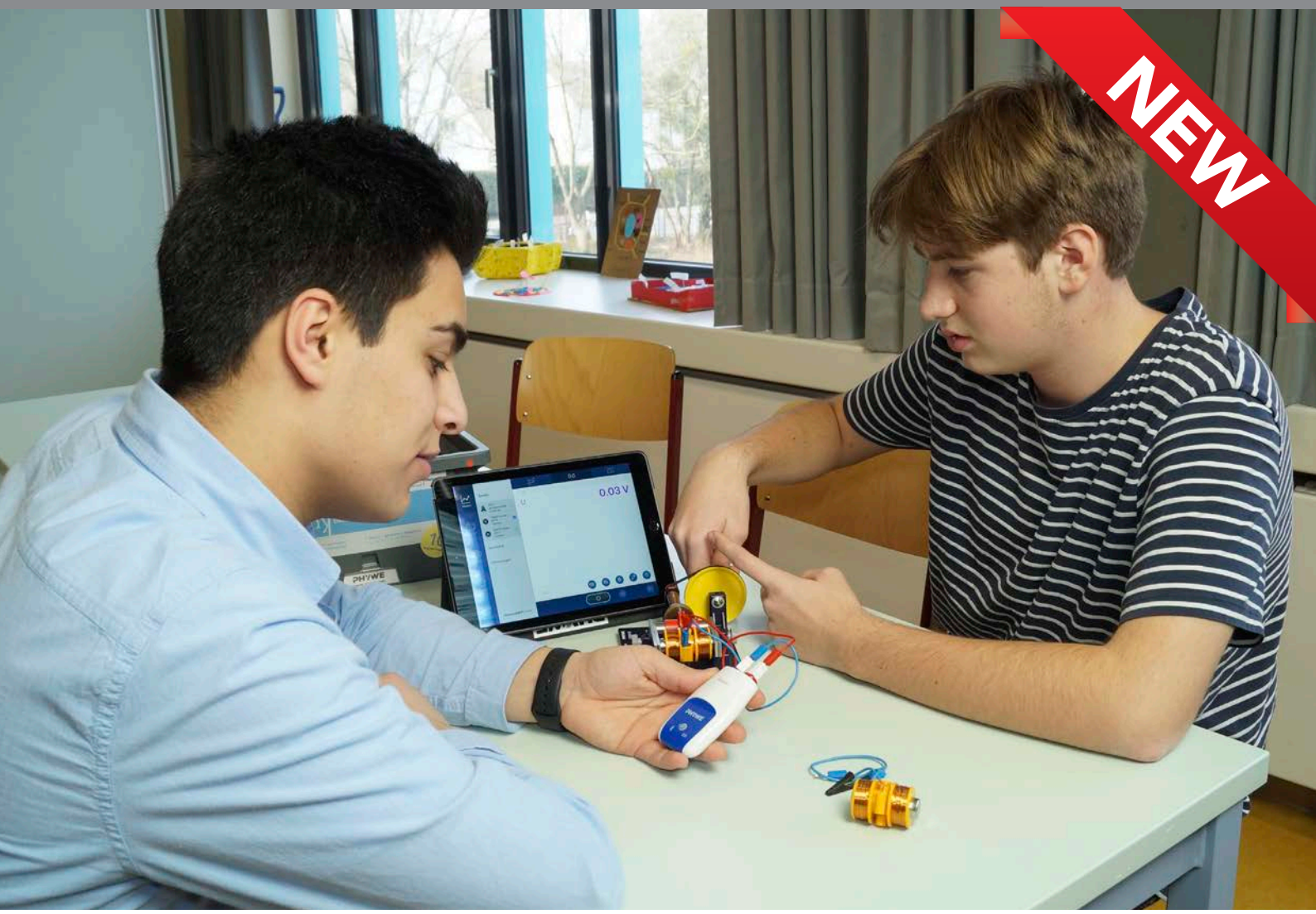
Cobra4

	Cobra SMARTsense	Cobra4 Wireless/USB-Link	Cobra4 Mobile-Link 2	Cobra4 Xpert-Link
Particularly suitable for:				
Student experiments	x	x	x	
Demonstration experiments	o[1]	x	x	x
Outdoor experiments	x	x	x	
Labcourse experiments		x		x
Particularly suitable with the following devices:				
iPad, iPhone	x	x		
Android tablet PC, smartphone	x	x		
Laptop/Computer (macOS)		x		x
Laptop/Computer (Windows)		x		x
can be used without a device			x	
Can be used with PHYWE measurement software:				
measureAPP (iOS, Android)	x	x		
measureLAB (macOS, Windows)		x		x
measure (Windows)		x	x	
does not require software (DataLogger)			x	
Recommended for the following class levels:				
Primary school	x		x	
Secondary school	x	x	x	o
High school	x	x	o	x
University/College	o	x	o	x
Connects with device via:				
USB		x	x	x
WLAN		x		
Bluetooth 4.0	x			
Measurement speed (measurement values per second):				
up to 1.000 Hz	x	x	x	x
up to 100.000 Hz		x		x
more than 100.000 Hz				x
Present measurement results via:				
Beamer*	x	x		x
Monitor*	x	x		x
Digital large-screen display (07157-00)	x	x		
All Cobra4 sensors can be used		x	x	x
Can be used as a datalogger			x	
Live datasharing in the network	x	x		x

Summary	
SMARTsense is the best system for easy, fast and affordable data acquisition with a mobile device.	Cobra4 is the flexible datalogging system which provides the best interfaces and its sensors for all class levels, subjects, applications and devices.

o = can be realized partly // x = can be realized fully

1) Currently 20 measure values // *Devices for content streaming like AppleTV or ChromeCast required



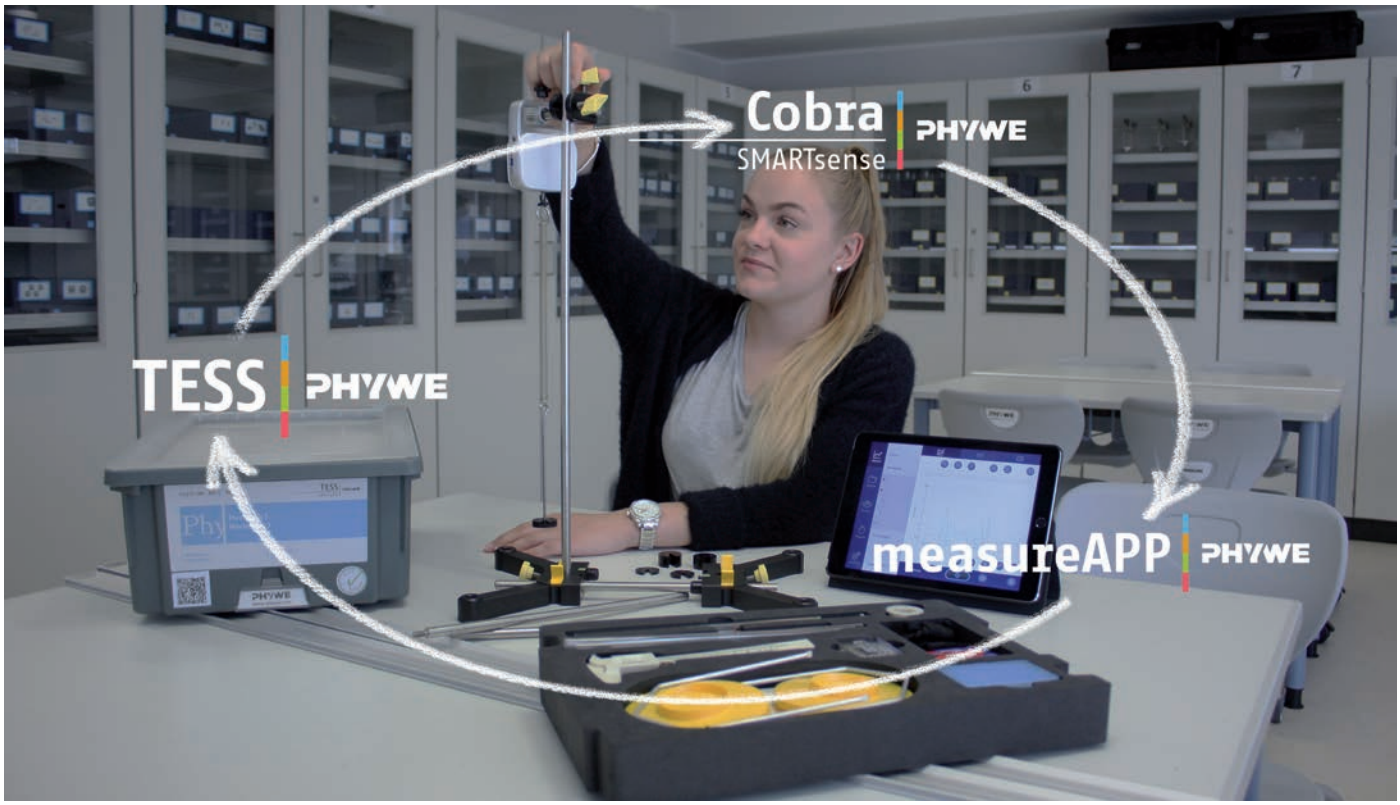
3. Computer-Assisted Measurement

3.1 Cobra SMARTsense

3.2 Cobra4

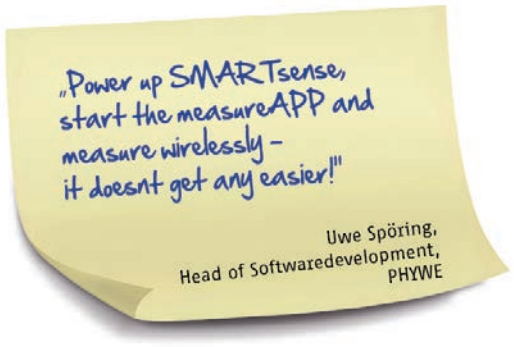
Cobra SMARTsense and curricuLAB® measureAPP –
Taking student experiments to the next level

- Digital education in natural sciences is directly linked to data logging
- Up to 60% less expensive than standard interface systems
- Didactic application of tablet computers and smartphones, especially in student experiments
- Higher motivation of students by utilizing everyday mobile devices
- Basic hands-on method of learning scientific concepts



Benefits for teachers and students

- All-in-one device / no interface necessary
- Unrivalled price-performance ratio
- Switch on and start measuring
- New technology: Bluetooth 4
- Designed for TESS student experiments
- Fully automated detection of sensors in the PHYWE measureAPP



Student experiments TESS and Cobra SMARTsense –
Using digital devices to acquire practical skills in student labs

The ideal combination:

+

Bluetooth®

Classical experiment (hands-on competence) + **Digital data logging (media competence)**

- Individual teaching styles: Your choice of measurement device – classical and digital
- Future-proof: Prepare today for the transition from classical to digital education
- Fast and efficient learning: The use of everyday digital devices increases the motivation of students
- More than 110 PHYWE experiments from all fields of natural sciences:

Phy Che Bio STEM

Any questions? Please feel free to contact us by sending an e-mail to digital-education@phywe.de

Cobra SMARTsense and measureAPP – The simple and intuitive way to measure

Bluetooth®

- Communicates directly via Bluetooth
- "multisensor mode": log up to 5 measurement values simultaneously!
- Compatible with free PHYWE measureAPP for tablet PCs (iOS and Android) and smartphones
- 23 Cobra SMARTsense sensors in total
- More than 110 PHYWE experiments today with over 300 to follow
- Covers the whole curriculum in all fields of science education

Phy 57 experiments in physics + 190 starting Q3 2018

Voltage
12901-00

Current
12902-00

Temperature
12903-00

Force
12904-00

Pressure
12905-00

Bio 36 experiments in biology + 41 starting Q3 2018

Light
12906-00

Humidity
12931-00

CO_2
12932-00

Oxygen
12933-00

EKG
12934-00

Che 22 experiments in chemistry + 46 starting Q3 2018 + 8 starting Q1 2019

pH
12921-00

Conductivity
12922-00

Dropcounter
12923-00

Colorimeter
12924-00

Thermocouple
12939-00

measureAPP PHYWE

- High performance
- Intuitive and easy to use / designed for students
- Modern and attractive design
- Compatible with all Cobra SMARTsense sensors
- Document your measurements and file digital media in your personal experiments folder
- Sophisticated, curriculum-based experiment guides

+ 11 starting Q1 2019

Acceleration
12907-00

Motion
12908-00

Photogate
12909-00

Magnetic Field
12911-00

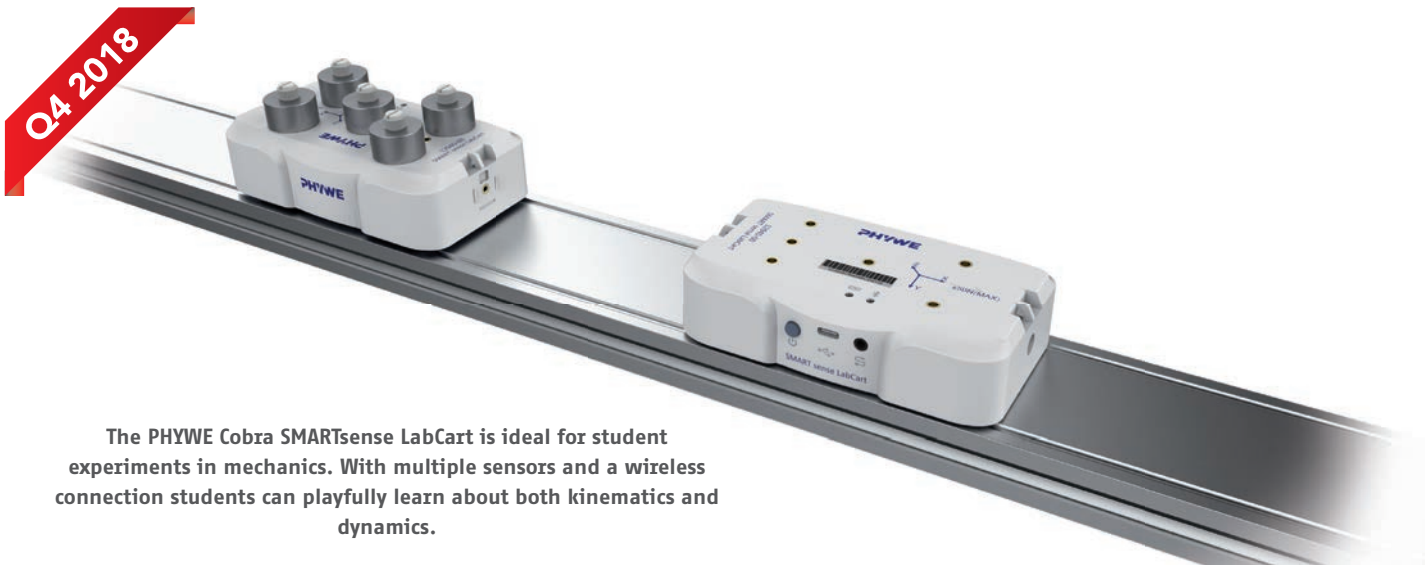
Radioactivity
12938-00

+ 8 experiments starting Q4 2018

Heart Rate
12935-00

Spirometer
12936-00

LabCart
force, speed, acceleration
12940-00



The PHYWE Cobra SMARTsense LabCart is ideal for student experiments in mechanics. With multiple sensors and a wireless connection students can playfully learn about both kinematics and dynamics.

NEW

Cobra SMARTsense - Voltage, ± 30 V

Benefits

- Easy measuring of voltage in student experiments.
- Resolution: 0.02 V
- Max. sampling rate: 1000 Hz

12901-00

NEW

Cobra SMARTsense - Magnetic field, ± 64 mT

Benefits

- Easy measuring of magnetic fields in student experiments.
- Resolution: ± 0,04 mT
- Max. sampling rate: 500 Hz

12911-00

NEW

Cobra SMARTsense - Current, ± 1 A

Benefits

- Easy measuring of electric current in student experiments.
- Resolution: 0.5 mA
- Max. sampling rate: 1000 Hz

12902-00

NEW

Cobra SMARTsense - Force, ± 50 N

Benefits

- Easy measuring of force in student experiments.
- Resolution: 30 mN
- Max. sampling rate: 1000 Hz

12904-00

NEW

Cobra SMARTsense - Temperature, - 40 ... 120 °C

Benefits

- Easy measuring of temperature in student experiments.
- Resolution: 0.01 °C
- Max. sampling rate: 10 Hz

12903-00

NEW

Cobra SMARTsense - Pressure, 20 ... 400 kPa

Benefits

- Easy measuring of pressure in student experiments.
- Resolution: 0.1 kPa
- Max. sampling rate: 500 Hz

12905-00

Cobra SMARTsense - Light, 1 ... 128 klx

NEW

Benefits

- Easy measuring of light intensity in student experiments.
- Resolution: 1 lx
- Max. sampling rate: 10 Hz

12906-00

Cobra SMARTsense - Acceleration, ± 8 g

NEW

Benefits

- Easy measuring of acceleration in student experiments.
- Resolution: 0.01 g
- Max. sampling rate: 100 Hz

12907-00

Cobra SMARTsense - Motion, 0.2 ... 2 m

NEW

Benefits

- Easy measuring of motion in student experiments.
- Resolution: 1 mm
- Max. sampling rate: 50 Hz

12908-00

Cobra SMARTsense - Photogate, 0 ... ∞ s, set of 2

NEW

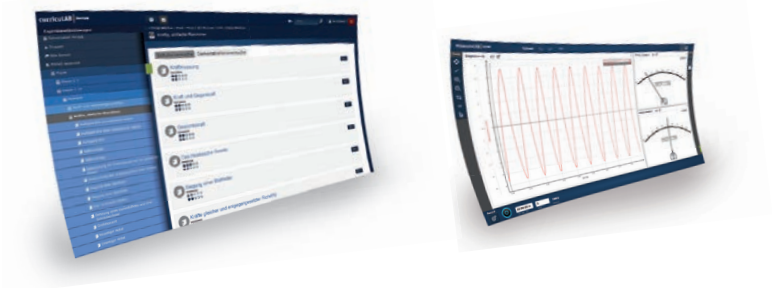
Benefits

- Easy taking of time in student experiments.
- Resolution: 0.01 ms
- Max. sampling rate: 1000 Hz

12909-00

Excellent. Experimentation. Network.

The digital teaching and learning plattform for natural science.



curricuLAB® PHYWE ActivityManager

curricuLAB® PHYWE ActivityManagerPRO

curricuLAB® PHYWE measureAPP

curricuLAB® PHYWE measureLAB

curricuLAB® PHYWE LabManager

NEW

Cobra SMARTsense - pH, 0 ... 14

Benefits

- Easy measuring of pH values in student experiments.
- Resolution: 0.01
- Max. sampling rate: 100 Hz

12921-00

NEW

Cobra SMARTsense - Conductivity, 0 ... 20000 µS/cm, 0 ... 100 °C

Benefits

- Easy measuring of conductivity in student experiments.
- Resolution: 8 µS/cm, 0.1 °C
- Max. sampling rate: 10 Hz

12922-00

NEW

Cobra SMARTsense - Dropcounter, 0 ... ∞

Benefits

- Easy measuring in titration experiments.
- Resolution: 30 Imp/s
- Max. sampling rate: 50 Hz

12923-00

NEW

Cobra SMARTsense - Colorimeter, 0 ... 100 %

Benefits

- Easy measuring of colors based on transmission at different wavelengths in student exp..
- Resolution: 0.01 %
- Max. sampling rate: 10 Hz

12924-00

WEB@ PHYWE

Visit our PHYWE website for all detailed information.

Scan the QR codes which are shown at the experiments

Cobra SMARTsense - Humidity, 0 ... 100 %

NEW

Benefits

- Easy measuring of humidity in student experiments.
- Resolution: 0.1 %
- Max. sampling rate: 10 Hz

12931-00

Cobra SMARTsense - EKG, 0 ... 4.5 mV

NEW

Benefits

- Easy measuring of the electric activity of the heart in student experiments.
- Resolution: 4.5 µV
- Max. sampling rate: 1000 Hz

12934-00

Cobra SMARTsense - CO_2, 0 ... 100000 ppm

NEW

Benefits

- Easy measuring of CO_2 concentration in student experiments.
- Resolution: 2 ppm
- Max. sampling rate: 1 Hz

12932-00

Cobra SMARTsense - Spirometer, ± 4 l/s

NEW

Benefits

- Easy measuring of air volume inspired and expired by the lung in student experiments.
- Resolution: 0.01 l/s
- Max. sampling rate: 1000 Hz

12936-00

Cobra SMARTsense - Heart Rate, 30 ... 200 bpm

NEW

Benefits

- Easy measuring of the heart rate in student experiments.
- Resolution: 1 bpm
- Max. sampling rate: 10 Hz

12935-00

Cobra SMARTsense - Oxygen, 0 ... 20 mg/l

NEW

Benefits

- Easy measuring of oxygen concentration in student experiments.
- Resolution: 0.01 mg/l
- Max. sampling rate: 100 Hz

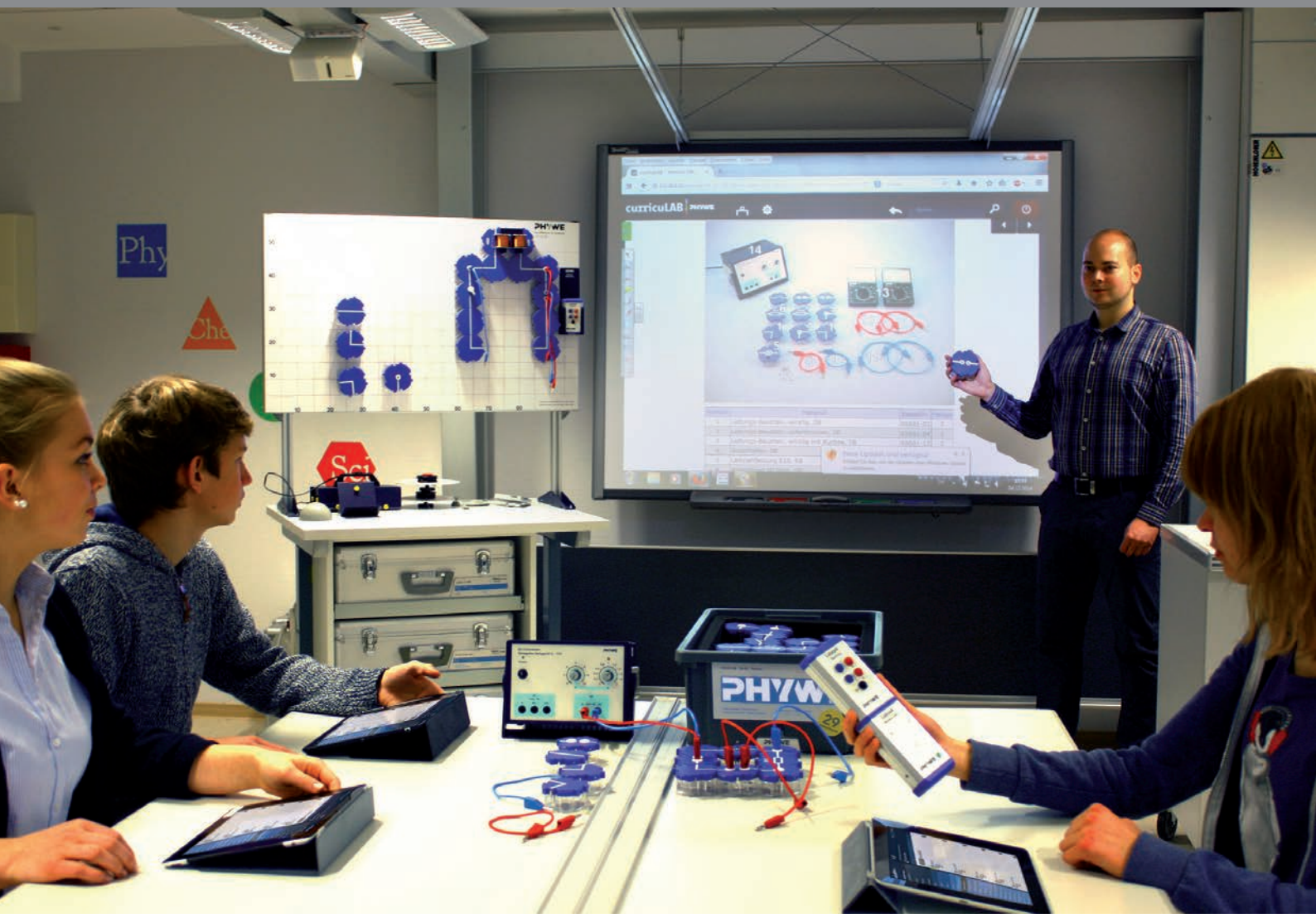
12933-00

PHYWE Cobra SMARTsense – Technical Specifications

Item number	Sensor	Measuring range	Resolution	Frequency	Rechargable	Weight	Standby after 5 min	Bluetooth 4.0	Maximum range 30 m
12901-00	Voltage	± 30 V	0.02 V	1000 Hz	✓	45 g	✓	✓	✓
12902-00	Current	± 1 A	0.5 mA	1000 Hz	✓	49 g	✓	✓	✓
12904-00	Force	± 50 N	30 mN	1000 Hz	✓	96 g	✓	✓	✓
12921-00	pH	0...14 pH	0.01 pH	100 Hz	CR2032*	42 g	✓	✓	✓
12903-00	Temperature	- 40...120°C	0.01 °C	10 Hz	CR2032*	34 g	✓	✓	✓
12909-00	Photogate	0 ... ∞ s	0.01 ms	1000 Hz	✓	120 g	✓	✓	✓
12922-00	Conductivity	0...20,000 µS/cm 0...100 °C	8 µS/cm 0.1 °C	10 Hz	CR2032*	60 g	✓	✓	✓
12905-00	Pressure	20...400 kPa	0.1 kPa	500 Hz	✓	35 g	✓	✓	✓
12906-00	Light	1...128 klx	1 lx	10 Hz	✓	22 g	✓	✓	✓
12931-00	Humidity	0...100 %	0.1 %	10 Hz	✓	29 g	✓	✓	✓
12907-00	Acceleration	± 8 g	0.01 g	100 Hz	✓	21 g	✓	✓	✓
12908-00	Motion	0.20...2m	1 mm	50 Hz	✓	40 g	✓	✓	✓
12911-00	Magnetic Field	± 64 mT	0.04 mT	500 Hz	✓	32 g	✓	✓	✓
12934-00	EKG	0...4.5 mV	4.5 µV	1000 Hz	✓	40 g	✓	✓	✓
12932-00	CO2	0...100,000 ppm	2 ppm	1 Hz	✓	56 g	✓	✓	✓
12923-00	Drop Counter	0...∞ Imp	30 Imp/s	50 Hz	✓	142 g	✓	✓	✓
12936-00	Spirometer	± 4 l/s	0,01 l/s	1000 Hz	✓	63 g	✓	✓	✓
12933-00	Oxygen	0...20 mg/l	0.01 mg/l	100 Hz	✓	40 g	✓	✓	✓
12924-00	Colorimeter	0...100 %	0.01 %	10 Hz	✓	150 g	✓	✓	✓
12935-00	Heart Rate	30...200 bpm	1 bpm	10 Hz	✓	36 g	✓	✓	✓

*Battery-lifetime half a year, depending on usage.

Bluetooth®



3. Computer-Assisted Measurement

3.2 Cobra4

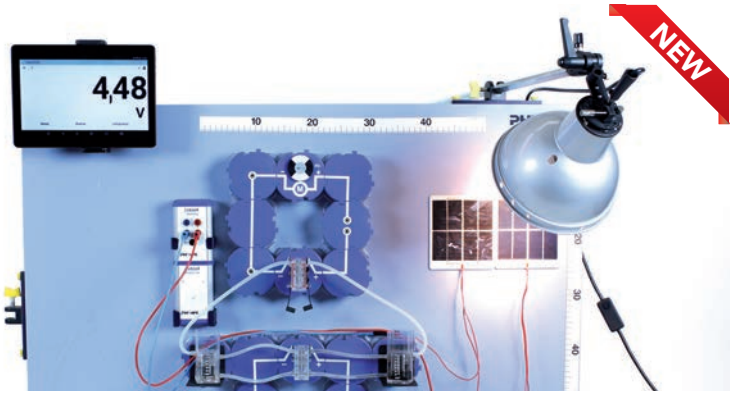
Cobra4 Wireless/USB-Link – for a modern data collection

The Cobra4 Wireless/USB-Link can be used with:

- the **measureAPP** on smartphones and tablets,
- the new **digital large-scale display** in a field experiment or in the class room
- and with **measureLAB** on your computer.

In use with the digital large-scale display in a field experiment

In use with a tablet in the class room



In use with the digital large-scale display in a demo experiment in the class room

Future-proof – connect any device and operating system via WLAN-connection.

Now available on App Store and Play Store

Your fast access to measureAPP...

PHYWE'S FREE APP
measure PHYWE

Available on the App Store

GET IT ON Google Play

Cobra4 Wireless/USB-Link, incl. USB cable

- Compatible with all Cobra4 sensors
- Wireless data transfer - independent of device (desktop, laptop, tablet, smartphone)
- Two modes of operation: Access-Point-mode for direct connection and Infrastructure-mode for integration in present network
- Alternatively usable via USB-connection
- Maximum data rate: 125 kHz (burst)
- Future-proof - Usable with any device via PC-software meaureLAB or the measureAPP (available for free on Apple App Store and Google Play Store)
- Measurement in real time
- Button on the device for direct control of start and stop of a measurement
- Integrated battery, continuous measuring for up to 4 hours
- Battery can be charged during use

Recommended Equipment

Item no.:	Description
	measureAPP for iOS or Android - available for free in App Store and Play Store
14580-61	Software measureLAB
07932-99	USB charger for Cobra4 Mobile-Link 2 and Wireless/USB-Link

12601-10

NEW

The Cobra4 Wireless/USB-Link is included with the new **Digital large-scale Display**, see chapter 5.1

Cobra4 Mobile-Link 2 incl. accessories

- Maximum data rate: 1 kHz (with SD memory card) / 2 kHz (USB data transfer to computer)
- Power supply: Li-ion rechargeable battery, 1950 mAh (up to 9 hours measuring time)
- Integrated acceleration sensor, measurement ranges: ±2g, ±4g, ±8g
- Illuminated display, 2,4'', 240x320 pixel, 65.536 colours
- Data storage: SD/MMC memory cards up to 32 GB
- Dimensions (mm): 155x65x35
- Weight: 200 g
- Incl. battery, USB data cable, charger and SD memory card
- compatible with all Cobra4 sensors

Recommended Equipment

Item no.:	Description
02161-10	Holder for Cobra4, magnetic
07157-93	Digital large-scale display (legacy)
12623-00	Cobra4 Display-Connect TX, transmitter for using the Cobra4 Mobile-Link with large-scale displays
12623-01	Cobra4 Display-Connect TX, receiver for using the Cobra4 Mobile-Link with large-scale displays
14550-61	Software measure Cobra4, multi-user licence
14580-61	Software measureLAB

12620-10

Cobra4 Xpert-Link, Demo-Interface –
professional data collection in one system

Two channels for current measurement
- channels galvanically isolated
- 1 mA...10 A, 2 MHz
- ideal for the implementation of experiments which require 2 measurement channels, e.g . in induction experiments

Oscilloscope function
- the Cobra4 Xpert-Link completely replaces an oscilloscope
- measurement of voltages, currents, phase shifts and TrueRMS possible

Connectors
- up to 2 light barriers or other devices with trigger input function (TTL level) can be controlled at the same time
- for power supply of light barriers via separate jacks with 5 V / max. 2 A –
- ideal for experiments which require several light barriers, e.g. Newton's laws

Compatible with all Cobra4 sensors!

Two channels for voltage measurement
- channels galvanically isolated
- 10 µV ... 30 V, 10 MHz
- ideal for the implementation of experiments which require 2 measurement channels
- TrueRMS

Connectors for additional sensors using Cobra4 Xpert-Connect adapters
- up to 2 Cobra4 sensors can be simultaneously connected and controlled

USB port
- USB connection to computer

Controllable relay
- relays can be easily and securely controlled via software
- max 30 V / 2 A
- ideal for experiments such as free fall

Cobra4 Xpert-Link

Cobra4 Xpert-Link is the universal interface for all application in Computer-Assisted Measurement with Cobra4. The measurement-software measureLAB is included.

Recommended Equipment

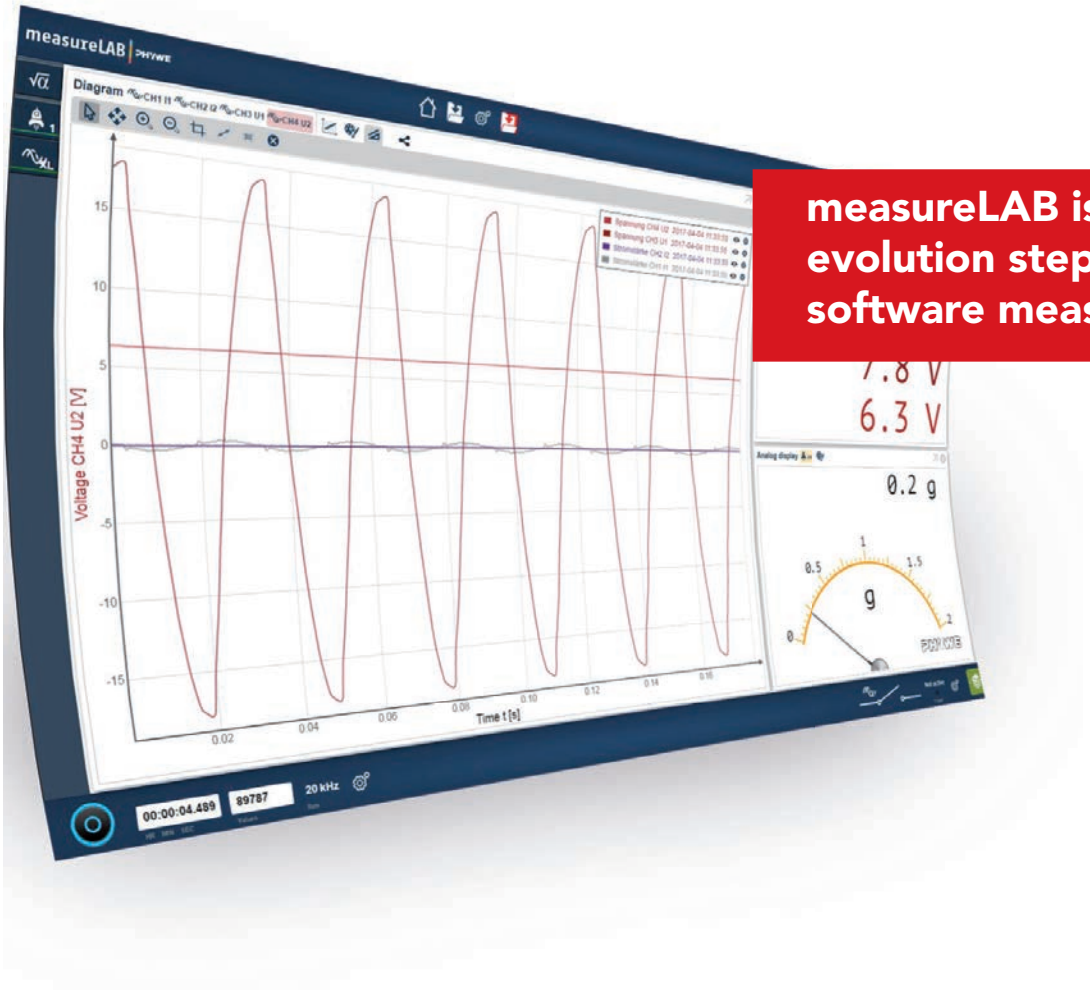
Item no.:	Description
07542-26	Adapter, BNC-plug/socket 4 mm
12625-01	Cobra4 Xpert-Connect

12625-99

Cobra4 Xpert-Connect

Cobra4 Xpert-Connect Interface allows to connect two Cobra4 sensor-units to the Cobra4 Xpert-Link.

Cobra4 Xpert-Link & measureLAB –
high-performance data collection and analysis



measureLAB is the next evolution step of PHYWE's software measure

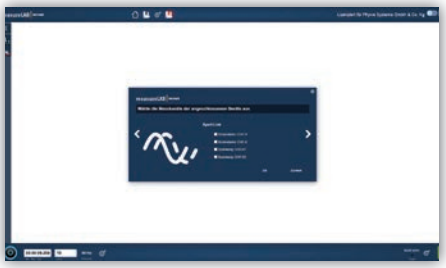
Benefits

- Operating system-independent, therefore future-proof: Windows and macOS
- Experiments are preconfigured in software: reduces preparation time
- Software oscilloscope
- Automatic identification of all Cobra4 interfaces and sensors
- Datasharing for demonstration experiments: Transfer of measurement data from teacher computer (measureLAB) to student tablet (free measureAPP for iOS and Android in the App Stores)
- Remote operation mode: students can use their own computers in the teaching lab

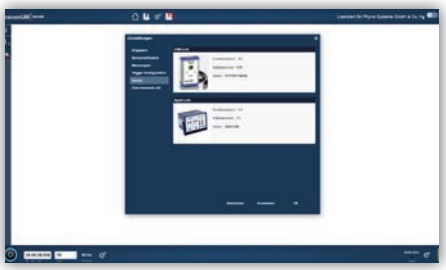
Function and Application

The software measureLAB enables computer-based student and demonstration experiments in natural science teaching. Measure, analyze and share measurement data in combination with the Cobra4 data-logging interfaces.

14580-61



Preconfigurations available



Automatic sensor identification

Phy Physics Sensors

Timer-Counter
Motion with light barriers
12651-00

Acceleration
3D acceleration
12650-00

Electricity
Current, voltage
12644-00

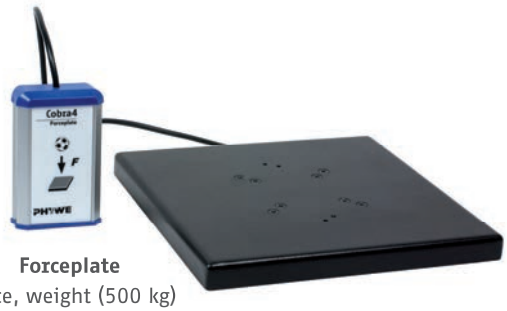
Energy
Current, voltage, work, power
12656-00

Radioactivity
Radioactivity
12665-00

Temperature
Temperature (2 x NiCr-Ni)
12641-00

Temperature
Temperature (semiconductor)
12640-00

Force 10 N
Force 10 N
12646-00



Forceplate
Force, weight (500 kg)
12661-00

Che Chemistry Sensors

pH
pH value
12631-00

Chemistry
pH, temperature
12630-00

Drop counter
Tritration
12636-00

Oxygen
Dissolved and gaseous oxygen
12676-00

CO_2
CO2 content in air
12671-01

Med Sensors for Human Physiology & Medicine

Electrophysiology
EKG, EMG, EOG
12673-00

Spirometry
Respiratory volume, wind speed
12675-00

Pulse
Pulse
12672-00

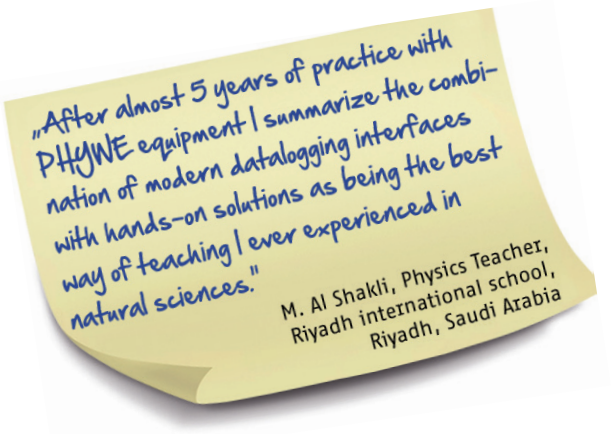
Soundlevel
Sound, dBA, dBC
12669-00

Tesla
Magnetic field
12652-00

Pressure
Pressure (7 bar)
12647-00

Thermodynamics
Pressure, temperature
12638-01

Weather
Air pressure, humidity, altitude, temperature, light intensity
12670-00



Colorimeter
Coloration of liquids
12634-00

Thermodynamics
Pressure, temperature
12638-01

Conductivity
Conductivity, temperature
12633-00

Conductivity+
Conductivity, temperature (Pt1000)
12632-00

Bio Biology Sensors

Oxygen
Dissolved and gaseous oxygen
12935-00

CO_2
CO2 content in air
12671-01

Conductivity
Conductivity, temperature
12633-00

Weather
Air pressure, humidity, altitude, temperature, light intensity
12670-00

Cobra SMARTsense and measureAPP –

Digital data acquisition directly integrated in the digital lessons!

+

=

Your easy entry into digital education

Cobra SMARTsense PHYWE

measureAPP PHYWE

- Plug & Play – Switch on and start measuring – it`s simple and intuitive
- measureAPP detects Cobra SMARTsense fully automatic
- Unrivalled price-performance ratio – Cobra SMARTsense is up to 60% less expensive than standard interface systems

Download measureAPP for free now and try it yourself!

Download on the App Store

Free download:

ANDROID APP ON Google play

4. TESS – Student experiments

Training-Experiment-System for Students

4.1 Basic Natural Sciences

4.2 Physics

4.3 Chemistry

4.4 Biology

Student set Substances in everyday use – digital and analog

Benefits

- Experiment guides are very easy to understand, especially for younger students
- Associated competences are directly linked to the experiments
- Curriculum compatible
- All components in one box: mobile teaching is possible
- Fit for the future: implementation of tablets possible
- Robust, stackable storage box with a foam insert fitting to the contained equipment

Digital Set

14 Experiments:

- Bimetallic principle
- Conductive and non-conductive materials
- Magnetic and non-magnetic materials
- Solubility of a substance
- Acidic or basic character of solutions
- Properties of matter - boiling point
- Properties of matter - density determination
- Properties of mixtures
- Mixture separations by sieving and filtration
- Mixture separations by magnetic separation
- Mixture separation - chromatography
- Comparison of a physical process and a chemical reaction
- Dissolution processes on liquids
- Hardness of water

+ 1 Cobra SMARTsense Temperature

15234-88D

Analog Set

The set continues to be available in the classical version:

Student set Substances in everyday use, TESS beginner Sciences
15234-88

Necessary Equipment

Student set Substances in everyday use, necessary accessories, TESS beginner Sciences
13430-88

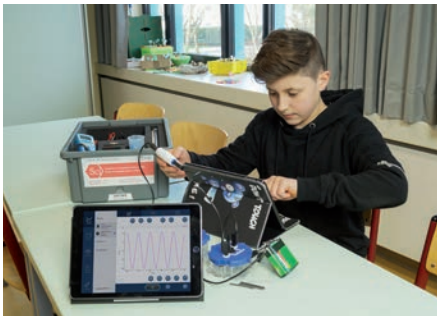
Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Student set Electric and magnetic devices in everyday use – digital and analog

Benefits

- Experiment guides are very easy to understand, especially for younger students
- Associated competences are directly linked to the experiments
- Curriculum compatible
- All components in one box: mobile teaching is possible
- Fit for the future: implementation of tablets possible
- Robust, stackable storage box with a foam insert fitting to the contained equipment



Digital Set

15 Experiments:

- Electrostatic induction
- Force of charged bodies
- The electric circuit
- Measurements in an electric circuit
- The changeover switch
- Conductive and non-conductive materials
- Series and parallel connection of bulbs
- The heat effect of electric current
- Magnetic and non-magnetic materials
- Magnetic force
- The electromagnet
- Magnetization
- Fragmentation of magnets
- The compass
- Observation of the magnetic field

+ 1 Cobra SMARTsense Voltage
+ 1 Cobra SMARTsense Current

15238-88D

Analog Set

The set continues to be available in the classical version:

Student set Electrical and magnetic devices in everyday use, TESS beginner Sciences
15238-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Student Set Mechanical devices in everyday use – digital and analog

Benefits

- Experiment guides are very easy to understand, especially for younger students
- Associated competences are directly linked to the experiments
- Curriculum compatible
- All components in one box: mobile teaching is possible
- Fit for the future: implementation of tablets possible
- Robust, stackable storage box with a foam insert fitting to the contained equipment

Digital Set

12 Experiments:

- Weight
- Measurement of weight
- Force and counterforce
- Pulling instead of lifting
- Force reduction with a two-sided lever
- Force reduction with a one-sided lever
- Changing direction of force
- Force reduction
- Force reduction and direction change of force
- Friction during motion
- Uniform and accelerated motion
- Fast and slow motion

+ 1 Cobra SMARTsense Force

15239-88D

Analog Set

The set continues to be available in the classical version:

Set Mechanical devices in everyday use, TESS beginner Sciences
15239-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Student Set Light, Air, Soil

Benefits

- All required materials and test descriptions in a stable and well-arranged storage box
- Interdisciplinary experiments with age-appropriate descriptions - learning to experiment independently
- All test descriptions on enclosed DVD as PDF and editable text files
- Teacher sets for demonstration experiments available
- Detailed manuals in color with additional information for the teacher available
- Equipment and technical data

Analog Set

18 Experiments:

- Light and shadows
- Silhouettes
- Mirror images of the shadow
- Playing wih mirrors
- Playing with a spoon
- The lost coin
- A lens made of water
- The magic wand
- A balloon in a flask
- The postcard trick
- Hot and cold air
- Fresh and spent air
- The thirsty candle
- A mini nursery
- Merely dirty
- Soil aeration
- A quick run trough
- Underfoot forces

15243-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Student Set Optics - Look at Light

Benefits

- All required materials and test descriptions in a stable and well-arranged storage box
- All required materials and test descriptions in a stable and clear storage
- Interdisciplinary experiments with age-appropriate descriptions - learning to experiment independently
- All test descriptions on enclosed DVD

Analog Set

5 Experiments:
- The book of mirrors
- The bent mirror
- The look into infinity
- The labyrinth of light
- The rainbow CD

15237-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

WEB@ PHYWE

Visit our PHYWE website for all detailed information.

Scan the QR codes which are shown at the experiments

Student Set Senses

Benefits

- All required materials and test descriptions in a stable and well-arranged storage box
- Interdisciplinary experiments with age-appropriate descriptions - learning to experiment independently
- all test descriptions on enclosed DVD as PDF and editable text files
- Teacher sets for demonstration experiments available
- Detailed manuals in color with additional information for the teacher available
- Equipment and technical data

Analog Set

15 Experiments:

- The tongue in the mirror
- Teamwork: how nose and tongue provide for taste
- A matter of taste: where does one taste what?
- Investigating skin
- Sense of touch
- Warm and cold
- Sound waves
- Music
- Orientation in space
- A view at the eye
- Close and far
- Candle on its head
- The blind spot
- Two eyes see more than one
- Optical illusions

15241-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Student Set Water – digital and analog

NEW Cobra SMARTsense

Benefits

- 3 experiments also digitally measurable on smartphone or tablet
- The ideal combination of classic experiments (action competence) and digital data acquisition (media literacy)
- Future-proof: Prepare today the transition to the digital school
- All required materials and test descriptions in a stable and clear storage
- Interdisciplinary experiments with age-appropriate descriptions - learning to experiment independently
- Matching teacher Sets available for demonstration experiments

Digital Set

14 Experiments:

- Water and ice
- Sweet and salty solutions
- The egg in water
- The refrigerater in the beaker
- Colder than ice
- Soft and hard water
- Soapsuds
- Water and oil
- The water mountain
- The sinking paper clip
- The soap vessels
- The crack in the water surface
- Water droplets
- Cleaning water

+ 1 Cobra SMARTsense Temperature

15233-88D

Analog Set

The set continues to be available in the classical version:

Student set Water, TESS beginner Sciences
15233-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Student Set Heat – digital and analog

Benefits

Set for student experiments, especially suitable for teaching of natural sciences in primary school and early secondary school.

- Contains all necessary materials and description in a sturdy storage.
- Included german handbook in color, DIN A5, ring binder.
- Additional set for demonstration experiments and handbook with hints for teachers available.

Digital Set

13 Experiments:

- Temperature sensitivity of the skin
- Thermal expansion of air and water
- Thermal expansion of water and methylated spirit
- Calibration of a thermometer
- Temperature measurement
- Temperature of mixture
- Wool as thermal insulator
- Air (feathers) as thermal insulator
- Thermal insulation
- Heat of evaporation of water
- Heat of evaporation of spirit
- Lowering of the melting point with salt
- Ice floats

+ 1 Cobra SMARTsense Temperature

15235-88D

Analog Set

The set continues to be available in the classical version:

Student set Heat, TESS beginner Sciences
15235-88

Recommended Equipment

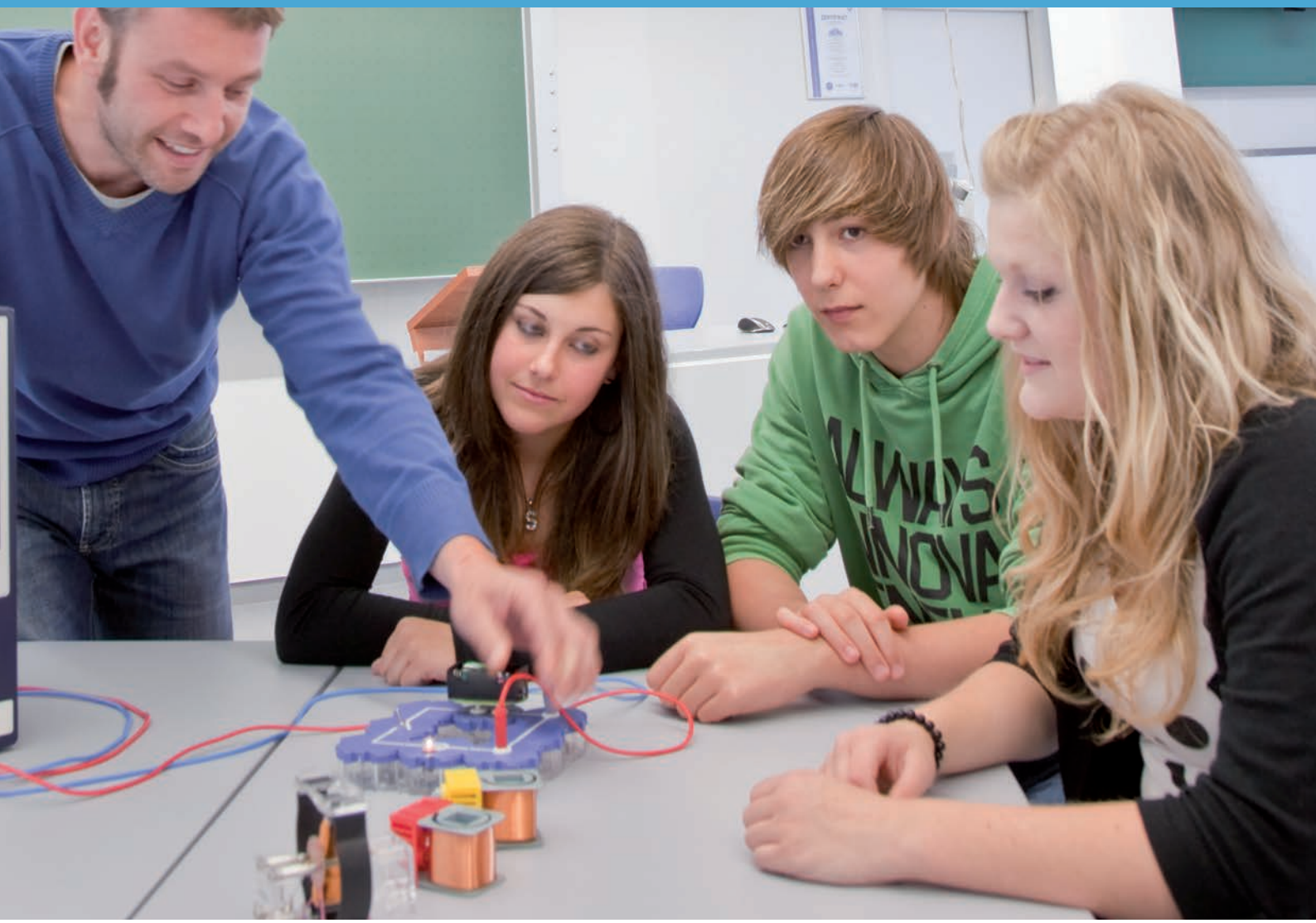
curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Storage and transport –
Storage container for TESS Sets

TESS PHYWE

A complementary component of the TESS-system are the mobile storage containers for storing tall and short boxes. The sets can be stored space-saving and clear within the containers.

Storage container with rollers for TESS sets, for 8 trays	15210-00
Storage container with rollers for TESS sets, for 18 trays	15211-00



4. TESS – Student Experiments

Training-Experiment-System for Students

4.2 Physics

Complete curriculum coverage in Physics –

Cover with the TESS and Demo System from PHYWE the requirements of modern natural science education

Topic / Sets or experimental collections	Mechanics 1-3	Centripetal Force	Wave Phenomena	Acoustics 1-2	Heat 1-2	Renewable Energy 1-3	Electricity / Electronics 1-3
	TESS / Demo	Demo	Demo	TESS	TESS / Demo	TESS / Demo	TESS / Demo
MECHANICS							
Forces, simple machines	✓						
Mechanics of fluids and gases	✓						
Vibrations and waves	✓		✓				
Linear motion	✓						
Circular motion		✓					
ACOUSTICS							
Sound generation, propagation and perception				✓			
Vibrations and waves				✓			
THERMODYNAMICS							
Temperature measurement					✓		
Thermal expansion					✓		
Heat transfer and thermal insulation					✓		
Thermal energy					✓	✓	
Physical states					✓		
ENERGY							
Energy forms, conversion and conservation	✓				✓	✓	✓
Use and application of renewable energy						✓	
Energy storage						✓	
Wind, water, solar, geothermal, fuel cells						✓	✓
ELECTRICITY							
Circuits							✓
Electrical components							✓
Magnetism							
Electrostatics							
Electromagnetism							✓
Electrical energy and performance							✓
Electric field							
Electromagnetic induction							✓
Electromagnetic waves							
OPTICS							
Straight propagation of light							
Reflection and refraction							
Colours							
Interference and diffraction							
RADIOACTIVITY							
Natural radioactivity							
Types of radiation and their properties							
STRUCTURE OF MATTER							
X-ray physics							
Atomic and nuclear physics							
Movement of charged particles in EM fields							

Demo PHYWE

TESS PHYWE

Electro-statics	Magnetism	Electric Motor / Generator	Electric Fields	Microwaves	Optics 1-3	Optics / Atomic Physics	Radio-activity	Structure of Matter
TESS	TESS	TESS	TESS	Demo	TESS / Demo	TESS	TESS / Demo	Demo
	Cobra SMART sense	Cobra SMART sense	Cobra SMART sense			Cobra SMART sense	Cobra SMART sense, Cobra 4	
						✓		
						✓		
	✓							
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								✓
						✓		✓
								✓

Student Basic Set Mechanics 1 – digital and analog

Benefits

- The ideal combination of classic experiments and digital data acquisition
- Individual teaching structure possible: you can choose the instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school to day
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students
- Real tripod material for a particularly stable and there for safe construction
- easy instructions including protocols

Digital Set

32 Experiments:

- Measurement of length
- Measurement of time
- Determination of the mass of solid and liquid bodies
- Determination of the density of solid bodies
- Determination of the density of liquids
- Measurement of forces
- Force and reaction
- Weight
- Hooke's law
- Force aligned in the same and opposite direction
- Combination of forces; parallelogram of forces
- Force on a pulley mounting
- Finding the center of gravity
- Reaction forces for an unloaded beam
- Reaction forces for a loaded beam
- Beam balance
- Double-sided lever
- One-sided lever
- Force and displacement on a fixed pulley
- Force and displacement on a free pulley
- Block and tackle formed from a free and a fixed pulley
- Block and tackle with four pulleys
- Potential energy and tension energy
- Power
- Finding the density of solid bodies by measuring the buoyancy
- Finding the density of liquids using a densimeter
- Helical spring pendulum
- Thread pendulum (mathematical pendulum)
- Damping
- Forced oscillation and resonance
- Reversible pendulum (physical pendulum)
- Coupled pendulum systems

+ 1 Cobra SMARTsense Force

15271-88D

Analog Set

The set continues to be available in the classical version:
Basic Set Mechanics 1
15271-88

Necessary Equipment

TESS advanced Mechanics 1 consumables for 10 groups
13450-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Download on the App Store

ANDROID APP ON Google play

Student supplementary set Mechanics 2

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Experimenting software for pupils and teachers available:minimal preparation time
- Matched with international curriculum: all topics are covered

Analog Set

20 Experiments

- Determination of the volume of regular and irregular bodies
- Determination of the density of air
- Bending of a leaf spring
- Calibration of a dynamometer
- Stability
- Restoring force on a displaced pendulum
- Friction
- Coefficient of friction
- Force and displacement on a step wheel
- Gear mechanisms and belt drives
- Joined vessels
- Hydrostatic pressure
- Buoyancy and floating
- Archimedes' principle
- Finding the density of immiscible liquids
- Capillary action
- Boyle-Mariotte law
- Pumps and siphons
- Oscillations of a leaf spring
- Displacement-time recording

15272-88

Necessary Equipment

Student set Mechanics 1
15271-88
TESS advanced Mechanics 1 consumables for 10 groups
13450-88
TESS advanced Mechanics 2 consumables for 10 groups
13451-88

Recommended Equipment

curricuLAB ActivityManager, site licence
14575-62

Student set Linear motion – digital and analog

NEW Cobra SMARTsense

Benefits

- The ideal combination of classic experiments (practical competence) and digital data acquisition (media competence)
- Individual teaching structure possible: you can decide to chose the measuring instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students
- Particularly accurate and reproducible measurement results through the use of forked light barriers
- Particularly modern coverage of the curriculum theme „movement“ in the student experiment

Digital Set

10 Experiments:
- Uniform linear motion
- Comparison of uniform and non-uniform motion
- Instantaneous and average speed
- Laws of uniform linear motion
- Laws of uniformly acceleration motion
- Potential and kinetic energy
- Free fall
- Newton's law: acceleration as a function of force
- Newton's law: acceleration as a function of mass
- Impulse

+ 1 Cobra SMARTsense Motion
+ 2 Cobra SMARTsense Photogate

15283-88D

Classic Sets

The set continues to be available in two classical versions:

Student set Linear motion with Timer 2-1
15283-88

Student set Linear motion with Cobra4 Mobile-Link
15284-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Student Set Acoustics 1

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Experimenting software for pupils and teachers available: minimal preparation time
- Matched with international curriculum: all topics are covered
- Multidisciplinary treatment of the subject acoustics: physics, biology and music
- More than 10 documented experiments, mainly software- based
- Powerful educational software for generation and analysis of acoustic signals

Analog Set

14 Experiments:

- Generation of sound waves
- Propagation of sound in air
- Propagation of sound in solid bodies
- Propagation of sound in water
- Sound as a sine wave
- Sound and noise
- Lower and upper hearing threshold
- Directional hearing
- Beat frequency
- Measurement of sound velocity
- Bone conduction
- Noise level traffic lights
- Scales and intervals
- Fundamental, overtone and tone colour

15289-88

Necessary Equipment

Student set Acoustics 1, necessary accessories for 1 group, TESS advanced Physics
15289-77

Recommended Equipment

curricuLAB ActivityManager, site licence
14575-62

Student Set Acoustics 2

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Matched with international curriculum: all topics are covered
- Experimenting literature for pupils and teachers available: minimal preparation time
- Multidisciplinary treatment of the subject acoustics: physics, biology and music
- More than 20 documented experiments (together with Acoustics 1), mainly software based
- Powerful educational software for generation and analysis of acoustic signals

Analog Set

8 Experiments:

- Harmonic Oscillation
- Visualization of the vibrations of a tuning fork
- Reflection and echo
- Standing waves
- Resonance
- Determination of an unknown frequency (beats)
- Reflection and absorption of sound
- Acoustic Doppler-effect

15321-88

Necessary Equipment

Student set Acoustics 1, TESS advanced Physics
15289-88

Student set Acoustics 1, necessary accessories for 1 groups
15289-77

Recommended Equipment

curricuLAB ActivityManager, site licence
14575-62

Student Set Heat 1 – digital and analog

NEW Cobra SMARTsense

Benefits

- The ideal combination of classic experiments and digital data acquisition
- Individual teaching structure possible: you can choose the instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students Complete equipment set: simple execution of the experiments
- Real tripod material for a particularly stable and safe construction
- Own construction of a calorimeter strengths the understanding
- Student-friendly instructions including protocol questions

Digital Set

21 Experiments:

- Heat sensitivity of the skin
- Thermal equilibrium
- Calibration of a thermometer (thermometer model)
- Expansion of liquids and gases
- Expansion coefficient of liquids
- Expansion of air at constant pressure
- Expansion of air at constant volume
- Thermal convection in liquids and gases
- Thermal insulation
- Heating different quantities of water
- Heating various liquids
- Temperature of mixed liquids
- Heat capacity of the calorimeter
- Volume change during the melting of ice
- Latent heat of fusion of ice
- Heat of evaporation of water
- Heat of condensation of water
- Evaporation
- Heat of solution
- Freezing point depression (freezing mixture)
- Boiling point elevation

+ 1 Cobra SMARTsense Temperature

15274-88D

Analog Set

The set continues to be available in the classical version:

Student Set Heat 1, analog
15274-88

Necessary Equipment

TESS advanced Heat 1 necessary accessories for 1 group
13455-88

TESS advanced Heat 1 consumables for 10 groups
13456-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android

curricuLAB® ActivityManager, site licence
14575-62

Student Set Heat 2

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Experimenting software for pupils and teachers available:minimal preparation time
- Matched with international curriculum: all topics arecovered

Analog Set

13 Experiments:

- Temperature measurement with a thermocouple
- Linear expansion of metals
- Bimetallic principle
- Thermal conduction of solid bodies
- Thermal conduction coefficient of metals
- Thermal conduction in liquids
- Absorption of thermal radiation
- Specific heat capacity of water
- Specific heat capacity of solid bodies
- Calorimetric temperature measurement
- Conversion of mechanical energy into internal energy
- Melting and freezing curve of sodium thiosulphate
- Distillation

15275-88

Necessary Equipment

Student set Heat 1
15274-88
TESS advanced Heat 2 necessary accessories for 1 group
13457-88
TESS advanced Heat 2 consumables for 10 groups

Recommended Equipment

curricuLAB ActivityManager, site licence
14575-62

Student set Renewable energy 1 – digital and analog

NEW Cobra SMARTsense

Benefits

- Complete equipment set for 17 experiments
- Covers energy conversion, heat energy from solar energy, ambient heat
- The equipment is stored in a rugged, stackable and compact box, allowing quick controlif set content is complete
- Matched with international curriculum: all topics are covered
- Covers major interdisciplinary and key technologies
- Interactive experimental procedure with interTESS, a software for PC assisted experiment performance, analysis and evaluation
- Use of the software interTESS minimizes preparation time and encourages individual learning speeds
- Together with the two supplementary sets, more than 30 additional experiments can be carried out covering solar, wind, water energy and fuel cell technology

Digital Set

17 Experiments:

- Conversion of light into motion with a solar cell
- Conversion of mechanical energy into electrical energy
- Conversion of thermal energy into electrical energy
- Conversion of thermal energy into motion
- Driving a water wheel
- Thermal conduction
- Influence of surface on the absorption of solar energy
- Influence of insulation on the absorption of solar energy
- Using the greenhouse effect with a solar collector
- Heating water in a solar collector
- Thermal insulation of houses and thermal imaging
- Thermal radiation and greenhouse effect
- Generation of electrical energy using a thermogenerator(thermoelectric power)
- Thermal voltage and temperature
- Peltier effect: cooling engine
- Peltier effect: heat pump
- Using ambient heat

+ 1 Cobra SMARTsense Temperature
+ 1 Cobra SMARTsense Voltage
+ 1 Cobra SMARTsense Current

15287-88D

Analog Set

The set continues to be available in the classical version:
Student set Renewable energy 1, analog
15287-88

Necessary Equipment

Student set Renewable energy 1, necessary accessories for 1 group
13480-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Student set Renewable energy 2, Solar, Water, Wind

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Matched with international curriculum: all topics are covered
- Comprehensive treatment of all subjects of energy, its conversion and storage and the use of renewable energy sources in combination with Set Renewable Energy in more than 40 experiments
- With set EN-SW quantitative treatment of additional relevant key technologies

Analog Set

26 Experiments:

- Influence of illumination level on voltage and current of a solar cell
- Influence of surface area of solar cell on voltage and current
- Voltage and current in a series connection of solar cells
- Voltage and current in a parallel connection of solar cells
- The solar cell as a power source for LED
- The solar cell as a diode
- Voltage and current of a solar cell as a function of light intensity
- Storage of electrical energy of a solar cell with the aid ofa rechargeable battery
- Solar-dark characteristic curve
- The characteristic current-voltage curves of solar cells
- Storage of the electric energy from a solar cell in a capacitor
- Electrical energy from wind energy
- Influence of wind speed
- Influence of wind direction
- Wind energy under load
- Influence of number of rotor blades
- Storage of electrical energy from wind energy with the aid of a rechargeable battery
- Storage of the electric energy gained from wind energy in a capacitor
- Current-voltage characteristic of the wind wheel
- Pumping water using solar energy
- Pumping water using wind energy
- Efficiency of the pump in the conversion of electric energy to potential energy
- Running water drives a generator
- Heating water using a parabolic trough
- How heating is influenced by the position of the absorber in the parabolic trough
- Model of a parabolic trough field

15288-88

Necessary Equipment

Student set Renewable energy 1, Basics and thermal energy
15287-88
Student set Renewable energy 1, necessary accessories for 1 group
13480-88

Recommended Equipment

curricuLAB ActivityManager, site licence
14575-62
TESS advanced Renewable Energy EN-BS optional acessories for 1 group
13481-88

Student set Renewable energy 3, Fuel cells

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Matched with international curriculum: all topics are covered
- Comprehensive treatment of all subjects of energy, its conversion and storage and the use of renewable energy sources
- With set Renewable Energy quantitative treatment of additional relevant key technologies

Analog Set

10 Experiments:

- Generation of hydrogen and oxygen using a PEM electrolyser
- Generation of electric energy using a PEM fuel cell
- Solar-hydrogen system
- Wind-hydrogen system
- Characteristic curve of a PEM electrolyser
- Faraday efficiency and energetic efficiency of a PEM electrolyser
- Current-voltage characteristic of a PEM fuel cell
- Faraday and energetic efficiencies of a PEM fuel cell
- The efficiency of a electrolyser-fuel cell system
- current-voltage characteristic of an air breathing fuel cell

15286-88

Necessary Equipment

Student set Renewable energy 1, Basics and thermal energy, TESS advanced Applied Sciences
15287-88
Student set Renewable energy 1, necessary accessories for 1 group
13480-88

Recommended Equipment

Software interTESS Applied Science, Renewable Energy, DVD
01081-00
curricuLAB ActivityManager, site licence
14575-62

Student set Electricity / Electronics 1 with Building Blocks – digital and analog

Benefits

- The ideal combination of classic experiments (practical competence) and digital data acquisition (media competence)
- Individual teaching structure possible: you can decide to chose the measuring instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students
- No additional cable connections between the different parts required - clearer and faster setup
- Secure contact through puzzle-like components
- Gold plated, corrosion resistant contacts
- Double learning success: Electrical circuit diagram visible on the top and right components on the underside

Digital Set

28 Experiments:

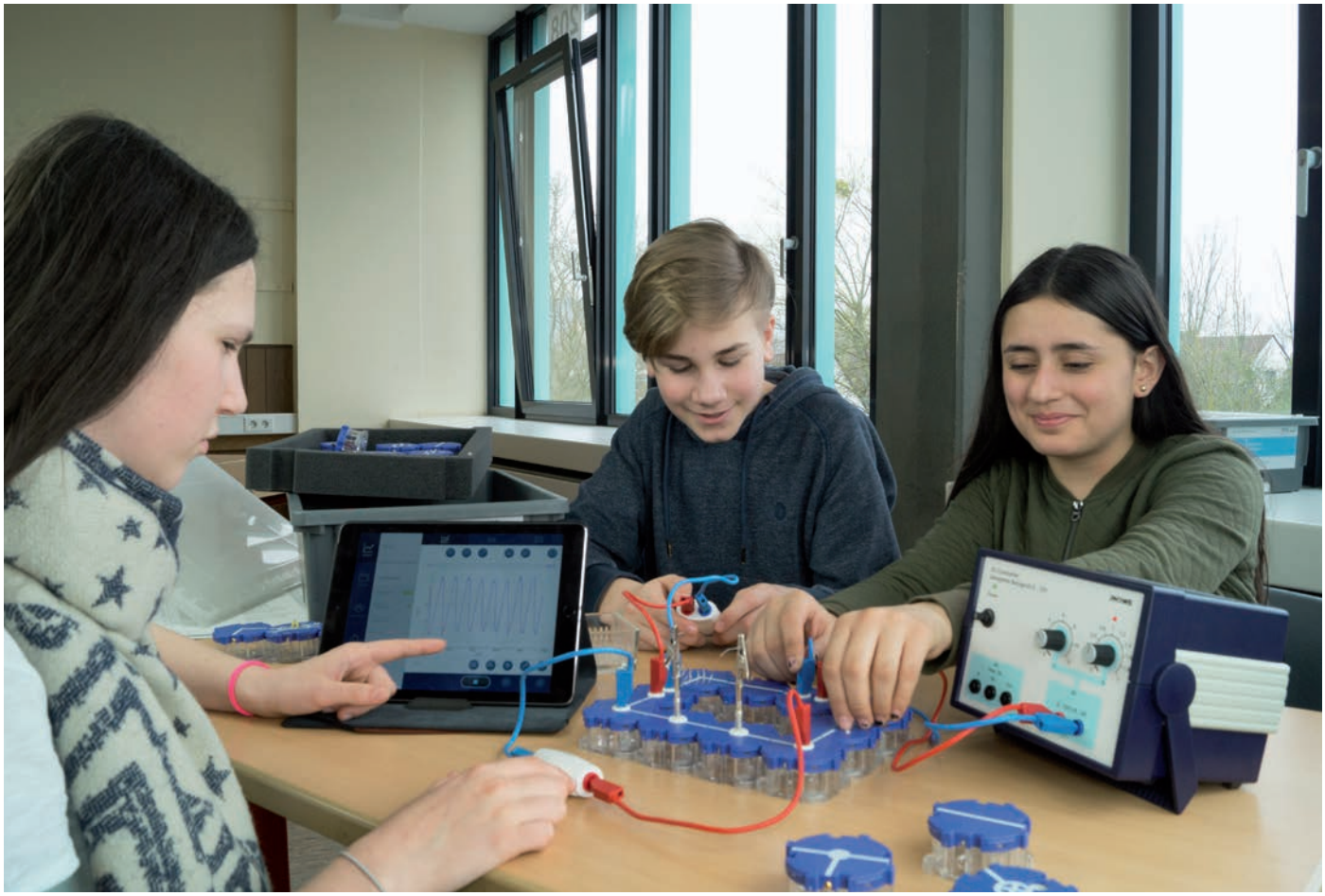
- The simple electrical circuit
- Measurement of voltage
- Measurement of current
- Conductors and non-conductors
- Changeover switches and alternating switches
- Parallel and series connection of voltage sources
- The safety fuse
- The bimetallic switch
- Ohm's law
- The resistance of wires - dependence on the length andcross-section
- The resistivity of wires
- Current and resistance in a parallel connection
- Current and resistance in a series connection
- Voltage in a series connection
- The potentiometer
- The internal resistance of a voltage source
- Electrical power and work
- Conversion of electrical energy into thermal energy
- Conductivity of aqueous solutions of electrolytes
- Connection between voltage and current in conductive proces-ses in liquids
- Electrolysis
- Galvanisation
- Galvanic cells
- The lead accumulator
- Earthing of the power supply line
- The protective conductor system
- The NTC resistor
- The PTC resistor

+ 1 Cobra SMARTsense Voltage
+ 1 Cobra SMARTsense Current

15264-88D

Analog Set

The set continues to be available in the classical version:
Student set Electricity / Electronics 1 with Building Blocks analog
15264-88



Necessary Equipment

Student set Electrics /Electronics 1, necessary accessories for 1 group, TESS advanced Physics
13470-88
Student set Electrics / Electronics 1, consumables for 10 groups, TESS advanced Physics
13471-88

Recommended Equipment

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Student set Electricity / Electronics 2 with Building Blocks, Electromagnetism and Induction

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Experimenting literature for pupils and teachers available: minimal preparation time
- Matched with international curriculum: all topics are covered
- The circuits are assembled directly on student's desk and the safe electric contact is guaranteed by the use of a unique puzzle block system with corrosion-free gold plated contacts. No breadboard is required.
- Rugged -PUZZLE- blocks featuring contrasted screen-printed electric symbol on top

Analog Set

18 Experiments:

- The magnetic effect of a current-carrying conductor
- A current-carrying conductor in a magnetic field
- The electric bell
- The electromagnetic relay
- Controlling with a relay
- The galvanometer
- The permanent magnet DC motor
- The series motor
- The shunt motor
- Generation of an induced voltage with permanent magnets
- Generation of an induced voltage with electromagnets
- The alternating current generator
- Voltage transformation
- Current transformation
- Self-induction when switching a circuit on
- Self-induction when switching a circuit off
- Coils in alternating current circuits
- The protective isolation transformer

15266-88

Necessary Equipment

Student set Electricity / Electronics 1
15264-88
Student set Electrics /Electronics 1, necessary accessories for 1 group
13470-88
Student set Electrics / Electronics 1, consumables for 10 groups
13471-88

Recommended Equipment

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Student set Electricity/Electronics 3 with Building Blocks, Electronics

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Experimenting literature for pupils and teachers available: minimal preparation time
- Matched with international curriculum: all topics are covered
- The circuits are assembled directly on student's desk and the safe electric contact is guaranteed by the use of a unique puzzle block system with corrosion-free gold plated contacts. No breadboard is required.
- Rugged -PUZZLE- blocks featuring contrasted screen-printed electric symbol on top

Analog Set

23 Experiments:

- Capacitors in direct current circuits
- Charging and discharging a capacitor
- Capacitors in alternating current circuits
- Diodes as electrical valves
- Diodes as rectifiers
- The characteristic curve of a silicon diode
- Properties of solar cells - dependence on the illuminance
- Current-voltage characteristic of a solar cell
- The NPN transistor
- The transistor as a direct current amplifier
- The current-voltage characteristic of an NPN transistor
- The transistor as a switch
- The transistor time-delay switch
- Characteristic curve of a Zener diode
- The Zener diode as voltage stabiliser
- Light-emitting diodes
- Photo diodes
- Bridge rectifiers
- Filter networks
- The transistor as a voltage amplifier
- Stabilisation of the operating point
- Temperature control of a transistor
- Undamped electromagnetic oscillations

15267-88

Necessary Equipment

Student set Electricity / Electronics 1
15264-88

Student set Electrics / Electronics 1, consumables for 10 groups
13471-88

Student set Electrics /Electronics 1, necessary accessories for 1 group, TESS advanced Physics
13470-88

Recommended Equipment

curricuLAB ActivityManager, site licence
14575-62

Student set Magnetism – digital and analog

NEW Cobra SMARTsense

Benefits

- Ideal combination of classic experiments (action competence) and digital data acquisition (media competence)
- Possible individual lesson design: you can decide to chose the measuring device (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students
- gnetism and the conversion of electrical energy into kinetic energy incl. required accessories

Digital Set

11 Experiments:

- Magnetic and non-magnetic substances
- Magnetic poles and polarity
- Magnetic attraction (distant effect)
- Magnetisation and de-magnetisation
- Breaking down magnets (elementary magnets)
- Combining magnets
- Representation of the field lines of a bar magnet
- Direction of the field lines of a bar magnet
- Pattern produced by the field lines of two like poles
- Pattern produced by the field lines of two unlike poles
- The earth's magnetic field

+1 Cobra SMARTsense Magnetic Field

15230-88D

Analog Set

The set continues to be available in the classical version:
Student set Magnetism, analog
15230-88

Necessary Equipment

TESS advanced Magnetism consumables for 10 groups
13409-88

Recommended Equipment

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Student set Electrostatics

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Experimenting software for pupils and teachers available: minimal preparation time
- Matched with international curriculum: all topics are covered
- The simple and didactically structured experiments offer fast set up and facilitate the students the entrance to the subject.

Analog Set

16 Experiments:

- Demonstration of the type of charge on rubbed rods
- Demonstration of the type of charge on films and plates
- Forces between charged bodies
- A model of an electroscope
- The mode of operation of an electroscope
- Electrostatic induction with conductors and non-conductors
- The effect of a force of electrostatic induction (imagecharge)
- Electrostatic induction with an electroscope
- A conductor as a capacitor
- Charge distribution in a Faraday cup
- Storing of positive and negative charges
- Charge transport with a pendulum
- The mobility of charges in insulators and conductors
- Testing conductivity with an electroscope
- Discharging by ionisation
- Discharging at points

15240-88

Necessary Equipment

TESS advanced Electrostatics consumables for 10 groups
13410-88

Recommended Equipment

curricuLAB ActivityManager, site licence
14575-62

Student set Electric motor / Generator – digital and analog

NEW Cobra SMARTsense

Benefits

- The ideal combination of classic experiments (practical competence) and digital data acquisition (media competence)
- Individual teaching structure possible: you can decide to choose the measuring instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devicesincreases the identification and thus increases the motivation of the students

Digital Set

10 Experiments:
- Magnetic field of a coil
- Conversion of electrical energy into kinetic energy
- Commutator
- Direct current motor
- Synchronous motor
- Series and shunt-wound motor
- Electromagnetic induction
- The electrical generator
- Engine-generator
- Transformer

+ 1 SMARTsense Current
+ 1 SMARTsense Voltage

15221-88D

Analog Set

The set continues to be available in the classical version:

Student set Electric motor / Generator, analog
15221-88

Necessary Equipment

Student set Electric Motor / Generator, necessary accessories for 1 group, TESS advanced Physics
13412-88

Student set Electric Motor / Generator, consumables for 10 groups, TESS advanced Physics
13413-88

Recommended Equipment

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for iOS und Android

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14575-62

Student set Equipotential lines and electric fields – digital and analog

NEW Cobra SMARTsense

Benefits

- The ideal combination of classic experiments (practical competence) and digital data acquisition (media competence)
- Individual teaching structure possible: you can decide to chose the measuring instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students
- No electrolyte required
- Direct measurement of potential with high resistance voltmeter
- Measuring points can be transferred (pressed through) onto a sheet of white paper during measurement

Digital Set

5 Experiments:
- Electric fields
- Electric field strength
- Inhomogeneous electric fields (dipole fields)
- The electric conductor as an equipotential surface
- Electrostatic tip-shape effect

+ Cobra SMARTsense Voltage

15250-88D

Analog Set

The set continues to be available in the classical version:
Student set Equipotential lines and electric fields analog
15250-88

Necessary Equipment

TESS advanced Equipotential lines necessary accessories for 1 group
13411-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Student set Optics 1

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Experimenting software for pupils and teachers available:minimal preparation time
- Matched with international Curriculum: all topics arecovered

Analog Set

40 Experiments:

- Optical illusions
- Rectilinear propagation of light
- Transparent and opaque objects
- Solar and lunar eclipses (with the light box)
- Reflection of light
- Reflection by a plane mirror
- Images in a plane mirror
- Reflection by a concave mirror
- Image construction for a concave mirror
- Reflection by a convex mirror
- Image construction for a convex mirror
- Refraction at the air-glass boundary
- Determining the refractive index of glass
- Refraction at the air-water boundary
- Refraction at the boundary between two liquids
- Refraction at the glass-air boundary
- Total reflection and the critical angle
- Passage of light trough a planoparallel plate
- Refraction at a prism
- Deviating prisms
- Reversing prisms
- Light path and focal length of a convex lens
- Image construction for a convex lens
- Light path and focal length of a concave lens
- Image construction for a concave lens
- Light path of lens combinations
- Focal length of lens combinations
- Spherical aberration
- Chromatic aberration
- Colour dispersion with a prism
- Reunification of spectral colours
- Complementary colours
-
- Mode of operation of the human eye (normal vision)
- Short-sightedness and its correction
- Long-sightedness an its correction
- Defective accommodation in old age and its correction

Requires supplementary set 13250-77:

- Shadows (umbra and penumbra)
- Additive colour mixing
- Subtractive colour mixing
- Colours of objects

15276-88

Necessary Equipment

Student set Optics 1, necessary accessories	
13460-88	
Optics consumables for 10 groups	
13461-88	
Supplementary Set Colour mixing	
13250-77	

Recommended Equipment

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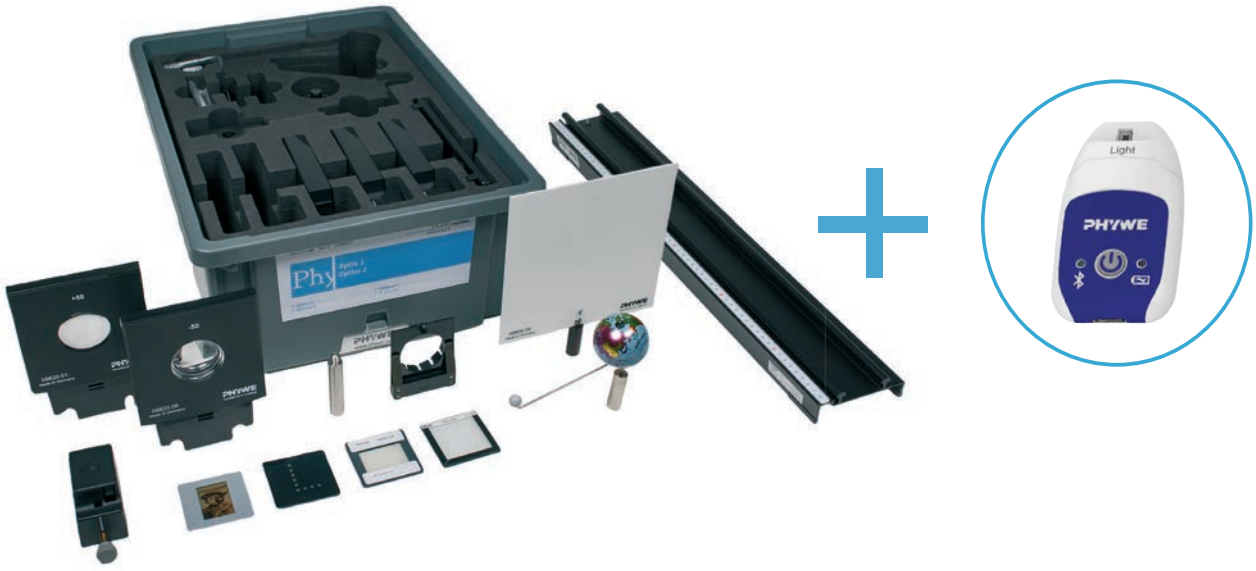
Student set Optics 2 – digital and analog

NEW Cobra SMARTsense



Benefits

- The ideal combination of classic experiments (practical competence) and digital data acquisition (media competence)
- Individual teaching structure possible: you can decide to chose the measuring instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students
- Extension with set-up kits possible at any time and no additional lights required, thereby recognition value for the student guaranteed

Digital Set

30 Experiments:

- Day and night
- The seasons
- The phases of the moon
- Solar and lunar eclipses (with the earth-moon model)
- The pinhole camera
- Luminous intensity (photometer)
- Illuminance (inverse square law)
- Projected image with a concave mirror
- Law of imagery for a concave mirror
- Determining the magnification of a concave mirror
- Images in a convex mirror
- Image obtained with a convex lens
- Determining the focal length of a convex lens
- Law of imagery for a convex lens
- Determining the magnification of a concave lens
- Image obtained with a concave lens
- Pincushion an barrel distortion
- The magnifying glass
- The structure of a microscope
- Determining the magnification of a microscope
- The astronomical telescope
- The Galilean telescope
- Determining the magnification of a telescope
- The camera
- The depth of focus of a camera
- The slide projector
- Diffraction at a grid
- Determination of the wavelength by grid diffraction
- Polarisation with filters
- Rotation of the polarisation plane with a sugar solution

+ 1 Cobra SMARTsense Light

15277-88D

Analog Set

The set continues to be available in the classical version:

Student set Optics 2, analog

15277-88

Necessary Equipment

Supplementary Set Colour mixing
13250-77
Student set Optics 1, necessary accessories
13460-88
Optics consumables for 10 groups
13461-88
Optics 2 consumables for 10 groups
13462-88
Student Basic Set Optics 1
15276-88

Recommended Equipment

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Student set Optics 3, Wave optics

Benefits

- Complete equipment set: simple execution of theexperiments
- The equipment is stored in a rugged, stackable and compact box,allowing quick control of completeness (foam insert)
- Experimenting literature for pupils and teachers available:minimal preparation time
- Matched with international curriculum: all topics arecovered
- Through the use of a stable optical bench made of metal safeand exact experimental setups

Analog Set

29 Experiments:

- Fresnel's double mirror experiment
- Fresnel's biprism experiment
- Young's double slit experiment
- Newton's rings
- Diffraction at an edge
- Diffraction at a slit
- Diffraction at a narrow obstacle (line) - Babinet's princip-le
- Diffraction at a double slit
- Diffraction at multiple slits
- Diffraction at a grating
- Determination of the wavelength by grid diffraction
- Coherence condition
- Diffraction at a crossed grating
- Diffraction at circular apertures
- Diffraction at a system of circular apertures of equal size
- Resolving power of optical devices
- Resolving power of the microscope
- Spectral resolving power of a grating
- Polarisation by filters
- Polarisation by strain double refraction (birefringence)
- Chromatic polarisation
- Polarisation by reflection
- Polarisation by refraction
- Polarisation by dispersion
- Malus' law
- Birefringence in calcite
- Brewster's law
- Rotation of the polarisation plane in a sugar solution
- Elliptic and circular polarisation

15280-88

Necessary Equipment

Student Basic Set Optics 1	
15276-88	
Supplementary Set Colour mixing	
13250-77	
Supplementary set Optics 2	
15277-88	
Student set Optics 1, necessary accessories	
13460-88	
Optics consumables for 10 groups	
13461-88	
Optics 2 consumables for 10 groups	
13462-88	
Optics 3 consumables for 10 groups	
13463-88	

Recommended Equipment

curricuLAB® measureAPP	
for iOS und Android	
curricuLAB® ActivityManager, site licence	
14575-62	

Student set Optics / Atomic physics – digital and analog

Benefits

- The ideal combination of classic experiments (practical competence) and digital data acquisition (media competence)
- Individual teaching structure possible: you can decide to chose the measuring instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students
- Matched with international curriculum
- Quantum and / or wave optics in student experiment

Digital Set

16 Experiments:

- Why is the sky blue?
- What does the spectrum of a light-emitting diode (LED) looklike?
- What does the LED spectrum look like with a transmissiongrating?
- What is the groove spacing on a CD?
- What can one learn from diffraction patterns?
- How is light attenuated when it passes through matter?
- When does a substance fluoresce?
- How is light attenuated by liquids?
- How are the energy and the colour of light connected?
- When is a light-emitting diode a receiver?
- How does the intensity of light decrease a function of thedistance?
- What does the photoelectric current of a solar cell dependon?
- At which wavelength does an LED emit light?
- What does the UI characteristic of an LED look like?
- How does light oscillate?
- How can light be “distorted”??

+ 1 Cobra SMARTsense Voltage
+ 1 Cobra SMARTsense Current

15350-88D

Analog Set

The set continues to be available in the classical version:
Student set Optics / Atomic physics
15350-88

Necessary Equipment

TESS advanced Optics / Atomphysics necessary accessories for 1 group
13466-88

Recommended Equipment

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for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

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Student set Radioactivity

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Matched with international curriculum: all topics are covered
- Experiments on the fundamentals of radioactivity using only common available natural radioactive sources
- Special radioactive emitter only required for 4 advanced experiments
- Counter tube with a large diameter to increase the sensitivity is an integral part of the set
- Measurements are made with the kit contained Cobra4 Mobile-Link with the option to save data (data logger) or to transfer to a PC (interface)

Cobra4 Set

16 Experiments:

- Why is the sky blue?
- What does the spectrum of a light-emitting diode (LED) looklike?
- What does the LED spectrum look like with a transmissiongrating?
- What is the groove spacing on a CD?
- What can one learn from diffraction patterns?
- How is light attenuated when it passes through matter?
- When does a substance fluoresce?
- How is light attenuated by liquids?
- How are the energy and the colour of light connected?
- When is a light-emitting diode a receiver?
- How does the intensity of light decrease a function of thedistance?
- What does the photoelectric current of a solar cell dependon?
- At which wavelength does an LED emit light?
- What does the UI characteristic of an LED look like?
- How does light oscillate?
- How can light be “distorted”?

15261-88

Necessary Equipment

TESS advanced Radioactivity RE consumables for 10 groups
13469-88

Recommended Equipment

curricuLAB ActivityManager, site licence
14575-62
Rradioactivity, optional accessories for 1 group
13490-88

4. TESS – Student Experiments

Training-Experiment-System for Students

4.3 Chemistry

Complete curriculum coverage in Chemistry –

Cover with the TESS and Demo System from PHYWE the requirements of modern natural science education

International Reference Curriculum (School)

Topic \ Sets or experimental collections	General Chemistry	Environment and Outdoors	Inorganic Chemistry	Acids, Bases Salts	Titration
	TESS / Demo	TESS / Cobra4	TESS / Demo	TESS / Demo	Demo
GENERAL CHEMISTRY					
Chemical and material properties	✓				
Mixture and seperation	✓				
State of matter, diffusion (kinetic particle theory)	✓		✓		
Fundamentals of chemical reactions (mass and energy turnover, ...)	✓				
Detection reaction, ion detection	✓		✓		
Chemical bond (polar, nonpolar, ionic, covalent)	✓			✓	
Periodicity and chemical properties	✓		✓		
Chemistry and environment		✓	✓		
INORGANIC CHEMISTRY					
Air and combustion		✓	✓		
Water	✓	✓	✓		
Metals and alloys			✓		
Non-metals, gases and semi-metals			✓		
Acids and bases, proton transitions			✓	✓	✓
Quantitative analysis: titrations					✓
Salts			✓	✓	
Redox reactions, electron transfer	✓		✓		
Special topics: firefighting, large-scale processes, explosives, ...			✓		
ORGANIC CHEMISTRY					
Basics of organics					
Hydrocarbons and petrochemistry					
Oxygenated organic compounds					
Polymer chemistry					
Food chemistry: fats, carbohydrates, amino acids / proteins, ...					
Aromatic hydrocarbons					
Special topics: detergents, medicines, fragrances / aromas, ...					
PHYSICAL CHEMISTRY					
Energy turnover in chemical reactions					
Gas laws					
Calorimetry, energetics of chemical reactions					
Kinetics of chemical reactions					
Electrochemistry - potentials, conductivity, electrolysis					
Chemical equilibria	✓				
Spectroscopy and photometry					

Demo PHYWE

TESS PHYWE

Analytical Chemistry	Organic Chemistry	Polymer Chemistry	Food Chemistry	Gas laws, Thermochemistry Kinetics	Electrochemistry	Colorimetry
TESS	TESS / Demo	TESS	TESS / Demo	Demo	TESS / Demo	TESS
✓						
✓	✓					
✓						
✓						
					✓	
	✓					
	✓					
	✓					
		✓				
			✓			
	✓					
	✓					
				✓		
				✓		
				✓		
				✓		
					✓	
				✓		
						✓

Student set General Chemistry – digital and analog

Benefits

- The ideal combination of classic experiments (practical competence) and digital data acquisition (media competence)
- Individual teaching structure possible: you can decide to chose the measuring instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students
- Experimental software available for students and teachers: Short preparation time
- Matched to education plans: all topics covered
- Set developed by teachers for general chemistry

Digital Set

25 Experiments:

- Properties of Matter,hardness, colour,magnetisability,water, solubility
- Properties of material - combustibility, melting point
- Properties of matter - boiling point
- Properties of matter - sublimation
- Properties of matter - density determination
- Properties of mixtures
- Liquid mixtures
- Mixture separation - evaporation
- Mixture separations - filtration, magnatic separation
- Mixture separation - extraction
- Mixture separation - chromatography
- Comparison of a physical process and a chemical reaction
- Reaction of copper and sulphur
- Test of oxygen
- Test for hydrogen
- Test for nitrogen
- Volume contraction of liquids
- Dissolution processes on liquids
- Dissolution of salts
- Crystallisation
- Test confirming the migration of ions by means of indicatorpaper
- Periodic system properties of a group of elements - Group 2
- Dipole properties
- Melting-point lowering and boiling-point elevation
- Behaviour of salts with regard to solvents of differentpolarities

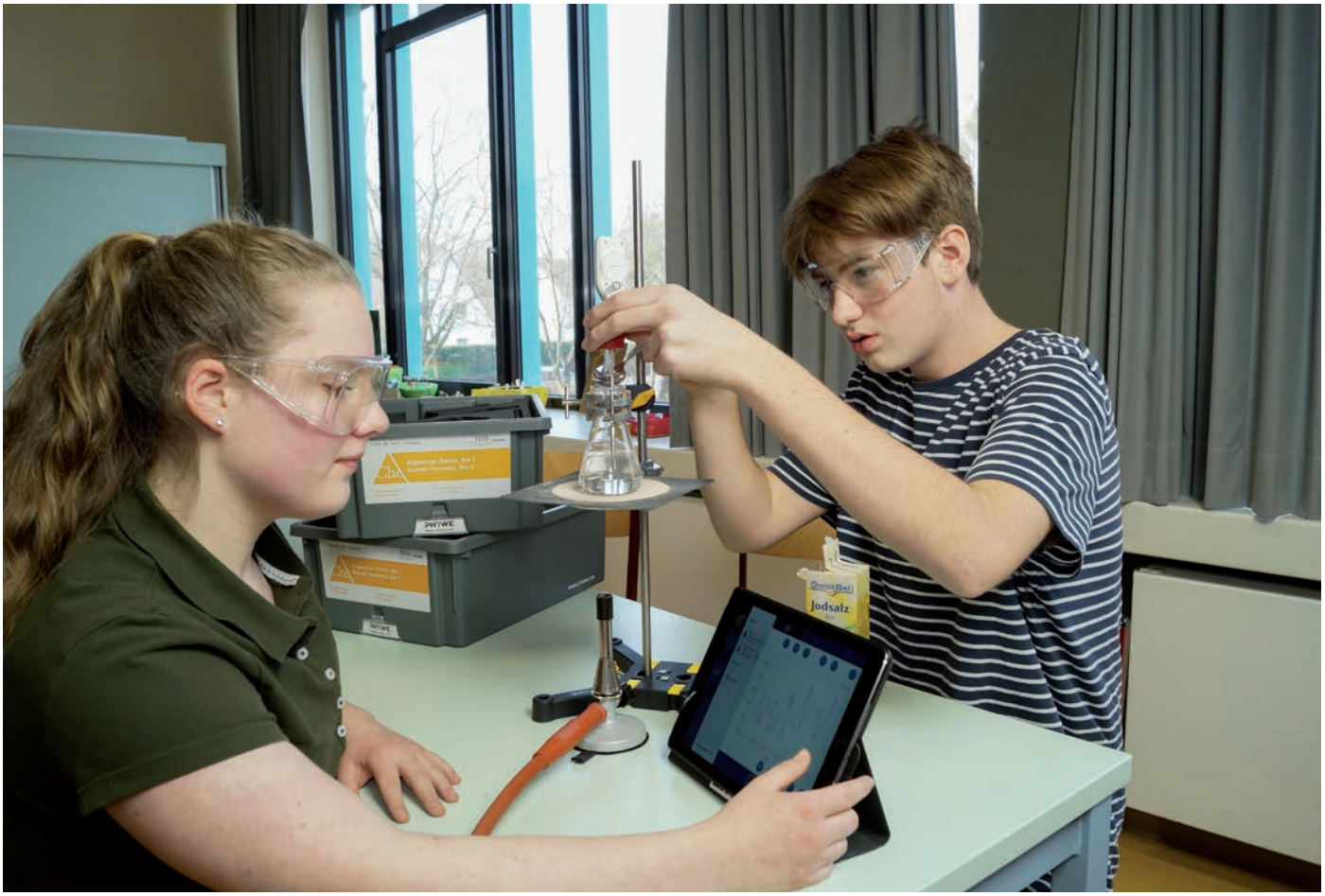
+ 1 Cobra SMARTsense Temperature

15300-88D

Analog Set

The set continues to be available in the classical version:

Student set General Chemistry, TESS advanced Chemistry
15300-88



Necessary Equipment

TESS advanced General Chemistry, consumables and chemicals for 10 groups
13300-10
TESS advanced General Chemistry, necessary accessories for 1 group
13431-88

Recommended Equipment

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for iOS and Android
curricuLAB® ActivityManager, site licence
14575-62

measureAPP PHYWE

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ANDROID APP ON Google play

Student set Inorganic chemistry – digital and analog

Benefits

- The ideal combination of classic experiments (practical competence) and digital data acquisition (media competence)
- Individual teaching structure possible: you can decide to chose the measuring instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students
- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Experimenting software for students and teachers available: minimal preparation time
- Matched with international Curriculum: all topics are covered
- Set developed by teachers for introduction into inorganic chemistry

Digital Set

35 Experiments:

- Oxidation of metals
- Factors determining the reaction behaviour of metals
- Oxygen, cause of oxidation
- The importance of air for combustion processes
- Air, a mixture of substances
- Properties of oxygen
- Reactions in pure oxygen
- Quantitative analysis of oxides
- Nitrogen, preparation and properties
- Carbon dioxide, preparation and properties
- Model of a fire extinguisher
- Structure and mode of operation of a Bunsen burner
- The candle flame
- Rusting- "slow combustion"
- Reduction of copper oxide
- Water content of natural substances
- Dissolved components in different waters
- Solubility of gases in water
- Solutions, colloids, suspensions
- Solubility of salts in water - comparison with the solubility of gases in water
- Mode of operation of an aeration tank (sewage treatmentplant)
- Water treatment in sewage treatment plants
- Hardness of water
- Test for water
- Water, an oxide
- Degradation of water by reducing agents
- Synthesis of water
- Production of gypsum plaster
- Processing of gypsum
- Plaster moulds
- Mineral constituents of plants
- Absorption of minerals by plants
- Ammonia fertilizer
- Burnt lime
- Soda-lime glass beads

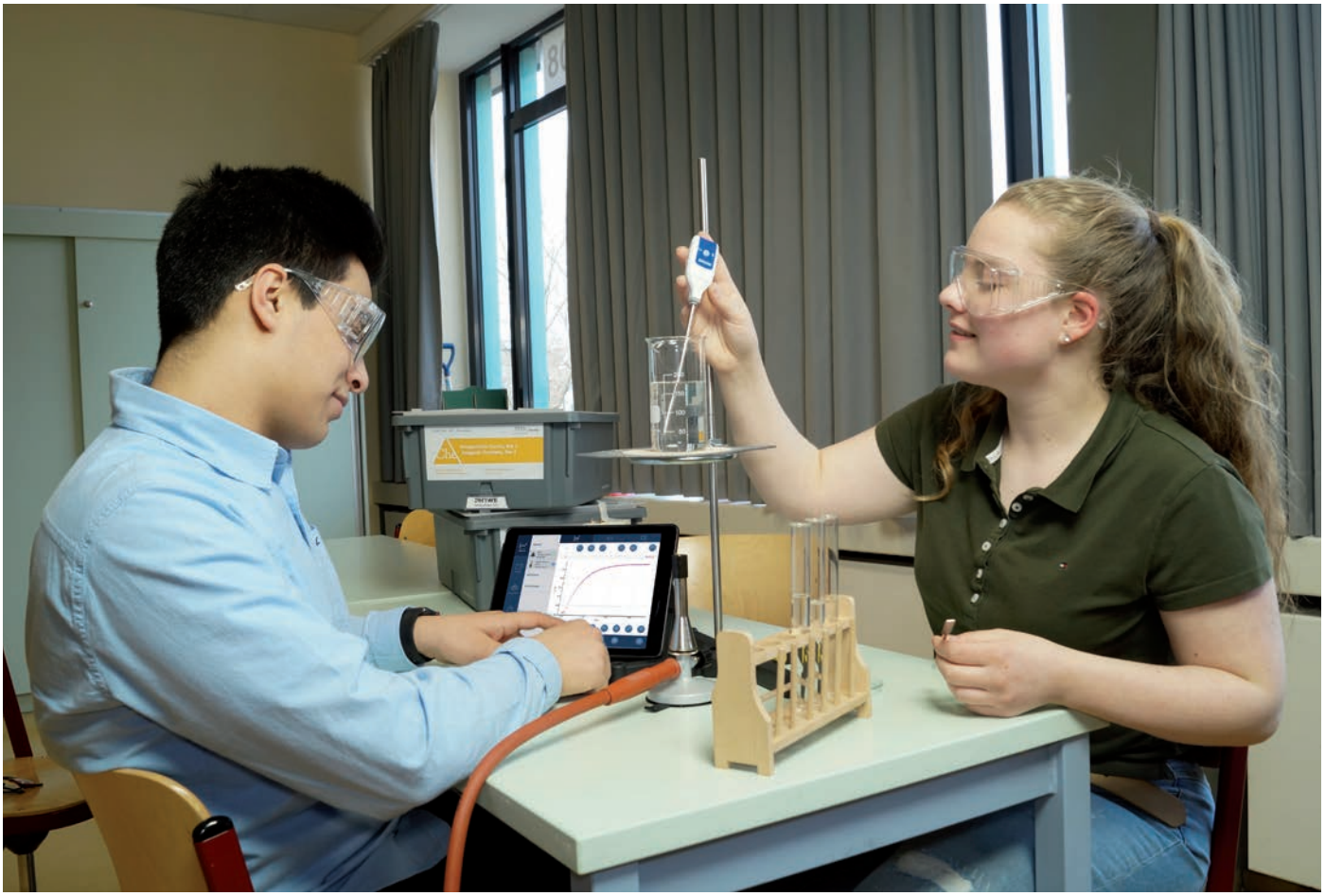
+ 1 Cobra SMARTsense Temperature

15301-88D

Analog Set

The set continues to be available in the classical version:

Student set Inorganic chemistry
15301-88



Necessary Equipment

TESS advanced Inorganic Chemistry, consumables and chemicals for 10 groups
13301-10

TESS advanced Inorganic Chemistry, necessary accessories for 1 group
13433-88 95.95€

Recommended Equipment

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Student set Acids, Bases, Salts – digital and analog

NEW Cobra SMARTsense

Benefits

- The ideal combination of classic experiments (practical competence) and digital data acquisition (media competence)
- Individual teaching structure possible: you can decide to chose the measuring instrument you want (classic or digital)
- Future-proof: preparing today the transition to the digital school
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students
- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Experimenting literature for pupils and teachers available: minimal preparation time
- Matched with international Curriculum: all topics are covered

Digital Set

31 Experiments:

- General safety precautions to be taken when handling acids
- Hazardousness of concentrated sulphuric acid
- Plant pigments as indicators
- The effects of acids on indicators
- The effects of acids and lyes on natural and commercialindicators
- The effects of acids on metals
- Acid strength
- Preparation and properties of hydrochloric acid
- Preparation and properties of sulphurous acid
- PVC- a potential hydrochloric acid former
- Sulphurous acid- environmental hazards due to the combustionof fossil fuels, acid rain
- Oxidation of sulphurous acid
- Preparation and properties of sulphuric acid
- Preparation and properties of carbonic acid
- Brönsted acids: conductivity comparison of molten and dis-solved oxalic acid
- Brönsted acids: acidity comparison of an aqueous and an ace-tonic solution of citric acid
- Safety precautions to be taken when handling lyes
- Alkalis - constituents of household detergents
- Aqueous solubility of ammonia
- Preparation and properties of a lime water/ magnesium hydro-xide solution
- Preparation and properties of sodium hydroxide solution
- Alkali formation due to a reaction of base metals with water - qualitative determination of the conductivity of solution
- Alkali formation due to a reaction of metal oxides with wa-ter
- Reaction of alkalis with aluminium - alkali strength
- Salt formation due to a reaction of acids with alkalis
- Salt formation due to a reaction of acids with metal oxides
- Salt formation from chemical elementsreaction of zinc and iron with sulphur and iodine
- Salt formation by precipitation reaction - qualitative determination of chlorids and sulphates
- Hydrolysis of salts
- Thermal decomposition of salts
- Osmosis: a "chemical garden"

+ 1 Cobra SMARTsense pH
+ 1 Cobra SMARTsense Temperature

15302-88D

Analog Set

The set continues to be available in the classical version:

Student set Acids, Bases, Salts, TESS advanced Chemistry

15302-88

Necessary Equipment

TESS advanced Chemistry Acids, Bases, Salts, necessary accessories for 1 group
13435-88
TESS advanced Chemistry Acids, Bases, Salts, consumables and chemicals for 10 groups
13436-88

Recommended Equipment

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Student set Titration and analytical chemistry – digital and analog

NEW Cobra SMARTsense

Benefits

- Complete experiment set: experiments easy to perform
- Stable storage box: durable and stackable, facilitate fast control if content is complete
- Experiment guides available both for students and teachers: preparation time reduced to a minimum
- Curriculum-compliant: all topics are covered
- Developed by teachers as an ideal introduction into titration and analytical chemistry

Digital Set

14 Experiments:

- Acids and their effect on indicators
- The effect of acids and bases on natural and synthetic indicators
- Identification of buffers with indicators
- Saline solutions and their effect on various indicators
- Titration of a strong acid with a strong base with the aid of a suitable indicator
- Titration of a strong acid with a strong base with the aid of several indicators
- Titration of a weak acid with a strong base with the aid of a suitable indicator
- Titration of a weak base with a strong acid with the aid of a suitable indicator
- Titration of a weak acid with a weak base with the aid of a suitable indicator
- Titration of a polyprotic acid with a strong base with the aid a suitable indicator
- Determining the pKa value of a weak acid with half titration
- Identifying cations with a flame test
- Anion analysis with precipitation reactions
- Determination of chloride by Fajans

+ 1 Cobra SMARTsense pH

15303-88D

Analog Set

The set continues to be available in the classical version:

Student set Titration and analytical chemistry
15303-88

Necessary Equipment

TESS advanced Analytic Chemistry, consumables and chemicals for 10 groups
13439-88
TESS advanced Analytical Chemistry, necessary accessories for 1 group
13440-88

Recommended Equipment

curricuLAB ActivityManager, site licence
14575-62
curricuLAB® measureAPP
for iOS and Android

Student set Analytical Chemistry with Cobra4 Mobile-Link

Benefits

- Complete experiment set: experiments easy to perform
- Stable storage box: durable and stackable, facilitate fast control if content is complete
- Experiment guides available both for students and teachers: preparation time reduced to a minimum
- Curriculum-compliant: all topics are covered
- Developed by teachers as an ideal introduction into titration and analytical chemistry

Digital Set

21 Experiments:

- Acids and their effect on indicators
- The effect of acids and bases on natural and synthetic indicators
- Identification of buffers with indicators
- Saline solutions and their effect on various indicators
- Titration of a strong acid with a strong base with the aid of a suitable indicator
- Titration of a strong acid with a strong base with Cobra4
- Titration of a strong acid with a strong base with the aid of several indicators
- Titration of a weak acid with a strong base with the aid of a suitable indicator
- Titration of a weak acid with a strong base with Cobra4
- Titration of a weak base with a strong acid with the aid of a suitable indicator
- Titration of a weak acid with a weak base with the aid of a suitable indicator
- Titration of a weak acid with a weak base with Cobra4
- Titration of a polyprotic acid with a strong base with the aid a suitable indicator
- Titration of a polyprotic acid with a strong with Cobra4
- Determining the pKa value of a weak acid with half titration
- Identifying cations with a flame test
- Anion analysis with precipitation reactions
- Determination of chloride by Fajans
- Titration of a buffer solution with a strong base with Cobra4
- Experimental confirmation: Henderson-Hasselbalch with Cobra4
- Titration of an acidic soft drink with a strong base with Cobra4

15303-77

Necessary Equipment

TESS advanced Analytic Chemistry, consumables and chemicals for 10 groups
13439-88

TESS advanced Analytical Chemistry, necessary accessoriesfor 1 group
13440-88 193.36€

Recommended Equipment

curricuLAB ActivityManager, site licence
14575-62

Student set Organic Chemistry – digital and analog

NEW Cobra SMARTsense

Benefits

- The ideal combination of classic experiments (practical competence) and digital data acquisition (media competence)
- Individual teaching structure possible: you can decide to chose the measuring instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students
- Experimenting software for pupils and teachers available: minimal preparation time
- Matched with international Curriculum: all topics are covered
- Set developed by teachers

Digital Set

36 Experiments:

- The decomposition of organic substances
- The detection of carbon with lime-water
- The detection of carbon by oxidation
- The detection of oxygen
- The detection of nitrogen
- The detection of sulphur
- The Beilstein test
- The characterisation of methane
- The homologous series of the alkanes
- The reactivity of the alkanes
- The characterisation of ethylene
- The characterisation of ethine (acetylene)
- Oil fields
- The cracking of petroleum
- Removal of paraffins by extraction
- Removal of paraffins by urea
- Alcoholic fermentation
- Prodution of methanol "wood spirit"
- Alco test-tubes
- The borax test
- The idoform test
- The properties of homologous series of alcohols
- Polyhydric alcohols
- The oxidation of alkanols
- Schiff's test and Fehling's test
- The characterisation of acetone
- The use of formic acid
- The characterisation of acetic acid "wood vinegar"
- The acidic character of carboxcyclic (alkane) acids
- Iron cloride test / Formation of verdigris
- Esters of acetic acid
- Esters of various alkane acids
- The splitting of esters
- Production of soap
- The properties of soap
- The action of soap

+ 1 Cobra SMARTsense Temperature

15304-88D

Analog Set

The set continues to be available in the classical version:

Student set Organic chemistry, TESS advanced Chemistry
15304-88

Necessary Equipment

TESS advanced Organic Chemistry, necessary accessories for 1 group
13437-88
TESS advanced Organic Chemistry, consumables and chemicals for 10 groups
13438-88

Recommended Equipment

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Student set Chemistry of Polymers – digital and analog

NEW Cobra SMARTsense

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Experimenting software for pupils and teachers available: minimal preparation time
- Matched with international curriculum: all topics are covered
- Set developed by teachers
- Ideal experimental introduction to the topic of polymers with references to everyday life

Digital Set

18 Experiments:

- Constituents of polymers (1): The thermal decomposition/oxidtion of polymers
- Constituents of polymers (2): The detection of polymer constitents/the Beilstein test
- The decomposition of naturally occuring polymers: The decompsition of starch
- Properties of plastics (1): The mechanical properties of platic
- Properties of plastics (2): Determination of the densities ofplastic
- Properties of plastics (3): Flammability
- Properties of plastics (4): Deformability on warning
- Properties of plastics (5): Determination of the melting rane
- Preliminary experiments on the synthesis of plastics (1):properties of monomers
- Polymerisation reactions (1): formation of polystereneproperties of monomers
- Step-growth polymerisation (1): The formation of polyamide
- Step-growth polymerisation (2): Production of nylon
- Polyaddition (1): aldol addition
- Polyaddition (2): Polyurethane formation
- Modification of plastics (5): production of polysterene foam
- Identification of plastics (1): thermoplastics and thermo-setting plastics
- Identification of plastics (2): identification scheme forthermoplastics
- Re-cycling procedures (1): Re-melting

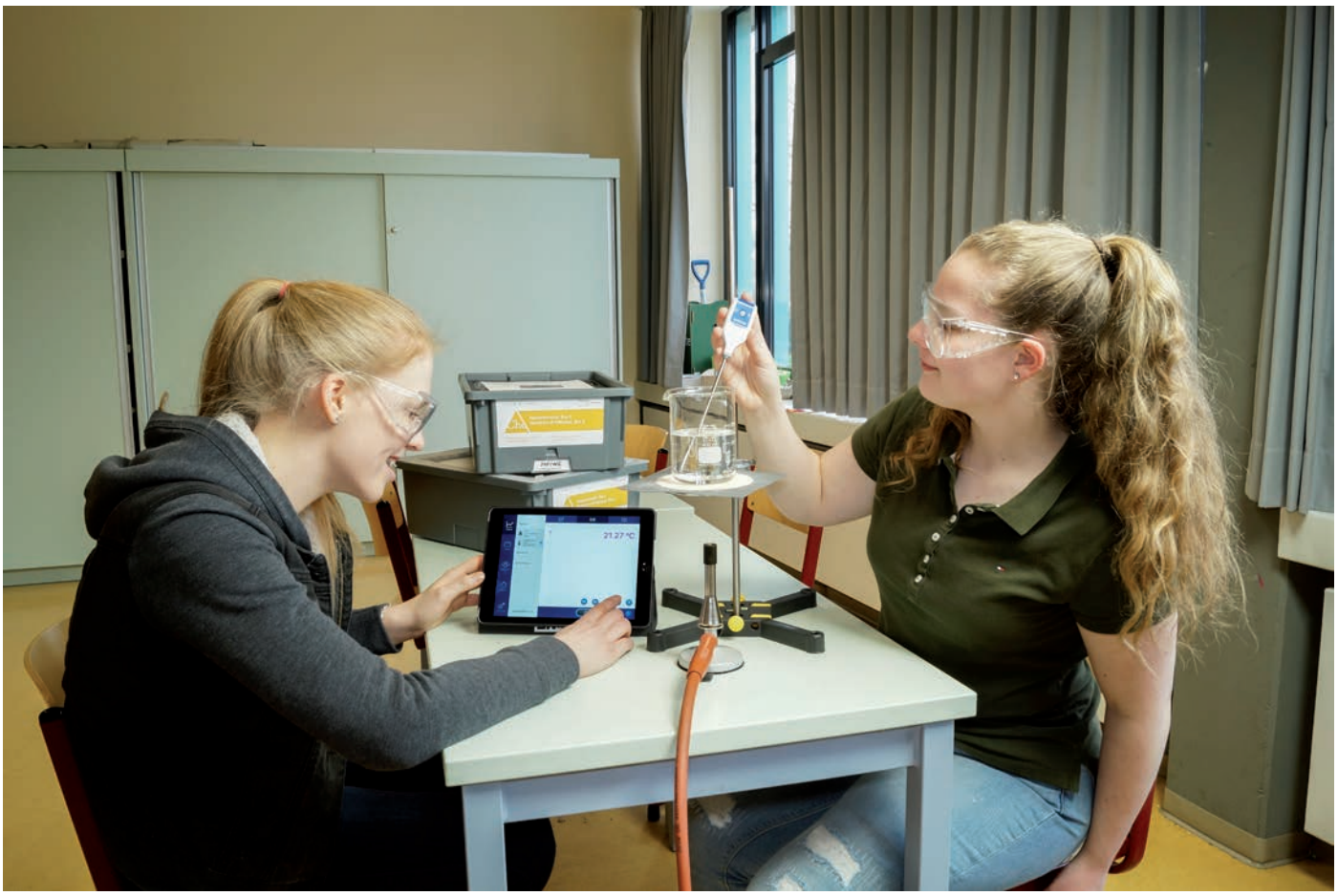
+ 1 Cobra SMARTsense Temperature

15305-88D

Analog Set

The set continues to be available in the classical version:

Student set Chemistry of polymers, TESS advanced Chemistry
15305-88



Necessary Equipment

TESS advanced Chemistry of polymers, necessary Accessories for 1 group
13482-88

TESS advanced Chemistry of polymers, consumables and chemicals for 10 groups
13483-88 1,059.76€

Recommended Equipment

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Student set Food chemistry – digital and analog

NEW Cobra SMARTsense

Benefits

- The ideal combination of classic experiments (practical competence) and digital data acquisition (media competence)
- Individual teaching structure possible: you can decide to chose the measuring instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the students
- Experimenting software for pupils and teachers available: minimal preparation time
- Matched with international Curriculum: all topics are covered
- Set developed by teachers

Digital Set

39 Experiments:

- The structure and composition of proteins
- The coagulation of egg white changes its composition
- Procedure for producing Quark
- The solubility of fats
- Winning oils
- Production of soap
- The composition of fats
- The water content of fatty products
- The production of margarine
- Detection of fats with dyes
- Removal of grease stains
- Fresh and spent deep-fry fat
- Detection of methanol
- Tanning matter in tea
- Coffee in beverages
- Active agents in pepper
- The term carbohydrate
- The solubility of carbohydrates
- The detection of glucose with Fehling's solution
- Reducing properties of glucose
- Fructose
- Lactose
- Detection of starch
- Potatoe starch and paste
- Composition of starch
- Wheat gluten
- Pectins
- Cleavage of starch during digestion
- Detection of vitamin C
- Drinking water treatment
- Carbon dioxide
- Ammonia in liquorice
- Phosphate in meat products
- Detection of nitrite in meat products
- Enzymatic browning
- Baking powder
- Emulsifying agents
- Enzymatic cleavage of proteins
- Catalases

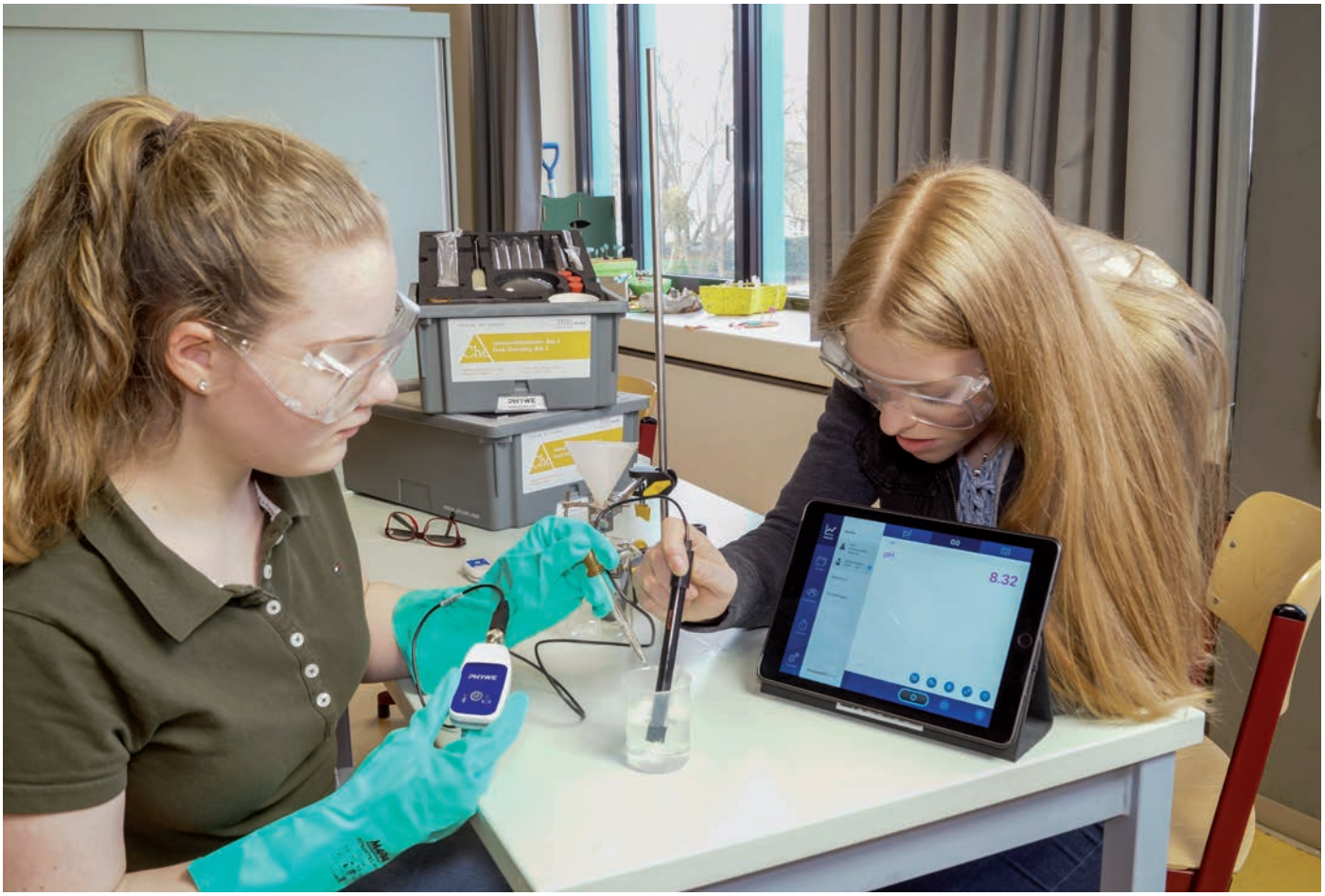
+ 1 Cobra SMARTsense Temperature

15306-88D

Analog Set

The set continues to be available in the classical version:

Student set Food chemistry,
TESS advanced Chemistry
15306-88



Necessary Equipment

Student set Food chemistry, necessary accessories for 1 group, TESS advanced Chemistry
13484-88
Student set Food chemistry, consumables and chemicals for 10 groups, TESS advanced Chemistry
13485-88

Recommended Equipment

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Student set Electrochemical measurement digital and analog

NEW Cobra SMARTsense

Benefits

- The ideal combination of classic experiments and digital data acquisition
- Individual teaching structure possible: you can decide on the instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the motivation of the students
- Experimenting software for pupils and teachers available: minimal preparation time
- Matched with international curriculum: all topics are covered
- Set developed by teachers

Digital Set

23 Experiments:

- A remarkable source of electric current
- Electric voltage from a salt solution
- Solution pressure
- The copper/zinc cell (Daniell cell)
- Connection of Daniell cells in series and in parallel
- Measuring and comparing the voltages of variousltages of various half-cells leads to an half-cells leads to an
- The voltaic cell
- Preparation of a simplified standard hydrogen electrode andmeasurement of some standard potentials
- Nonmetal galvanic cells
- The silver/silver chloride as reference electrode
- Determination of standard potentials using thentials using the silver/silver chloride as silver/silver chloride as
- Measurement of the standard potential of the redox couple Fe3+/Fe2+
- Galvanic cells from a series of concentrations, their potentialsand how to calculate them
- Setting up a concentration series with potassium chloride solutions and silver/silver chloride electrodes
- Galvanic cells with different redox couples/concentrations and the calculation oftheir potentials
- Changes in the voltage of a concentration seriesdue to precipitationor binding
- The solubility products of silver halides
- Corrosion of metals, local cells, cathodic protection against corrosion
- Why is the base metal aluminium so non-corrosive?
- Protecting against corrosion by passification
- Galvanic zincking
- Storing energy in reversible galvanic cells,so-called storage batteries or accumulators
- The zinc/oxygen cell

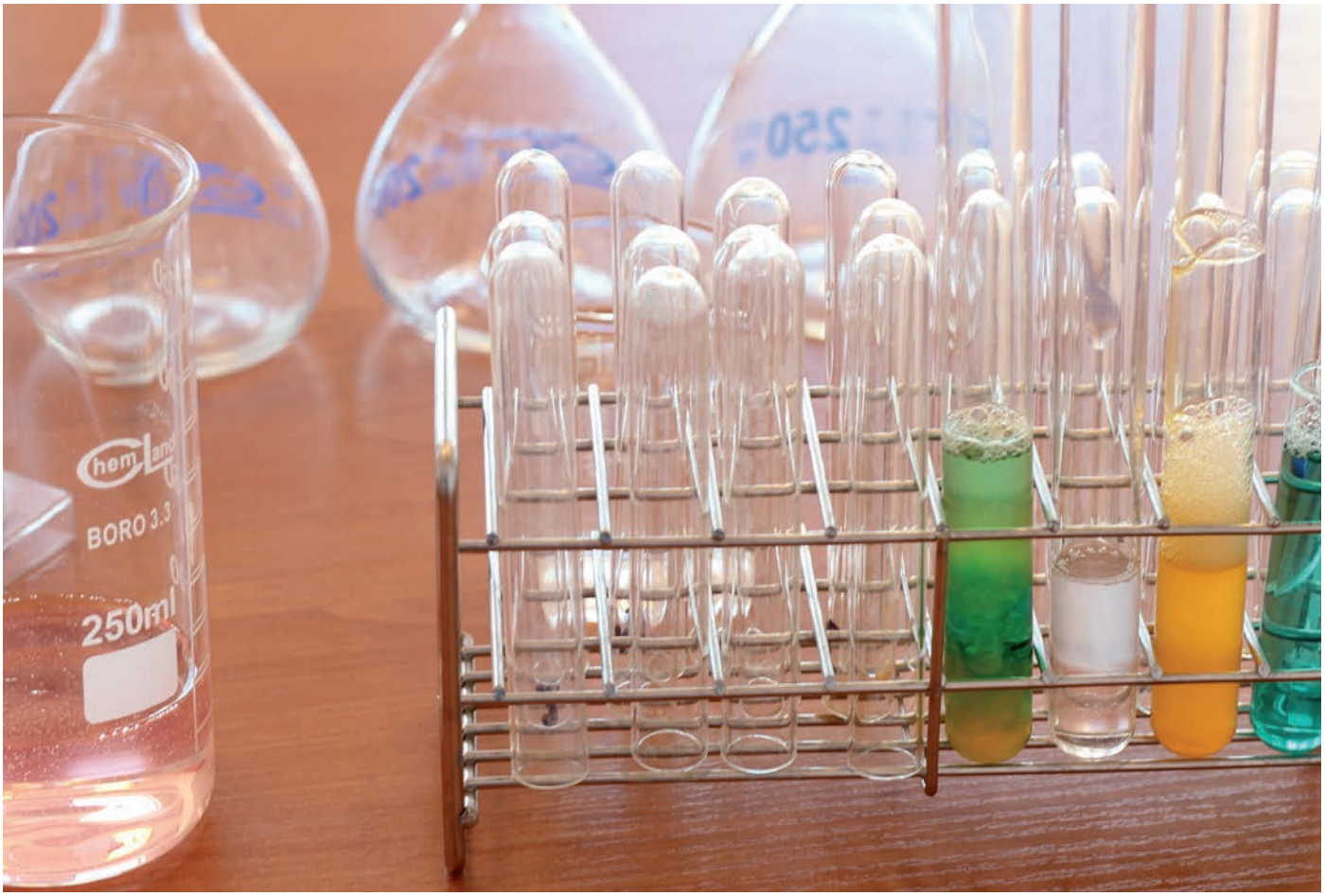
+ 1 Cobra SMARTsense Current
+ 1 Cobra SMARTsense Voltage

30505-88D

Analog Set

The set continues to be available in the classical version:

TESS Electrochemical measurement set
30505-88



Necessary Equipment

TESS advanced Chemistry Electrochemical measurement set necessary accessories for 1 group
13422-88
TESS advanced Electrochemical measurement set, consumables and chemicals for 10 groups
30505-10

Recommended Equipment

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4. TESS – Student Experiments
Training-Experiment-System for Students

4.4 Biology

Complete curriculum coverage in Biology –

Cover with the TESS and Demo System from PHYWE the requirements of modern natural science education

International Reference Curriculum (School)				
Topic \ Sets or experimental collections	Microscopy	General Biology	Plant Physiology and Biochemistry	Environment and Outdoors
	TESS	TESS / Demo	TESS / Demo	TESS
		Cobra SMARTsense	Cobra SMARTsense, Cobra 4	Cobra SMARTsense, Cobra 4
CELLS AND MICROBIOLOGY				
Microscopy: basics and working techniques	✓			
Plant and animal cells	✓			
Specialized cells, tissues and organs	✓			
Seed plants, ferns, fungi	✓			
Vertebrates and other animals	✓			
Cell structure and transport	✓			
Cell organelles - electron microscopic, recognizable structures	✓			
Methods of cell research				
ANIMALS				
Vertebrates: mammals, birds, reptiles, amphibians and fish	✓	✓		
Invertebrates: insects and spiders	✓			
PLANTS				
Anatomy and physiology of seed plants, ferns	✓	✓		
Photosynthesis and cellular respiration		✓	✓	
Reproduction in flowering plants	✓	✓		
Germination and growth		✓		
ECOLOGY				
Structure and characteristics of ecosystems		✓		✓
Aquatic ecosystems: lake, river				✓
Land ecosystems, soil analysis		✓		
Importance / endangerment of ecosystems (prot. of species, sustainability, restoration)		✓		✓
THE HUMAN				
Anatomy: bones and skeleton, joints, muscles, internal organs	✓	✓		
Physiology: respiration, heart and blood circulation		✓		
SENSORY ORGANS				
Sense of light and sense of gravity		✓		
Hearing		✓		
Sense of taste and sense of smell		✓		
NUTRITION AND DIGESTION				
Nutrients		✓		
Digestion and excretion	✓	✓		
COMMUNICATION AND REGULATION				
Nervous system, neurobiology				
METABOLISM				
Photosynthesis and cellular respiration / dissimilation and assimilation			✓	
Material cycle: producers, consumers, destructors		✓	✓	
Enzymes			✓	
Cell metabolism, fermentation, citrate cycle, chemosynthesis, biotechnology			✓	
GENETICS				
Molecular genetics				
Genetic engineering				
BEHAVIOUR				
Behavior in humans and animals		✓		

Demo PHYWE

TESS PHYWE

Biological Water Analysis	Soil Examination	Human Physiology and Electro-physiology	Neuro Simulator	Molecular Biology	Biotechnology
TESS	TESS	TESS	Demo	TESS	Demo
		Cobra SMART sense	4 Cobra		
					✓
✓					
✓	✓				
✓					
	✓				
	✓				
		✓			
		✓			
		✓	✓		
					✓
					✓
				✓	
				✓	
		✓			

Student set Microscopy

Benefits

- Set covers all microscopy topics of international curricula
- Complete equipment set, experiments easy to perform
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Experiment guides for pupils and teachers available: minimal preparation time
- CD-ROM available with:
- Colored presentation templates to 47 microscope topics
- For direct presentation via a beamer
- Experiment guides for 50 microscopy experiments
- With artworks of the student worksheets (with monochrome drawings) and teacher support sheets (in color with several hundred pictures)

Analog Set

50 Experiments:

- The components of a microscope
- Working with the microscope
- Microscopic magnification
- Preparation of temporary microscopic slides
- Manual section technique
- Staining of living organisms
- Rapid staining technique
- Fixation and staining
- Embedding in Canada balsam
- Preparation of reagents
- The cell wall of the onion
- The cellular membrane of animal cells
- Chloroplasts in moss leaves
- Chromoplasts
- Nucleus and chromosomes
- Vacuole
- Plasmolysis and deplasmolysis
- Protoplasma streaming
- Upper epidermis of a deciduous leaf
- Lower epidermis with guard cells
- Cross-section of a deciduous leaf
- Cross-section of a conifer (gymnosperm) leaf - adaption to arid conditions
- The stem of a dicotyledonous plant - Identification of xylem and phloem tissue
- The stem of a monocotyledonous plant
- Root with root-hair cells
- Cross-section of a plant ovary
- Starch as a nutritional reserve substance in plants
- Wing feathers of birds
- Comparison of raw milk and homogenised milk
- Fish scales in comparison
- Skeletal muscle
- Blood cells
- Kidney
- Liver cells (hepatocytes)
- Fish gills
- Insect wings
- The mouth parts of insects
- Planaria
- Nematoda
- Brine shrimp (Artemia salina)
- Water flea (Daphnia)
- The ciliated epithelium of mussels
- The spore capsules of ferns
- Mould fungi growing on food
- Ciliates in a hay infusion
- Colony-forming ciliates in an aquarium
- Volvox
- Diatoms in moor water
- Radiolaria
- Bacteria

15290-88

Necessary Equipment

Student set Microscopy, necessary accessories for 1 group, incl. microscope BioBlue BB.4250
13443-88
Student set Microscopy, consumables for 10 groups, TESS advanced Biology
13444-88

Recommended Equipment

curricuLAB ActivityManager, site licence
14575-62
CD-ROM for TESS Microscopy
13290-12

Student microscope for primary school

MOTIC student microscope „FunScope"

Motic

Introductory student microscope with two applications: for microscope slides with transmitted light other objects with incident light. Monocular, with LED illumination for cordless operation.

- Budget microscope for primary education
- Two applications: incident and transmitted illumination
- Perfect for first-time users of microscopes

MOT-FUNSCOPE

Student microscope for junior high school

Euromex MicroBlue MB.1001 microscope

euromex microscopes holland

The modern MicroBlue microscopes are entry-level models for secondary schools
MicroBlue monocular microscope with achromatic 4/10/S40x objectives and LED illumination

- Eyepiece secured wide field eyepiece WF 10x/18 mm with fixed pointer
- Observation tube Monocular 45° inclined tube, 360° rotation. Tube length 160 mm
- Nosepiece Nosepiece for 3 objectives. Ball-bearing mechanism and click-stops
- Objectives Achromatic 4x N.A. 0.10, 10x N.A. 0.25 and S40x N.A. 0.65 35 mm parafocal objectives. The S40x objective is spring- mounted
- Stages Square stage 105 x 105 mm with two object clamps
- Focus control Coaxial coarse- and fine adjustment knobs on both sides with 0.002 mm graduations. Friction of focus control can be adjusted
- Condenser Fixed lens N.A. 0.65 condenser with iris diaphragm and filter holder
- Illumination LED 1 Watt illumination with intensity control, rechargeable batteries with external power supply/charger
- Packaging complete with spare fuse, manual and dustcover in styrofoam case

EUR-MB-1001

Student microscope for senior high school

MOTIC Binocular microscope, model 2820

Motic

- Binocular head / inclined 45 degrees and 360 degrees rotating
- Widefield eyepieces WF10x/18 mm / Quadruple nosepiece
- Achromatic objective EA 4x, 10x, 40x S
- Coaxial coarse and fine focusing adjustment
- Built-in low position coaxial mechanical stage
- 1.25 N.A. Abbe condensor
- Iris diaphragm with filter holder
- LED illumination 20 mA, 3.5 V, 70 mW with intensity control
- battery operated, with battery charger
- Incl. dust cover

62197-93

Euromex MicroBlue MB.1051-LCD microscope with fixed 5.6 inch LCD screen

Monocular microscope with fixed 5.6 inch LED screen to directly view the image on a screen. The ultimate in user friendliness: view the image on a screen instead through the eyepiece! Several users can view the image at the same time. Ideal for digital classes!

- 5,6 inch LCD screen with 640 x 480 pixels with built-in SD card for saving of images in jpeg format
- Video resolution of 640 x 480 pixels, saving in AVI format Nosepiece for 4 objectives.
- Achromatic 4x N.A. 0.10, 10x N.A. 0.25 and S40x N.A. 0.65 DIN 35 mm parafocal objectives
- Square stage 115 x 100 mm with 55 x 22 mm X-Y translation stage
- Coaxial coarse and fine adjustments with 200 graduations, precision 15 µm, 3 mm per rotation

EUR-MB-1051-LCD

Our most popular stereomicroscope

MOTIC stereo microscope ST-30C 6LED Cordless

- Binocular inclined tube.
- Stereohead rotatable through 360°.
- Stable stand with stage plate and 2 stage clips.
- Height-adjustable binocular eyepiece unit.
- Focussing by means of two coaxial focussing knobs with sliding clutch.
- One pair of interchangeable wide-field eyepieces WF10×/20 with eyecups.
- Rotatable nosepiece with 2 aligned pairs of objectives 2×/4× or 1×/3× for rapid magnification change.
- Magnification:20×/40× or 10×/30×.
- 5 LEDs for incident light and 1 LED for transmitted light
- Rechargeable so it can be used independent from a network
- Connection voltage 230 V,50...60 Hz.
- Complete with dust cover and battery charger

62466-93

Our most popular microscope camera for digital learning

MOTIC Moticam 1CMOS Technology

- With the included image editing software for PC, Macintosh OSX and Linux platforms, the images can be measured and analyzed. It also provides a variety of other tools for teachers, students and researchers.
- Equipped with all necessary accessories that fit Moticam 1 on virtually any microscope eyepiece and thus allows you to turn any microscope into a digital microscope.
- With the attached macrolens the camera can be used also as a video camera.
- 1280 x 720 Pixel with 1/2.9"-CMOS chip and USB Interface, 30 fps
- 2 size-adaptable ocular adapters for all microscopes
- Calibration slides for the precise determination of the size standard in the software allowing dimensions of objects to be measured
- Focusable 12 mm macrolens for webcam use
- Macrotubus to give the camera a stable stand in combination with the macrolens during the observation of objects (for example: insects, minerals, ...)
- Software „Motic image plus 3.0" for Windows, MacOS and Linux

63300-00

Student set General biology – digital and analog

Benefits

- The ideal combination of classic experiments (practical competence) and digital data acquisition (media competence)
- Individual teaching structure possible: you can decide to chose the measuring instrument you want (classic or digital)
- Future-proof: Prepare the transition to the digital school today
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of the student
- Complete equipment set: simple execution of the experiments
- The equipment is stored in a durable, stackable and compactbox, allowing quick control of completeness (foam insert)
- Experimenting software for pupils and teachers available:minimal preparation time
- Experiments for nearly all of the curriculum topics
- Basic student equipment for biology laboratories
- High-quality support material included

Digital Set

41 Experiments:

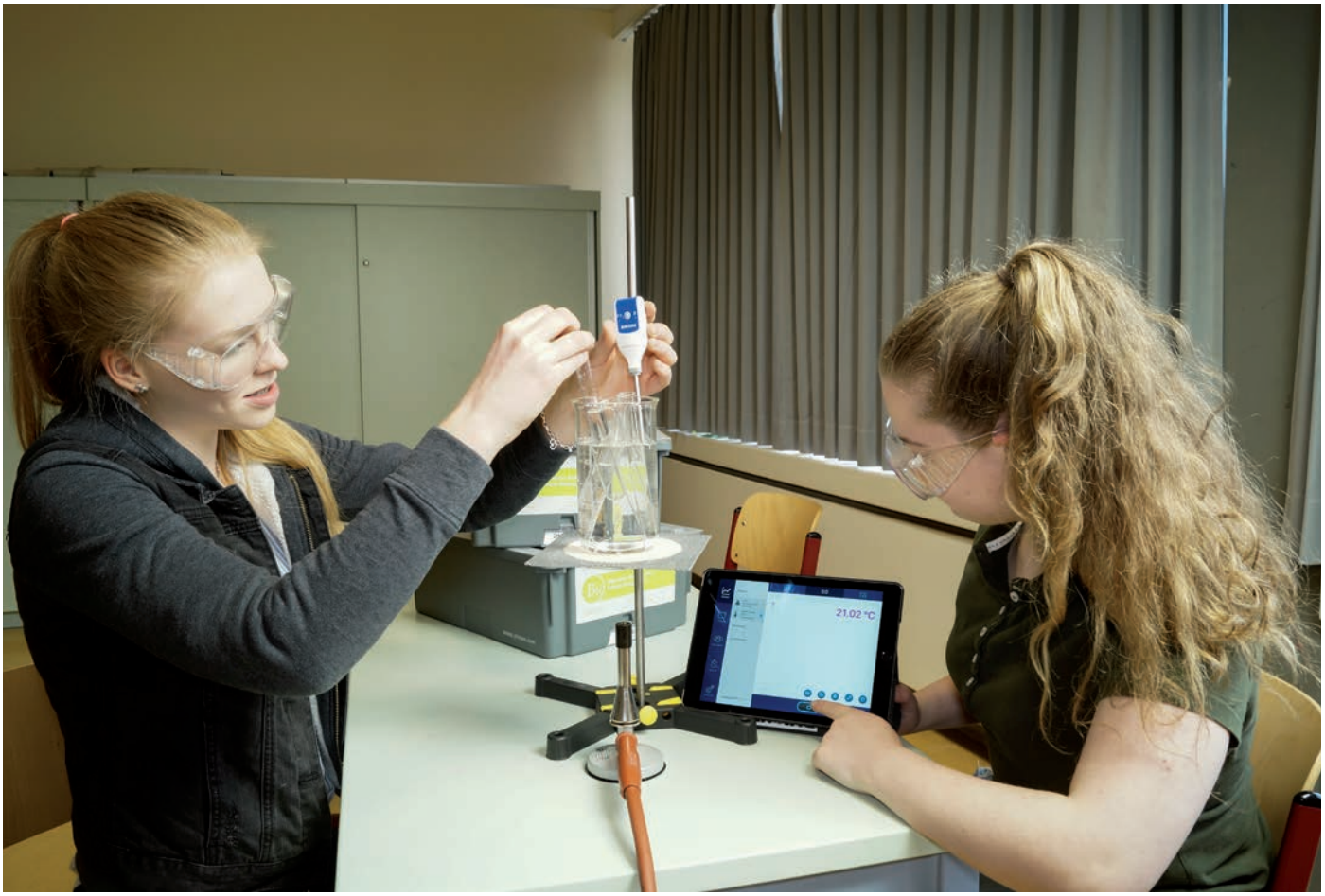
- We study a flower
- Hermophrodite flowers
- Monoecious and dioecious flowers
- Structure and strength of bones
- Body heat
- From seed to plant
- Conditions necessary for germination of seeds
- Swelling
- Germination and oxygen
- Germination and temperature
- Germination and light
- Inhibition of germination in fruits
- The function of the seed leaves
- Construction of a plant seed
- Wilting of plants
- Protection against evaporation
- The function of roots
- Water supply of plants
- Conditions necessary for photosynthesis
- The green leaf pigment
- The size of soil particles
- The calcium content of the soil
- Foods and nutrients
- Starch containing nutrients
- Sugar containing nutrients
- Fat containing nutrients
- Protein containing nutrients
- Digestion in the mounth
- Digestion in the stomach
- Digestible and indesgestible protein
- The function of the bile
- Digestion in the intestine
- Digestible and indigestible fats
- Examination of the exhaled air
- The sense of smell
- The combination of the senses of the taste and smell
- The sense of taste
- The blind spot
- Optical illusions
- Response of algae to light
- Dispersal of seeds

+ 1 Cobra SMARTsense Temperature

15296-88D

Analog Set

The set continues to be available in the classical version:
Student set General biology, TESS advanced Biology
15296-88



Necessary Equipment

Student set General biology, necessary accessories for 1 group, TESS advanced Biology
13486-88
Student set General biology, consumables for 10 groups, TESS advanced Biology
13487-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

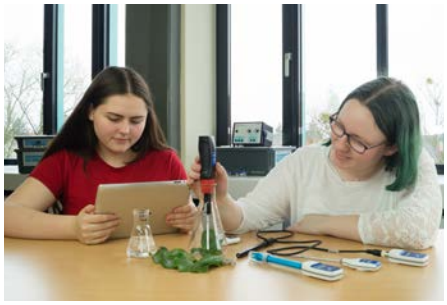
Download on the App Store

ANDROID APP ON Google play

Student set Biochemistry and plant physiology – digital

Benefits

- Future-proof: Preparing today the transition to the digital school; it can also be used in a student internship
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation of students
- 10 experiments in one set
- Compact setup
- Reliable and reproducible results



Digital Set

10 Experiments:

- Photosynthesis (2 methods)
- Transpiration of leaves
- Respiration (CO_2 and O_2 measurement)
- Glycolysis (2 methods)
- Determination of the Michaelis constant
- Enzyme inhibition
- Substrate inhibition of enzymes
- Enzyme activity of catalase

+ 1 Cobra SMARTsense pH
+ 1 Cobra SMARTsense Light
+ 1 Cobra SMARTsense Pressure
+ 1 Cobra SMARTsense Temperature
+ 1 Cobra SMARTsense Conductivity
+ 1 Cobra SMARTsense CO2
+ 1 Cobra SMARTsense Oxygen

15620-88D

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Student set Environment and outdoors – digital

Benefits

- Whether in the classroom, outdoors or on project days: in this robust aluminium case, you will always find the right device for carrying out fascinating experiments with school groups.
- Up to 4 groups can work on and investigate interesting topics in parallel.
- All data are saved on SD memory cards.
- Students can evaluate the data at home, as a homework assignment.
- The measure evaluation software is included for FREE and may,of course, be used privately by each pupil.
- This device is also ideal for use e.g. in the context of a school hiking day: here, a topographic profile can easily be produced with the weather sensor. In geography lessons, the data can be evaluated and interpreted together. If the height is then set against the temperature, humidity relative to the path, or temperature relative to the time of day, great discoveries can be made, which are both practical and fun.

Digital Set

14 Experiments:

- Water quality - contamination with heavy metals
- We examine our drinking water Altitude measurement on a trail
- Weather observation
- Terrain mapping
- Changes of the light conditions in a deciduous forest
- Acidity changes of a watercourse
- Comparison of soil and air temperatures in the course of a day
- The pH value of various soils
- Salinity of soils and plant substrates
- Raised bog and fen
- Salinity changes of a watercourse
- Learning stations
- We visit a wastewater treatment plant

+ 1 Cobra SMARTsense Humidity
+ 1 Cobra SMARTsense pH
+ 1 Cobra SMARTsense Conductivity
+ 1 Cobra SMARTsense Temperature

12626-88D

Classic Set

The set continues to be available in the classical version with Cobra4:
Student set Environment and outdoors for 4 work groups
12626-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62

Student set Soil examination

Benefits

- Easy to perform analyses using rapid test indicator sticks
- Problem-oriented investigative methods to determine soil acidification, lime requirement, nitrogen supply, soil compaction, etc.
- The case can be used by 6 works groups working in tandem
- Includes detailed instruction manual

Analog Set

Determine the following parameters:

- Soil profile (soil horizons, soil type)
- Mineral matter (stone content, fine earth content, soil texture)
- Body of humus (humus content, humus type), water/ air (soil moisture, water capacity, water permeability rate, utilisable water capacity)
- Soil structure (soil compaction, aggregate stability/ tilth)
- Acidity (pH value, lime content)
- Nutrients (nitrate content of soil, nitrate content of fruit and vegetables)
- Soil life (soil animals)

30836-88

Necessary Equipment

TESS Examination of soil consumables for 10 groups
30836-10

Recommended Equipment

Soil auger
64221-01

Student set Biological water analysis

Benefits

- This kit enables 6 working groups to simultaneously carry out examinations of running and standing waters in the field.
- The enclosed manual containing tables and sheets for analysis allow assignment to the water quality classes I. .. IV

Analog Set

The physical, chemical, and bacteriological examination procedures primarily allow an assessment of the momentary water quality. As the variety of species in a body of water decreases with increasing pollution, and thus the composition of the organism societies changes, the biological determination of the water quality provides additional important indications on the water quality and allows conclusions to be drawn on the previous pollution. The species and frequency of indicator organisms at various degrees of pollution are thereby coupled to the water quality classes I to IV.

30834-88

Student set Human and Electrophysiology – digital

Benefits

- For datalogging with mobile devices
- Perfectly matched to digital science lessons with tablets and smartphones
- Faster and higher learning success: The use of digital devices increases the identification and thus increases the motivation ofthe students
- For datalogging with tablets
- Complete equipment set: simple execution of the experiments
- Simple to operate (plug & measure), thus also suitable for middle schools

Digital Set

9 Experiments:

- Blood pressure measurement
- We investigate our heartbeat - electrocardiography
- We determine our heart frequency
- We investigate our physical fitness - the heart under stress
- Pulse at rest and during exercise
- How much air can our lungs contain
- Direct determination of lung volume from a spirogram
- Does the lung volume depend on how tall you are?
- Diagnosis of lung disease (FEV)

+ 1 Cobra SMARTsense EKG
+ 1 Cobra SMARTsense Spirometer
+ 1 Cobra SMARTsense Heart Rate
+ 1 Cobra SMARTsense Temperature

15674-88D

Classic Cobra4 Sets

Alternatively two sets with Cobra4 sensors are still available:

Student set Electrophysiology for tablets and PCs, TESS advanced Applied Sciences

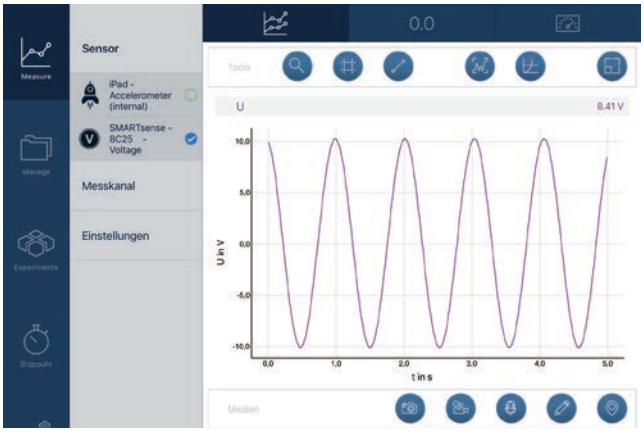
15674-88

Schülerversuche Humanphysiologie für Tablets und PCs

15678-88

Recommended Equipment

curricuLAB® measureAPP
for iOS und Android
curricuLAB® ActivityManager, site licence
14575-62



Screenshot measureAPP

Download on the App Store

ANDROID APP ON Google play

Student set Molecular biology

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a rugged, stackable and compact box, allowing quick control of completeness (foam insert)
- Electrophoresis chamber and safety lid made of Plexiglas - break-proof
- The gel is poured into the UV transparent chamber - no extra accessories necessary
- The current circuit cannot be connected until the safety hood has been placed in position - touch-safe

Analog Set

- Electrophoresis of Plasmide DNA
- Electrophoresis of Lambda DNA
- Forensic DNA finger printing
- Paternity Test with DNA Electrophoresis

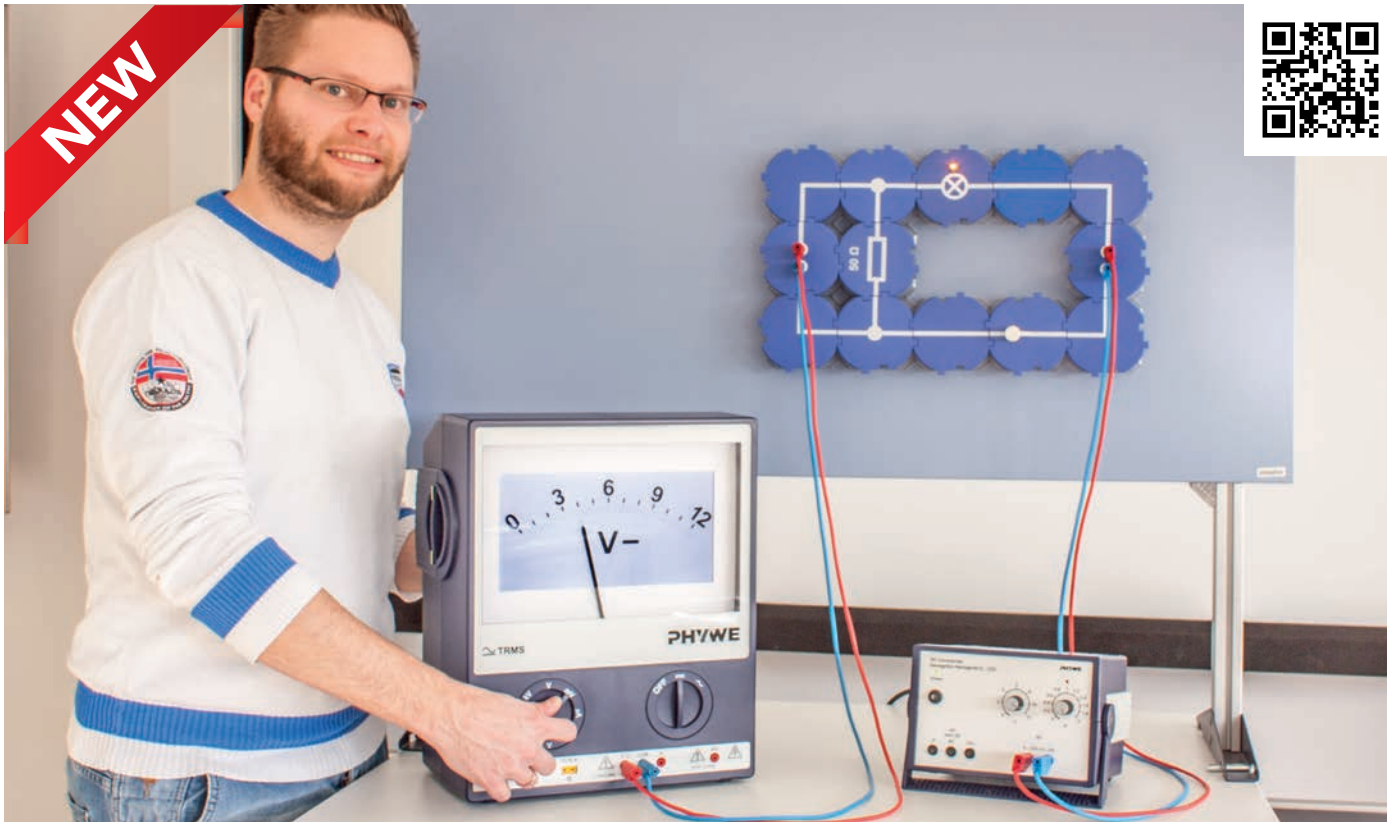
15310-88

Necessary Equipment

TESS advanced Biology Set Molecular Biology, necessary accessories for 5 groups
13448-88
Electrophoresis power supply 100V/200V
65966-93
Kit: Bacterial plasmid DNA in gel electrophoresis
KLA-530-100
Kit: Agarose gel electrophoresis of lambda DNA
KLA-530-110
Kit: Forensic DNA Fingerprinting (crime scene)
KLA-530-120
Kit: Paternity test of a DNA profile by gel electrophoresis
KLA-530-130

5. Demo – Teacher Experiments

PHYWE Demonstration multimeter ADM 3 current, voltage, resistance, temperature



Benefits

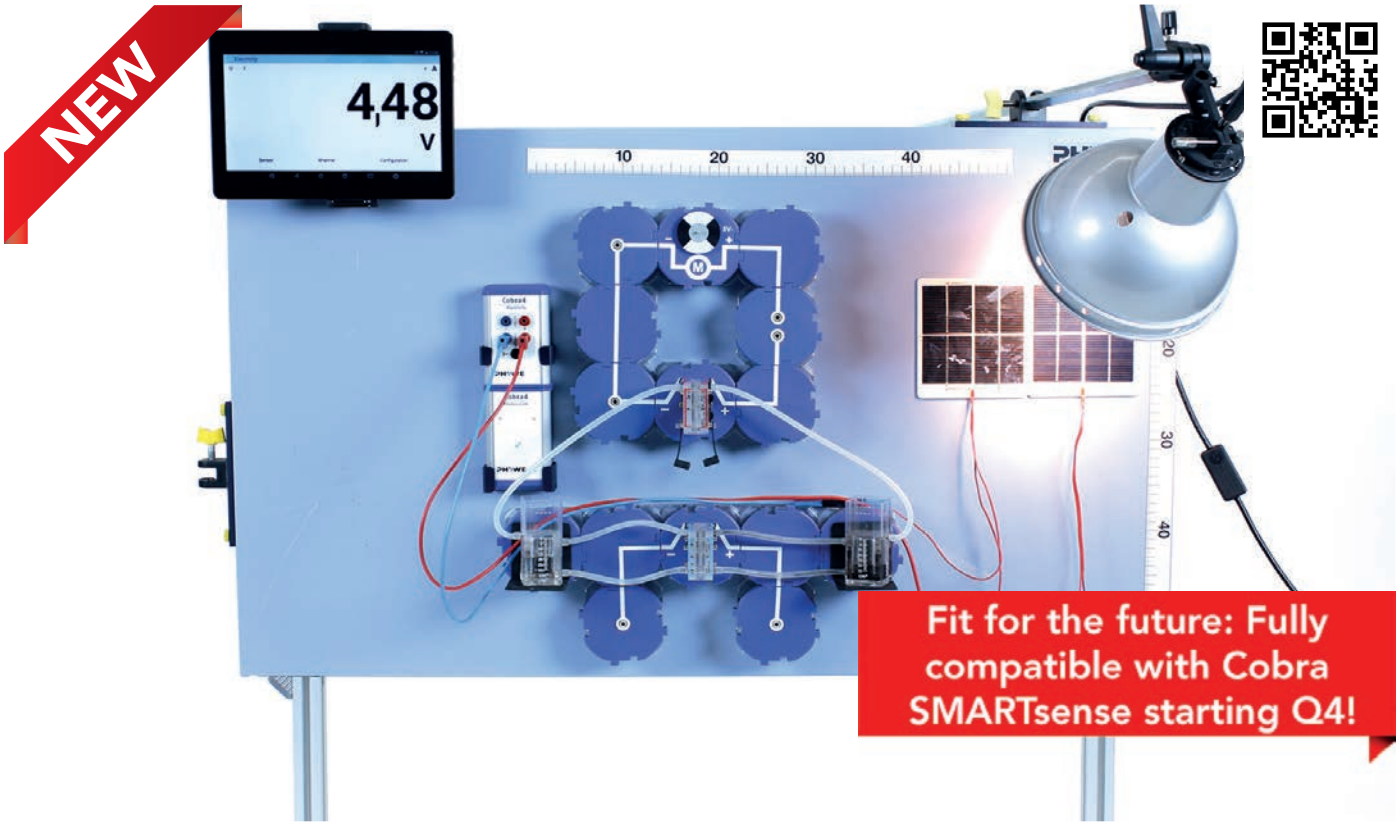
The universal demo measuring device for natural science education:

- NEW: Analogue and digital multimeter in one device
- NEW: Display of current, voltage, resistance and temperature
- NEW: Direct temperature measurement for NiCr-Ni probes
- NEW: 12 V scale matching the supply voltage of many common experiments
- NEW: 76 measuring ranges with fast switching scales by the press of a button
- NEW: High contrast, large illuminated screen readable throughout the room
- NEW: Serves as wireless large-scale display for all Cobra4 sensors
- Convenient for teachers with control elements and an additional display on the back panel
- Electronic overload protection for all measuring ranges
- Continuous operation of up to 10 h due to high-capacity battery
- Power-saving stand-by mode after approx. 60 min
- Future-proof thanks to firmware update support

The ADM 3 is available in two variants:

	PHYWE ADM 3	PHYWE ADM 3 light
Article-No.	13840-00	13830-00
Measuring ranges		
Number of measuring ranges	76	33
Direct / alternating voltage	1 µA...10 A	1 mA...10 A
Direct / alternating current	1 mV...10 kV	1 V...300 V
Resistance	0...10 MΩ	–
Temperature	-200 °C...1200 °C NEW	–
Other Features		
Back panel display	✓	–
Back panel controls	✓	–
External sensor connectivity	✓ NEW	–
Electronic overload protection	✓	✓
4-mm-Sicherheitsbuchsen	✓	✓
Shock-resistant plastic case	✓	✓
Article-No.	13840-00	13830-00

PHYWE - Digital large-screen display



Function and Applications

Large display for teacher experiments to display of measured values, which are measured with the Cobra4 Wireless /USB-link (included in delivery). The large display can be mounted on a tripod (included in delivery) or the adhesive board and enables a large variety of experimental setups. The digital large display automatically recognizes all Cobra4 sensor units so that demonstration experiments can be expanded flexibly.

Equipment and Technical Data

- Large display (25 cm screen diagonal) for digital display of measured values
- Incl. tripod system with sturdy stand
- Incl. mobile datalogger (Cobra4 Wireless Link)
- Delivered in sturdy metal case

Benefits

- Large digital display with 10-inch display
- High-contrast display
- Data transmission via WLAN - no additional transmitter or receiver necessary
- Easy connection and measurement - no configuration or installation of software necessary
- Independent of the mains due to the battery operation

07157-00

Recommended Equipment

Demo Physics board with stand
02150-00

With sturdy stand and metal case

SMARTsense

Starting Q4 2018 new SMARTsense variant will become available including two SMART sense-sensors Temperature und Voltage:
Digital large-screen display
Cobra SMARTsense
07157-00D

Teacher demonstration set Light, Air, Earth

Experimental set of demonstration experiments for introduction to light, air and earth expecially designed for teaching of natural sciences in primary schools and lower grades of secondary school. Complement mentary student set.

5 experiments:
- Day and night - light and shade
- Things to do with a magnifying glass
- Air is not nothing
- Air pollution
- Determination of soil horizons

13244-88

Teacher demonstration set Water

Experimental set of demonstration experiments for introduction to water expecially designed for teaching of natural sciences in primary schools and lower grades of secondary school. Complements pupils set of the same name.

5 experiments:
- The state of aggregation of water
- Water hardness
- Bank filtration
- Distillation
- The conductivity of water

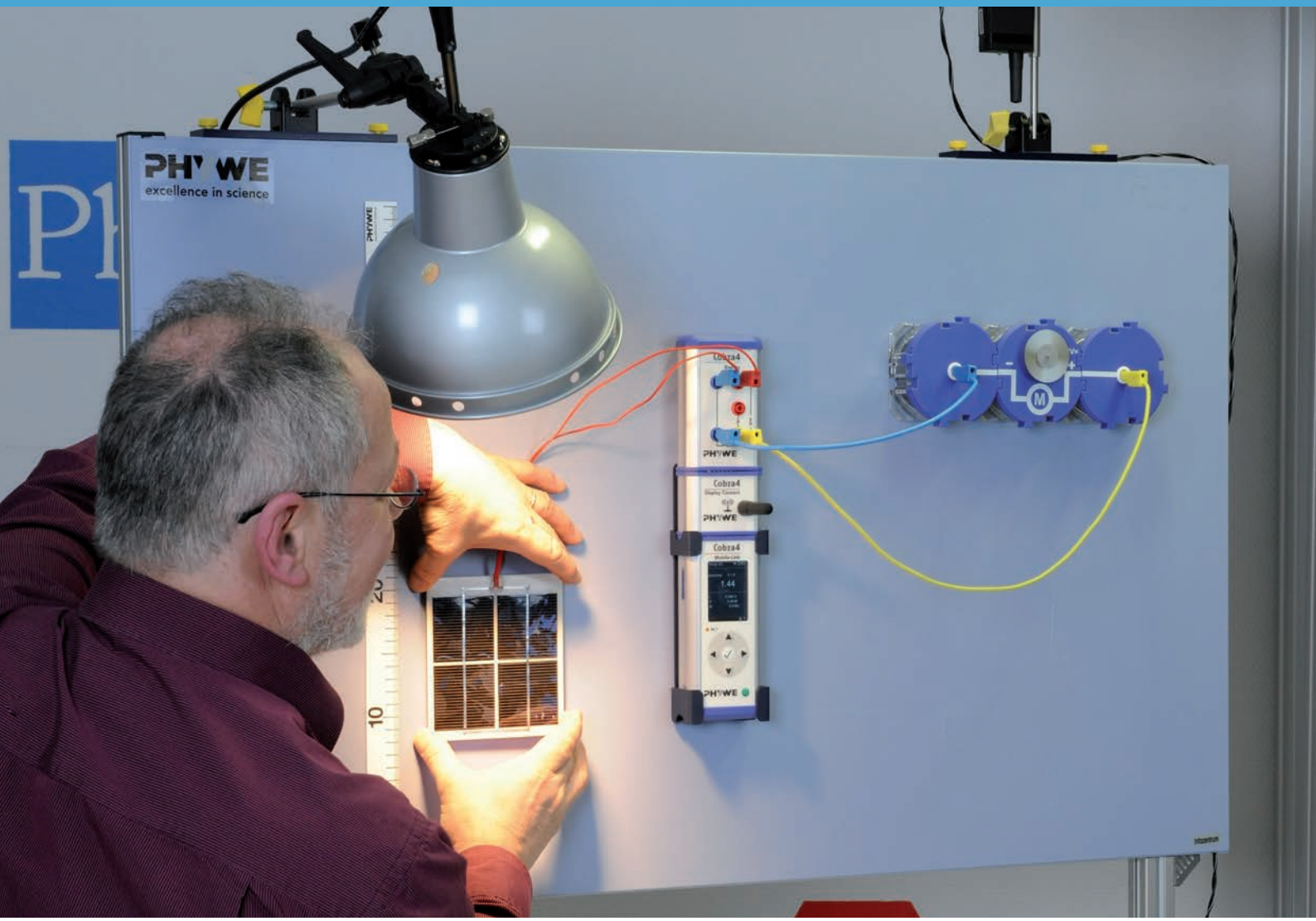
13234-88

Teacher demonstration set Heat

Experimental set of demonstration experiments for introduction to heat expecially designed for teaching of natural sciences in primary schools and lower grades of secondary school. Complements pupils set of the same name.

5 experiments:
- Absorption of heat radiation
- Flow of water due to heat
- Heat transport in glass and metal
- Temperatures in different waterdepths
- Ice floats, maximum of density of water at 4°C

13236-88



5. Demo – Teacher Experiments

5.3 Physics

You can find the curriculum overview for Physics in chapter **4.2 TESS Student Sets - Physics**

Teacher set Mechanics 1

Benefits

- Demonstrative measurement of forces with large circular dynamometers with a fixing magnet and ball-bearing pulley with two cord grooves for two measuring ranges
- The experiments can be modified easily
- Magneto-adhesive angular disc and measuring scale facilitate the measurements
- Coloured arrows enhancing observations and explanations
- Easy teaching by using the demo board for demonstration
- Magneto-adhesive components ensure easy handling and freedom of positioning
- Secure fastening using magnets with an adhesive force of at least 10 N
- Complete equipment set: simple execution of the experiments
- The equipment is stored in a robust aluminum case with removable lid
- Foam insert for a quick control of completeness and secure transport of the set
- Experimenting software for all teacher experiments are delivered as PDF documents on a DVD
- Matched with international Curriculum: all topics are covered

24 Experiments

- Mass and weight
- Extension of a rubber band and helical spring
- Hooke's law
- Force and counterforce
- Composition of forces having the same line of application
- Composition of non-parallel forces
- Resolution of a force into two non-parallel forces
- Resolution of forces on an inclined plane
- Resolution of forces on a crane
- Determination of the centre of gravity of an irregular plate
- Double-sided lever
- One-sided lever
- Double-sided lever and more than two forces
- Reaction forces
- Torque
- Beam balance
- Fixed pulley
- Free pulley
- Block and tackle
- Thread pendulum
- Spring pendulum
- Physical pendulum (reversible pendulum)
- Tension energy
- Density determination by measuring buoyancy

15510-88

Necessary Equipment

Teacher set Mechanics, necessary equipment	15510-01
Demo Physics board with stand	02150-00

Recommended Equipment

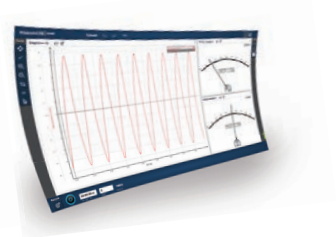
curricuLAB® ActivityManager (online), site licence	14570-62
curricuLAB® LabManager, site licence	14590-61

„Thanks to the demo physics board, everything is clearly visible for the students."

Renate Sanden, physics teacher

Excellent. Experimentation. Network.

The digital teaching and learning plattform for natural science.



curricuLAB® ActivityManager PHYWE

curricuLAB® ActivityManagerPRO PHYWE

curricuLAB® measureAPP PHYWE

curricuLAB® measureLAB

curricuLAB® LabManager

Teacher set Mechanics 2

Benefits

- Magneto-adhesive and flexible track with a reinforced front edge, which allows to set up completely unconventional track shapes for experiments on the law of conservation of energy
- Magneto-adhesive components ensure easy handling and freedom of positioning
- Secure fastening using magnets with an adhesive force of at least 10 N
- Easy marking of motions using colored arrows and points
- Liquid levels are easy to observe on the plain background
- The experiments can be modified in next to no time
- Complete equipment set in addition to Mechanics 1
- The equipment is stored in a robust aluminum case with removable lid
- Foam insert for a quick control of completeness and secure transport of the set
- Matched with international Curriculum: all topics are covered

19 Experiments

- Making and calibrating a dynamometer
- Bending of a leaf spring
- Restoring force on a displaced pendulum
- Frictional force
- Determination of the coefficient of friction of an inclinedplane
- Sliding weight balance
- Wheel and axle
- Toothed gearing
- Belt drive
- Energy conversion of a roller coaster
- U-tube manometer
- Hydrostatic pressure
- Communicating vessel
- Hydraulic press
- Artesian well
- Archimedes' principle
- Discharge velocity of a vessel
- Pressure in gases
- Boyle-Mariotte law

15511-88

Necessary Equipment

Teacher set Mechanics 1
15510-88
Teacher set Mechanics 1, necessary equipment
15510-01
Teacher set Mechanics 2, necessary equipment
15511-01
Demo Physics board with stand
02150-00

Recommended Equipment

curricuLAB ActivityManager (online), site licence
14575-62
curricuLAB® LabManager, site licence
14590-61

Teacher set Linear Motion (Dynamics)

Benefits

- Extremely robust demonstration track with a length of 1.5 m included
- Scale in the track with mm graduation
- Adjustable feet over the entire track length for a very simple alignment of the track on small tables
- Cart for demonstration tracks with low friction sapphire bearings
- No overloading due to elastic bearing of base plate
- Rolling on flat planes prevented as wheels are covered by overlapping side walls
- Timer 4-4: with 4 measuring inputs and 1 trigger input and four 4-digit digital displays
- 6 different operating modes allow the timer unit to be adjusted to suit almost any experimental requirement: distance-time law for four tracks, measurement of speed at four positions, principles of collisions, measurement of the orbiting time of a rotary movement, the direct measurement of the duration of a complete swing of a mechanical pendulum and for short or long-term measurements with two 8-digit displays by connecting each of 2 timers (0000.0000 to 9999.9999 seconds)
- Matched with international Curriculum: all topics are covered
- Complete equipment set: simple execution of the experiments
- The equipment is stored in a robust aluminum case with removable lid
- Foam insert for a quick control of completeness and secure transport of the set

13 Experiments

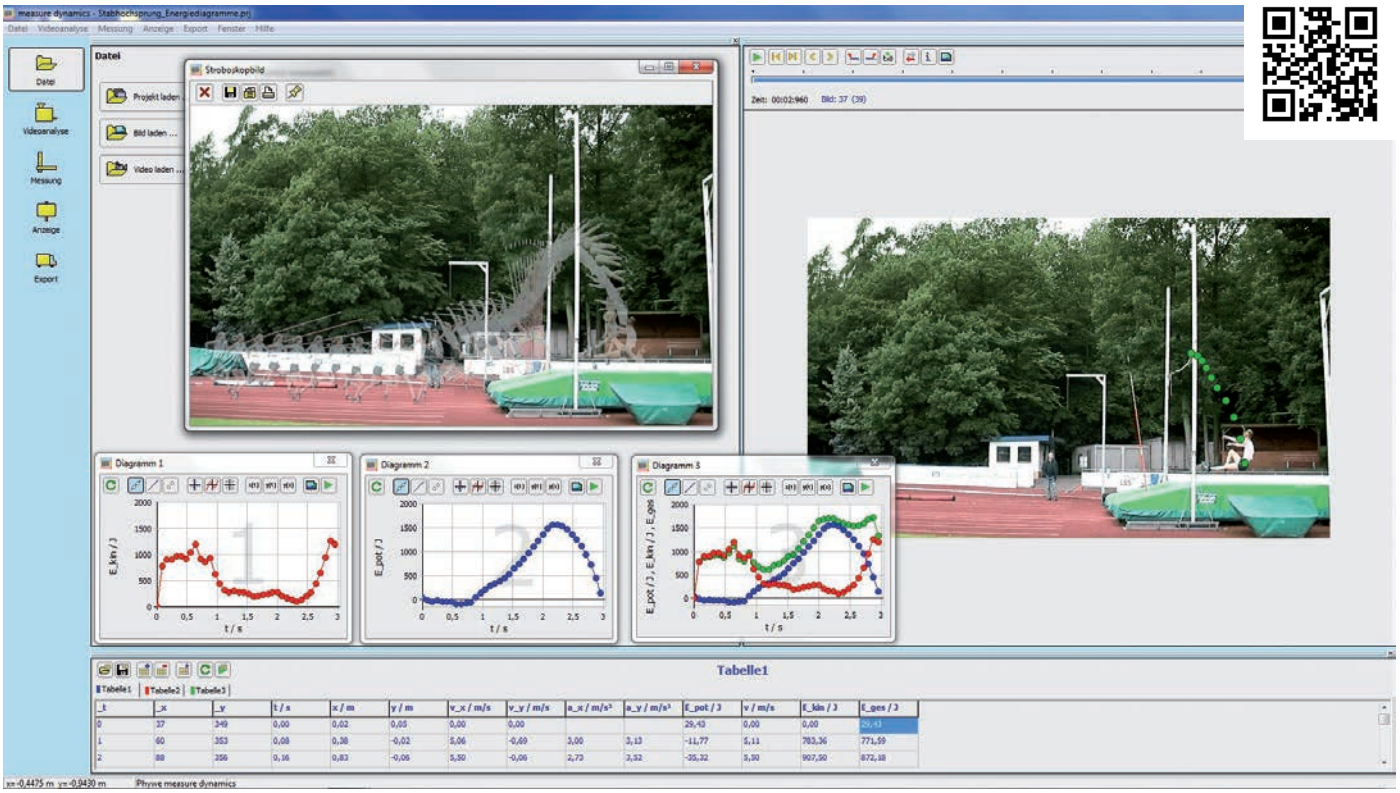
- Velocity-independent and velocity-dependent friction Linear uniform motion
- Uniformly accelerated motion with an accelerating mass
- Uniformly accelerated motion with an inclined track
- Uniformly decelerated motion
- Law of inertia (Newton's first law)
- Fundamental law of dynamics (Newton's second law)
- Law of reciprocal actions (actio = reactio, Newton's thirdlaw)
- Equivalence of inertial mass and gravitational mass
- Conservation of momentum in elastic collisions
- Conservation of momentum in inelastic collisions
- Conservation of momentum in multiple elastic collisions
- Conservation of momentum in multiple inelastic collision

15514-88

Recommended Equipment

Teacher set Linear Motion, optional equipment (additional cart)
15515-88
curricuLAB ActivityManager (online), site licence
14575-62
curricuLAB® LabManager, site licence
14590-61

Software „Measure Dynamics“, site licence



Benefits

- Automatic object recognition and tracing, including several filmed objects simultaneously, e.g. coupled pendulum, or movement of different body parts of the human body
- Dialogue-supported creation of trajectories as well as movement, velocity and acceleration diagrams
- Stroboscopic effect for motion sequences (visualization of the entire path of movement)
- Easy data transfer of all measured values to MS Excel®, PHYWE measure, PHYWE measureLAB, and other applications
- Video processing includes cutting, compression and other common features
- Software-guided modeling for didactical transfers (including homework)
- Compatible with all Windows versions from Windows 7

Function and Applications

The measurement software „measure Dynamics“ provides an inexpensive way to analyze movements and display them in the shape of diagrams. All you need is a digital video camera, like webcams, camcorders or common digital cameras with movie function. A site licence is provided to install the software on every PC at the site and on all personal PCs of students and teaching personnel.

Classroom Applications

Demonstration experiments in the classroom or lecture hall, for example, all types of one-dimensional and two-dimensional movements

„Field studies“, for example, display of motion sequences in shot-putting, basket-shooting in basketball, trampoline jumping, high-jump, and much more

14440-62

Centripetal force/centrifugal force with Cobra4

Benefits

- Wireless connection with Cobra4 Wireless/ USB-Link enables accurate data logging
- Automatic sensor identification and loadable pre-settings with the software measureLAB
- High precision allows to determine the rotational frequency
- Variable adjustment of the rotational velocity
- Set-up optionally provides the possibility to perform the classical variant of the experiment with an analogue spring balance

Principle

The examination of the dependencies of the centripetal force is a classic experiment of mechanics. Here and in experiments with rotational movements in general radio transmission offers many advantages. Conventional set-ups of experiments to measure the centripetal force mostly measure the force through a cord to stationary measuring units outside. If a spring scale is used to measure the values, greater speed also increases the radius of the path due to the increasing elongation of the spring. Therefore, the examination of the centripetal force with altered radii or angular speeds while setting the other quantity to a fixed value is rather complicated to perform. The Cobra4 Sensor-Unit Force with elongation measurement strips simplifies this experiment. Radio transmission additionally simplifies the set-up of this experiment, since an external fixation of the sensor is not necessary. So it is easy to examine the dependencies of the centripetal force on angular velocity, radius and mass.

P6000660

PHYWE Ripple Tank with LED light source, complete set

Benefits

- Reflection-free basin on adjustable feet
- 3-point adjustment
- Amplitude and frequency variable excitation dipper system
- Almost soundless operation
- Stroboscope for synchronous and „slow-motion" projection of waves
- Simultaneous LED display of: frequency, amplitude, phase shift and type of illumination
- Control of all parameters takes place via the keypad located on top
- Projection on transparent drwaing table for distortion-free image of the wave pattern
- Green LED for brilliant pictures
- A simple display of the wave pattern is easily possible by placement of a sheet of paper

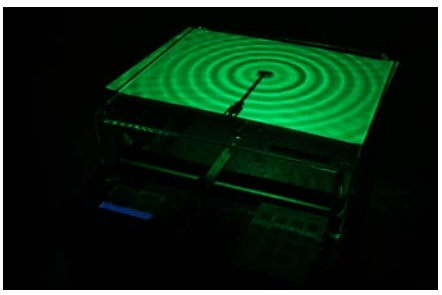
12 Experiments

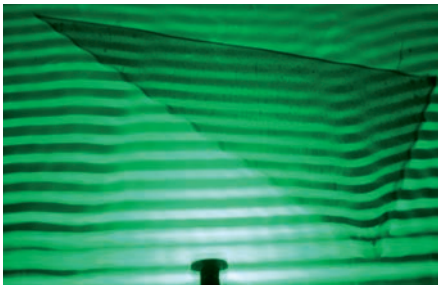
- Generation of waves
- Reflection by various obstacles
- Connection between the frequency and wavelength
- Doppler effect
- Dependence of the velocity of propagation on the depth ofwater
- Refraction at a planoparallel plate / on a prism
- Refraction at a convergent lens / at a divergent lens
- Interference of water waves travelling in opposite directions
- Influence of the phase difference on the interference pat-terns of two exciters
- Interference pattern of several point exciters (Huygens)
- Diffraction at obstacles and slits
- Diffraction and interference at a double slit

11260-88

Recommended Equipment

curricuLAB ActivityManager (online), site licence
14575-62
Demo mirror for PHYWE Ripple Tank
11260-30
External vibration generator for PHYWE Ripple Tank
11260-10





Teacher set Heat

Benefits

- Optimised for demonstration experiments: Transformation from horizontal into vertical direction with the help of the Demo board
- Demonstrative display of the measured values on the digital large-scale display
- Secure fastening of burners and hot vessels
- Glass equipment, liquid levels and flowing liquids can be observed easily on the plain background
- Complete equipment set: Simple execution of the experiments
- The equipment is stored in a robust aluminum case with removable lid
- Foam insert for a quick control of completeness and secure transport of the set
- Matched with international Curriculum: All topics are covered

15 Experiments

- Volume expansion of liquids
- Preparing a thermometer scale
- Linear expansion of solid bodies
- Volume expansion of gases at constant pressure
- Pressure increase during the heating of gases with constantvolume
- Heat convection in liquids and gases
- Heat conduction in solid bodies
- Anomaly of water
- Absorption of thermal radiation through black and white bodies
- Melting of ice
- Distillation
- Thermal energy and heated mass
- Measurement of the mixing temperature
- Specific heat capacity of solids
- Thermal conduction in water

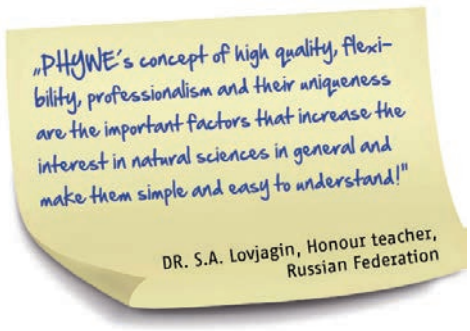
15530-88

Necessary Equipment

Teacher set Heat, necessary equipment	
15530-02	
Demo Physics board with stand	
02150-00	

Recommended Equipment

curricuLAB® ActivityManager (online), site licence
14570-62
curricuLAB® LabManager, site licence
14590-61



Teacher set Renewable Energy 1, Basics and Thermal Energy

Benefits

- Rugged magnetically adhesive puzzle blocks featuring contrasted screen-printed electric symbol on top
- Wiring diagram of the experiments can be completely illustrated
- Safe electric contact is guaranteed by the use of a unique puzzle block system with corrosion-free gold plated contacts
- Corresponding students kits available
- Expandable by Demo sets Renewable Energy 2 and 3
- Easy teaching by using the demo board for demonstration
- Complete equipment set: simple execution of the experiments
- The equipment is stored in a robust aluminum case with removable lid
- Foam insert for a quick control of completeness and secure transport of the set
- Experimenting software for all teacher experiments is delivered
- Matched with international Curriculum: all topics are covered

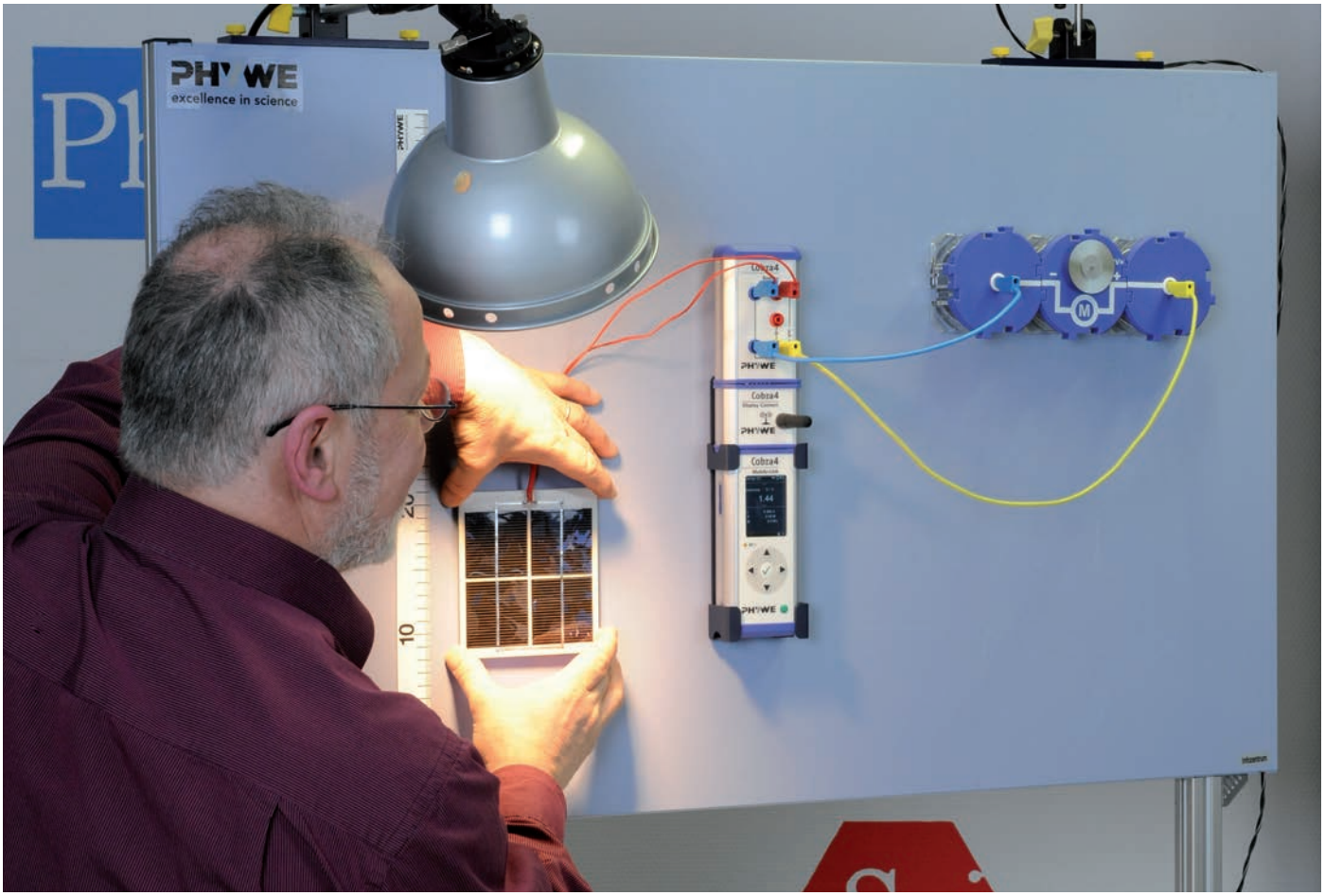
10 Experiments

- Conversion of light into motion with a solar cell
- Conversion of thermal energy into electrical energy and motion
- Conversion of electrical energy into thermal energy
- Conversion of electrical energy into mechanical energy and vice versa
- Influence of the surface on the absorption of solar energy
- The greenhouse effect
- Heating water in a solar collector
- Peltier effect: Cooling engine
- Peltier effect: Heat pump
- Pilot experiment for the use of ambient heat with the help o the peltier heat pump

15580-88

Necessary Equipment

Cobra4 extension set for renewable energy: electrical quantities, temperature
15608-88
Teacher set Renewable Energy 1, Basics and Thermal Energy, necessary equipment
15580-01
Demo Physics board with stand
02150-00



„The set "Demo renewable energy" is really universal. Using a highly methodical interface it makes this important and modern topic really understandable for the students."

Vadim Zinchuk,
Department Director /Honorary physic teacher,
Natural sciences college Nr. 145,
Kiev, Ukraine

Recommended Equipment

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Teacher set Renewable Energy 2, Solar cells, Wind energy, Hydropower

Benefits

- Demonstrative devices for experiments to photovoltaic, conversion of wind energy and hydropower into electrical energy
- Wiring diagram of the experiments can be completely illustrated
- Realistic design of the components
- Corresponding students kits available (TESS advanced Renewable Energies): for flexible and competence-oriented science classes
- Complete equipment set in addition to Renewable Energy 1
- The equipment is stored in a robust aluminum case with removable lid
- Foam insert for a quick control of completeness and secure transport of the set
- Matched with international Curriculum: all topics are covered

17 Experiments

- Voltage and current of a solar cell - Influence of surface area and lighting
- Voltage and current in a series and parallel connection of solar cells
- Operating a LED with solar energy
- The solar cell as a diode
- Storage of electrical energy of a solar cell with the aid of an accumulator
- Storage of the electric energy from a solar cell with the aid of a capacitor
- The characteristic current-voltage curves of a solar cell
- Electrical energy from wind energy - influence of wind speed, wind direction and load
- Influence of number of rotor blades
- Storage of electric energy from wind energy with an accumulator
- Storage of the electric energy won from wind energy in a capacitor
- Current-voltage characteristic of a wind wheel
- Pumping water using solar energy
- Pumping of water using wind energy
- Running water driving a generator - determination of the power
- Heating water using a parabolic trough
- Model of a field of a parabolic troughs

15581-88

Necessary Equipment

Teacher set Renewable Energy 1, Basics and Thermal Energy
15580-88
Cobra4 extension set for renewable energy: electrical quantities, temperature
15608-88
Teacher set Renewable Energy 1, Basics and Thermal Energy, necessary equipment
15580-01
Demo Physics board with stand
02150-00

Recommended Equipment

Teacher set Renewable Energy 3, Supplementary Set Fuel Cells
15582-88
curricuLAB® ActivityManager (online), site licence
14570-62
curricuLAB® LabManager, site licence
14590-61

Teacher set Renewable Energy 3, Fuel Cells

Benefits

- For many qualitative and quantitative experiments on hydrogen technology, the source of useful energy is always the electric fuel cell. This kit contains the essential building blocks for the construction of a fuel cell
- The placement of fuel cell and electrolyzer onto the demo building blocks of the electric/electronic system allows a demonstrative and clear set-up on the board
- The quadruple PEM fuel cell can provide an output voltage of about 3.5 V and operate so larger bulbs and motors
- Electrolyzer with high gas production to provide the quadruple fuel cell
- Operation of the fuel cell also with air to represent realistic technology applications of H-technology, such as in automobiles or power supplies
- Corresponding students kits available
- Complete equipment set in addition to Renewable Energies 1
- The equipment is stored in a robust aluminum case with removable lid
- Foam insert for a quick control of completeness and secure transport of the set
- Matched with international Curriculum: all topics are covered

7 Experiments

- Generation of hydrogen and oxygen and the characteristic curve of a PEM electrolyseur
- Faraday efficiency and energetic efficiency of a PEM electrolyser
- Generation of electric energy with a PEM fuel cell / Solar hydrogen system
- Wind hydrogen system
- Current-voltage characteristic and power of a PEM fuel cell
- Faraday efficiency and energetic efficiency of a PEM fuel cell
- Efficiency of an electrolyseur-fuel cell-system

15582-88

Necessary Equipment

Teacher set Renewable Energy 1, Basics and Thermal Energy
15580-88
Cobra4 extension set for renewable energy: electrical quantities, temperature
15608-88
Teacher set Renewable Energy 1, Basics and Thermal Energy, necessary equipment
15580-01
Teacher set Renewable Energy 3, supplementary set Fuel Cells, necessary equipment
15582-01
Demo Physics board with stand
02150-00

Recommended Equipment

Teacher set Renewable Energy 2, supplementary set Solar cells, Wind energy, Hydropower
15581-88
curricuLAB® ActivityManager (online), site licence
14570-62
curricuLAB® LabManager, site licence
14590-61

Teacher set Electricity/Electronics Building Block System 1

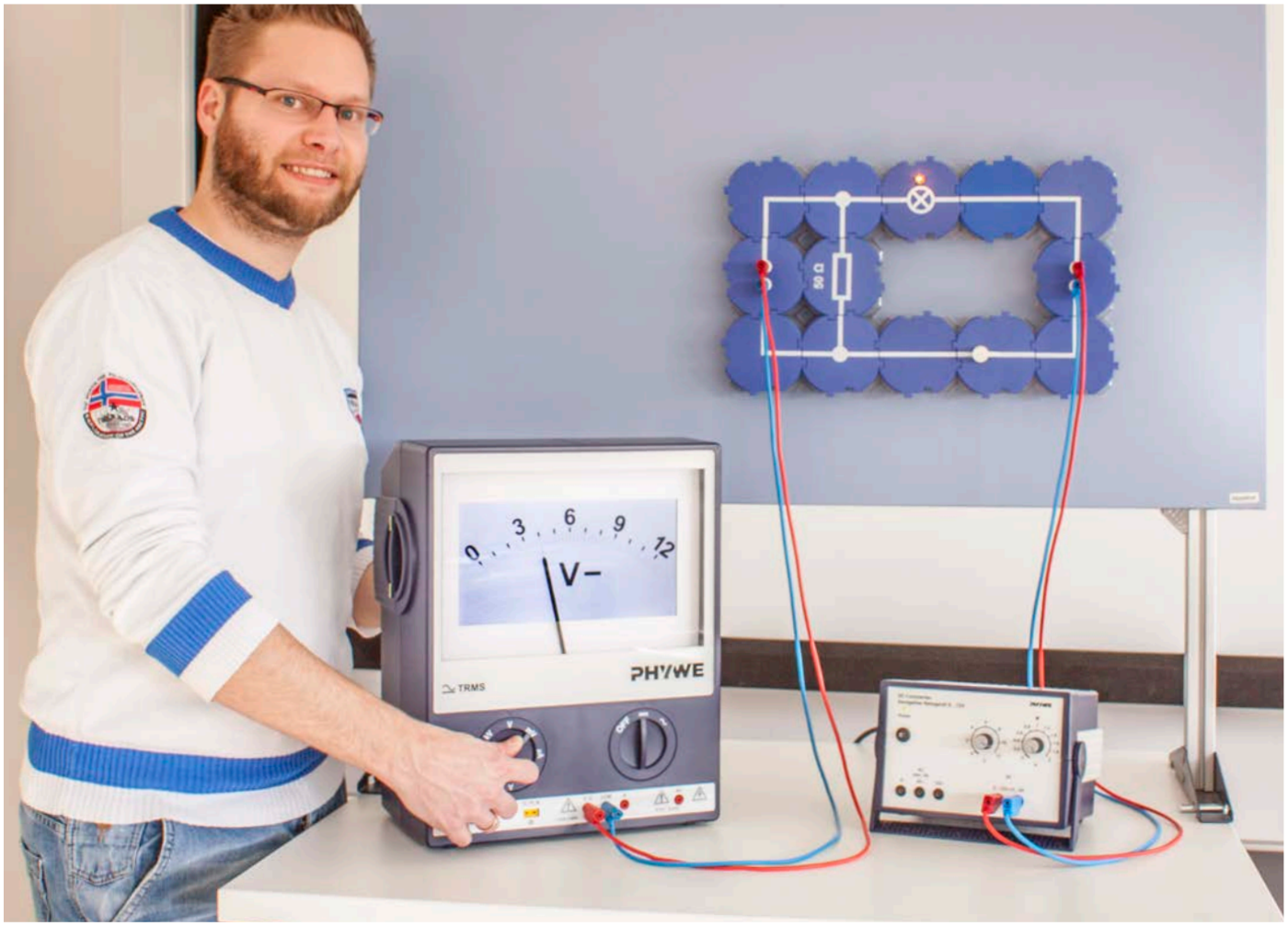
Benefits

- Many experiments for qualitative and quantitative introduction to the topic electricity
- Knowledge transfer of the elemental behaviour of numerous electrical components
- Circuit assemblies show their wiring diagram
- 100% compatibility between teacher and student building blocks
- Rugged magnetically adhesive puzzle-style building blocks with screen-printed electric symbols
- Building blocks are easy to remove and swap due to their gripper rims
- Safe electric contact is guaranteed by the use of a unique puzzle block system with corrosion-free gold plated contacts
- Teaching made easy thanks to the magnetic demonstration board
- Complete equipment set for quick and easy set-up and performance of the experiments
- The equipment is stored in a robust aluminum case with removable lid
- Foam insert for quick control if set content is complete
- Compliant with international curricula

30 Experiments

- The simple circuit
- Voltage measurement
- Current measurement
- Conductors and non-conductors
- Changeover switches and alternating switches
- Series and parallel connection of sources of voltage
- The safety fuse
- The bimetallic switch
- And- and Or circuit
- Ohm's law
- The resistance of wires - dependence on the length andcross-section
- The resistance of wires- dependence on the material and temperature
- The resistivity of wires
- Current and resistance in a parallel connection
- Current and resistance in a series connection
- Voltage in a series connection
- The potentiometer
- The internal resistance of a voltage source
- The power and work of the electric current
- Conversion of electrical energy into thermal energy
- Conductivity of aqueous solutions of electrolytes
- The connection between current and voltage in conductiveprocesses in liquids
- Electrolysis
- Galvanisation
- Galvanic cells
- The lead accumulator
- Earthing of the power supply line
- The protective conductor system
- The NTC resistor
- The PTC resistor

15569-88



Necessary Equipment

Teacher set Electricity/Electronics Building Block System, necessary equipment	15570-01
Demo Physics board with stand	02150-00

Recommended Equipment

curricuLAB® ActivityManager (online), site licence	14570-62
curricuLAB® LabManager, site licence	14590-61

curricuLAB® LabManager PHYWE

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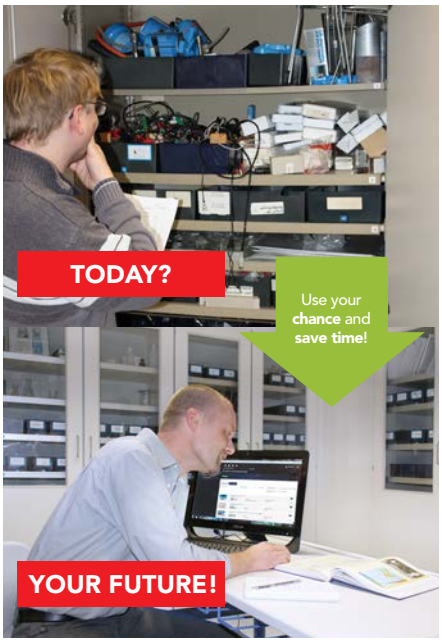
curriculab@phywe.de



Teacher set Electricity/Electronics Building Block System 2, Electromagnetism and Induction

Benefits

- Continuing experiments from the field of electricity to the topics electromagnetism and induction
- Instructional model engine with double-T armature, stator pole pieces and support surface for stator magnet
- Wiring diagram of the experiments can be completely illustrated
- Rugged magnetically adhesive -PUZZLE- blocks featuring contrasted screen-printed electric symbol on top
- The building blocks are easy to remove from experimental set-ups using the gripper rims
- Safe electric contact is guaranteed by the use of a unique puzzle block system with corrosion-free gold plated contacts
- 100% compatibility between teacher and student building blocks
- The equipment is stored in a robust aluminum case with removable lid
- Foam insert for a quick control of completeness and secure transport of the set
- Experimenting software for all teacher experiments is delivered
- Matched with international Curriculum: all topics are covered

24 Experiments

- Conversion of electrical energy into mechanical energy and vice versa
- The magnetic effect of a current-carrying conductor
- The Lorentz force: current-carrying conductors in a magneticfield
- The electric bell
- The electromagnetic relay
- Controlling with a relay
- The galvanometer
- The permanent magnet motor
- The series motor
- The shunt motor
- The synchronous motor
- Generation of induced voltages with a permanent magnet
- Generation of induced voltages with an electromagnet
- The alternating current generator
- The direct current generator
- Lenz's law
- The behaviour of a direct current generator under load
- Voltage transformation
- Current transformation
- The forces between the primary and secondary coils of a transformer
- Self-induction when switching a circuit on
- Self-induction when switching a circuit off
- The coil in the alternating current circuit
- The protective isolation transformer

15571-88

Necessary Equipment

Teacher set Electricity/Electronics Building Block System 1
15569-88
Teacher set Electricity/Electronics Building Block System 1, necessary equipment
15570-01
Teacher set Electricity/Electronics Building Block System 2, Electromagnetism and Induction, necessary equipment
15571-01
Demo Physics board with stand
02150-00

Recommended Equipment

curricuLAB® ActivityManager (online), site licence
14570-62
curricuLAB® LabManager, site licence
14590-61

„I can recommend the electricity/electronics building block system. It is highly useful, well-structured, durable, and can be stored in a particularly clear manner."

Joachim Meyer, teacher, Königslutter

Teacher set Electricity/Electronics Building Block System 3, Electronics

Benefits

- Continuing experiments from the field of electricity to the topic electronics
- Provides insight into semiconductor technology and deep going comprehension of the functional principle of capacitor, diode and transistor
- 100% compatibility between teacher and student building blocks
- Wiring diagram of the experiments can be completely illustrated
- Rugged magnetically adhesive puzzle blocks featuring contrasted screen-printed electric symbol on top
- The building blocks are easy to remove from experimental set-ups using the gripper rims
- Safe electric contact is guaranteed by the use of a unique puzzle block system with corrosion-free gold plated contacts
- Complete equipment set in addition to Electricity/Electronis 1
- The equipment is stored in a robust aluminum case with removable lid
- Foam insert for a quick control of completeness and secure transport of the set
- Matched with international Curriculum: all topics are covered

27 Experiments

- Capacitors in direct current circuits
- Charging and discharging a capacitor
- Capacitors in alternating current circuits
- Diodes as electrical valves
- Characteristics of a silicon diode
- Properties of solar cells - dependence on the illuminance
- The current-voltage characteristic of a solar cell
- Series and parallel connection of solar cells - open-circuit voltage and short-circuit current
- Series and parallel connection of solar cells - current-vol-tage characteristics and power
- The NPN transistor
- The transistor as a direct current amplifier
- The current-voltage characteristic of a transistor
- The transistor as a switch
- The transistor time-delay switch
- The PNP transistor
- Characteristic curve of a Zener diode
- The Zener diode as voltage stabiliser
- Light-emitting diodes
- Photo diodes
- Bridge rectifiers
- Alternating voltage amplification with a transistor
- Stabilisation of the operating point of a transistor ampli-fier stage
- Temperature control of a transistor
- Undamped electromagnetic oscillations
- The Darlington circuit
- The two-stage transistor amplifier
- Optical fibre communication

15572-88

Necessary Equipment

Teacher set Electricity/Electronics Building Block System 1
15569-88
Teacher set Electricity/Electronics Building Block System 1, necessary equipment
15570-01
Teacher set Electricity/Electronics Building Block System 3, supplementary set Electronics, necessary equipment
15572-01
Demo Physics board with stand
02150-00

Recommended Equipment

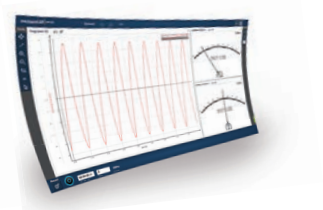
curricuLAB® ActivityManager (online), site licence
14570-62
curricuLAB® LabManager, site licence
14590-61

„From our point of view PHYWE is the ideal high tech solution for seriously and interesting high school practical courses. The unique factor of PHYWE-solutions is that it allows to organize research work for students already beginning with 9th grade."

DR. S.A. Lovjagin, Honour teacher, Russian Federation

Excellent. Experimentation. Network.

The digital teaching and learning plattform for natural science.



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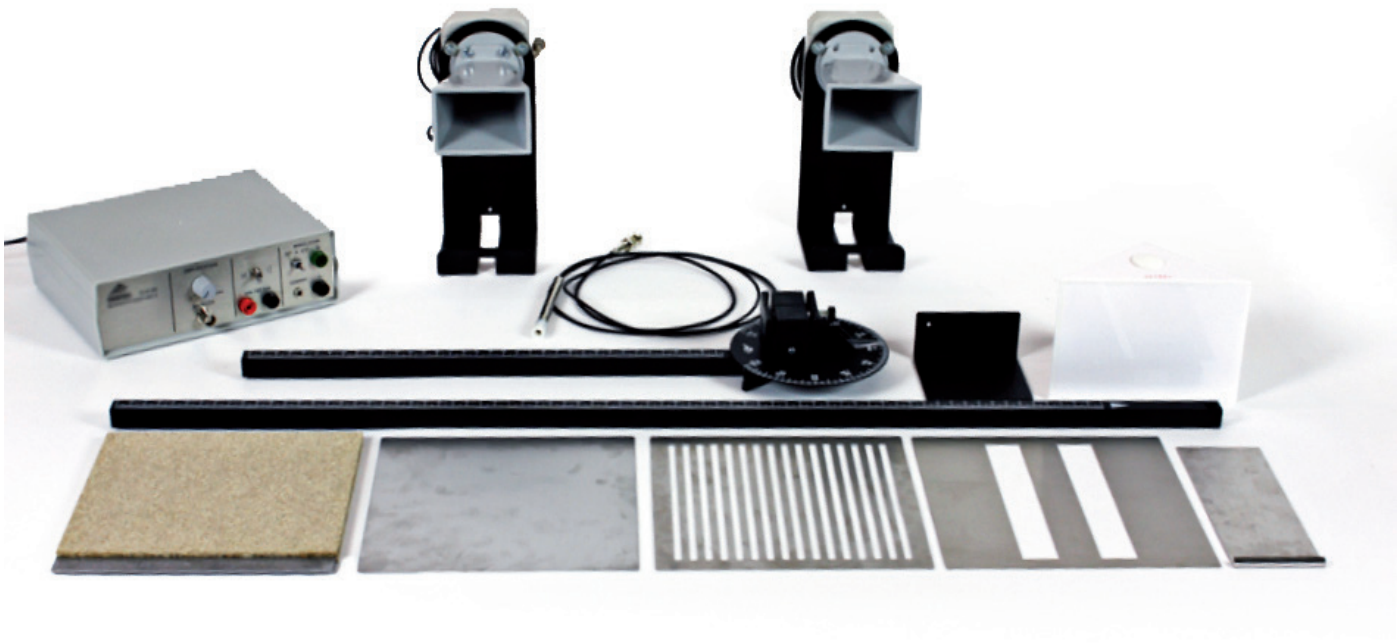
curricuLAB® PHYWE ActivityManagerPRO
curricuLAB® PHYWE measureAPP
curricuLAB® PHYWE measureLAB
curricuLAB® PHYWE LabManager

Microwave set, 230 V



Function and Applications

This apparatus allows microwaves to be transmitted and received. The components and equipment included allow for various experiments to be performed. These can achieve both qualitative and quantitative results. A narrow beam of electro-magnetic waves with wavelength in the cm range can be output by a transmitter and picked up using the horn antenna or the sensor probe. The modulation of the receiver signal can be rendered audible by means of an internal speaker and the intensity of the signal can also be controlled.

6 Experiments

- Polarization of Microwaves
- Reflection, Transmission and Refraction of Microwaves
- Propagation of Microwaves (Inverse Square Law)
- Standing Waves in the Range of Microwaves
- Conservation of Energy in Reflection and Transmission of Microwaves
- Diffraction and Interference of Microwaves

11742-93

Necessary Equipment

Demonstration multimeter ADM3, current, voltage, resistance, and temperature
13840-00
Connection cord, safety, 32A, 100cm, red
07337-01
Connection cord, safety, 32A, 100cm, black
07337-05

YouTube

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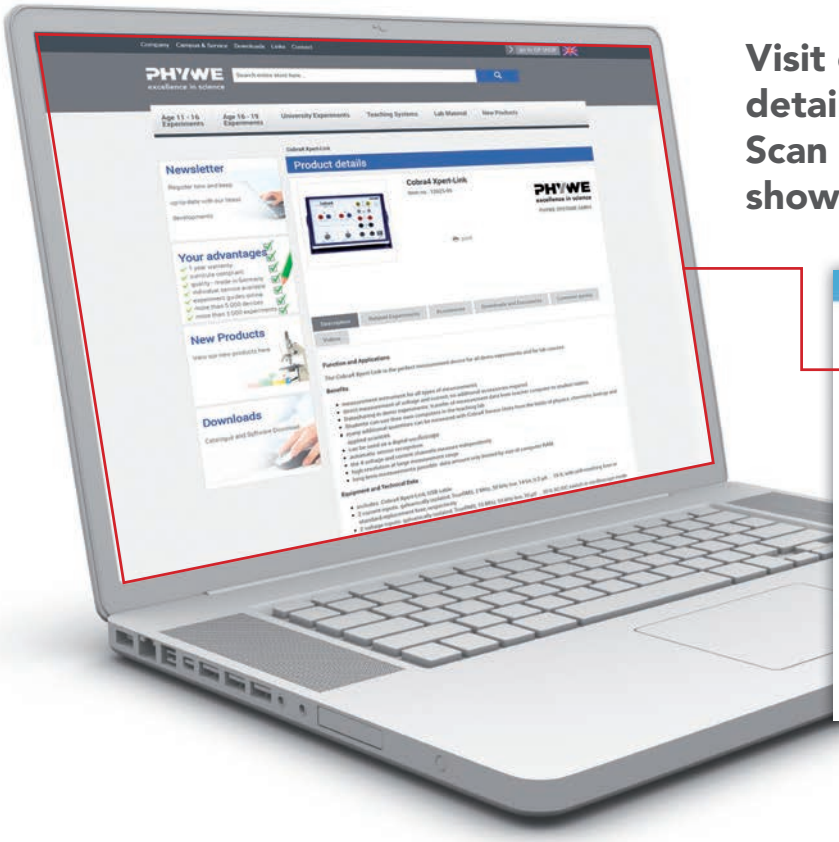

Visit our PHYWE website for all detailed information.
Scan the QR codes which are shown by the experiments

Teacher set Optics

Benefits

- Excellent complement to identical student experiments by directly comparable devices
- Light-intense halogen lamp
- Demonstrative models of lenses
- Minimum preparation time
- Easy teaching by using the demo board for demonstration
- Complete equipment set: simple execution of the experiments
- The equipment is stored in a robust aluminum case with removable lid
- Foam insert for a quick control of completeness and secure transport of the set
- Matched with international Curriculum: all topics are covered

60 Experiments

- Rectilinear propagation of light
- Shadow formation by a point light source
- Umbra and penumbra with two point light sources
- Umbra and penumbra with an extensive light source
- Length of shadows
- Solar and lunar eclipses with a point light source
- Solar and lunar eclipses with an extensive light source
- Reflection of light
- The law of reflection
- Formation of an image point by a plane mirror
- Image formation by a plane mirror
- Applications of reflection by plane mirrors
- Reflection of light by a concave mirror
- Properties of a concave mirror
- Real images with a concave mirror
- Law of imagery and magnification of a concave mirror
- Virtual images with a concave mirror
- Aberrations with a concave mirror (catacaustics)
- Reflection of light by a convex mirror
- Properties of a convex mirror
- Image formation by a convex mirror
- Law of imagery and magnification of a convex mirror
- Reflection of light by a parabolic mirror
- Refraction of light at the air-glass boundary
- Refraction of light at the air-water boundary
- The law of refraction (quantitative)
- Total reflection of light at the glass-air boundary
- Total reflection of light at the water-air boundary
- Passage of light through a planoparallel glass plate
- Refraction by a prism
- Light path through a reversing prism
- Light path of through a deviating prism
- Light transmission by total reflection
- Refraction of light by a convergent lens
- Properties of a convergent lens
- Real images with a convergent lens
- Law of imagery and magnification of a convergent lens
- Virtual images with a convergent lens
- Refraction of light at a divergent lens
- Properties of a divergent lens.
- Image formation by a divergent lens
- Law of imagery and magnification of a divergent lens
- Lens combination consisting of two convergent lenses
- Lens combination consisting of a convergent and a divergentlens
- Spherical aberration
- Chromatic aberration
- Colour dispersion with a prism
- Non-dispersivity of spectral colours

- Reunification of spectral colours
- Complementary colours
- Additive colour mixing
- Subtractive colour mixing
- Structure and function of the human eye
- Short-sightedness and its correction (myopia)
- Long-sightedness and its correction (hyperopia)
- The magnifying glass
- The camera
- The astronomical telescope
- The Newtonian reflecting telescope
- Herschel's reflecting telescope

15550-88

Necessary Equipment

Teacher set Optics, necessary equipment
15550-01
Demo Physics board with stand
02150-00

Recommended Equipment

curricuLAB® ActivityManager (online), site licence
14570-62
curricuLAB® LabManager, site licence
14590-61

curricuLAB® PHYWE LabManager

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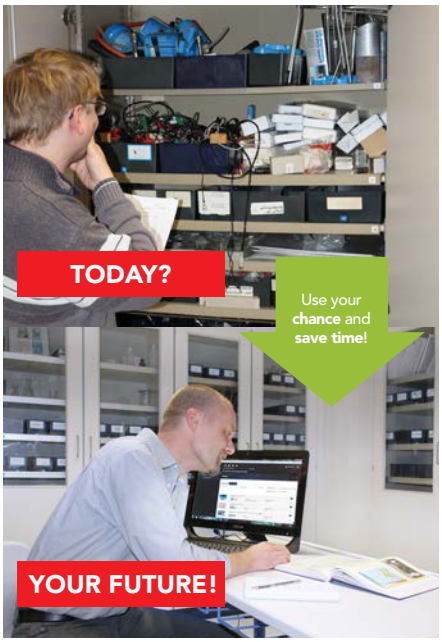

Teacher set Radioactivity

Benefits

- Complete equipment set: simple execution of the experiments
- The equipment is stored in a robust aluminum case with removable lid
- Foam insert for a quick control of completeness and secure transport of the set
- Experimenting software for all teacher experiments is delivered
- Matched with international Curriculum: all topics are covered
- The Geiger-Müller counter is attached to the top of the board where it is clearly visible
- Magneto-adhesive components for a simple and clear arrangement
- Student experiments can be carried out parallel to demonstration experiments due to identical holders

18 Experiments

- Determination of counting rates with the Geiger-Müller coun-ter
- Background effect
- Detection of radioactive substances with the ionisationchamber
- Statistical fluctuations and frequency distribution of coun-ting rates
- Radioactivity of minerals
- Radioactivity of potassium
- Radioactivity of incandescent mantles.
- Detection of radioactivity in the air
- Range of alpha particles
- Attenuation of beta rays
- Deflection of beta- particles (electrons) in a magnetic field
- Deflection of beta+ particles (positrons) in a magneticfield
- Attenuation of gamma rays
- The behaviour of gamma rays in a magnetic field
- The inverse-square law for gamma rays
- Determination of the radioactive half-life
- Level control
- Layer thickness determination

15590-88

Necessary Equipment

Teacher set Radioactivity, necessary equipment
15590-01
Demo Physics board with stand
02150-00

Recommended Equipment

curricuLAB® ActivityManager (online), site licence
14570-62
curricuLAB® LabManager, site licence
14590-61

XRE 4.0 X-ray expert set for schools

Functions and Application

Complete experiment set covering the fundamental principles and areas of applications of X-rays. To be extended by upgrade sets for further applications and topics.

Unit complies with the most recent German and European regulations for radiation protection.

8 Experiments

- Counter tube characteristics
- Radiographic examination of objects
- Qualitative examination of the absorption of X-rays
- Quantitative examination of the absorption of X-rays
- Characteristic X-rays of copper
- Bremsstrahlung
- Bragg's law
- Monochromatisation of X-rays

09117-88

Recommended Equipment

XRC 4.0 X-ray characteristics upgrade set (radiation spectra of various different anode materials, Moseley's law, Rydberg constant, Duane-Hunt's law)
09130-88

XRD 4.0 X-ray dosimetry upgrade set (dosimetry, ionisation of the air by X-rays)
09170-88

Sicherheitsverbindungsleitung, 32 A, 100 cm, schwarz
07337-05 5,02€

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curricuLAB® LabManager, site licence
14590-61

„In a research laboratory students might see a research XRD machine, but with the XR 4.0 they really operate the X-ray machine: load crystal samples, set scan parameters, record patterns, and analyse their own data."
Pat McMillan, University of New South Wales, School of Physics, Australia

Specific charge of the electron - e/m

Electrons are accelerated in an electric field and enter a magnetic field at right angles to the direction of motion. The specific charge of the electron is determined from the accelerating voltage, the magnetic field strength and the radius of the electron orbit.

Students learn about

- Cathode rays
- Lorentz force
- Electron in crossed fields
- Electron mass
- Electron charge

P2510200

Franck-Hertz experiment with an Ne-tube

Electrons are accelerated in a tube filled with neon vapour. The excitation energy of neon is determined from the distance between the equidistant minima of the electron current in a variable opposing electric field.

Students learn about

- Energy quantum
- Quantum leap
- Electron collision
- Excitation energy

P2510315

Elementary charge and Millikan experiment

Charged oil droplets subjected to an electric field and to gravity between the plates of a capacitor are accelerated by application of a voltage. The elementary charge is determined from the velocities in the direction of gravity and in the opposite direction.

Students learn about

- Electric field
- Viscosity
- Stokes' law
- Droplet method
- Electron charge

P2510100

5. Demo – Teacher Experiments

5.4 Chemistry

You can find the curriculum overview for Chemistry in chapter **4.3 TESS Student Sets - Chemistry**

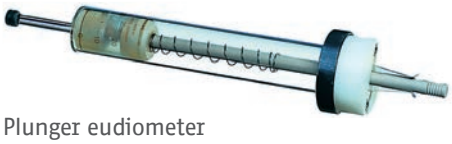
The Glass Jacket Apparatus System –
demonstrative, transparent und didactically vivid

The PHYWE glass jacket apparatus system consists of the glass jacket and special inserts and accessories. It was primilarily developed for experimenting with gases and can be used for teaching in chemistry, physics and biology classes. It is used to develop the gas laws, to determine molar masses, to measure combustion enthalpies, and many other things.

BESTSELLER

Glass jacket


Slow eudiometer


Plunger eudiometer


Gas syringe


Gas seperation column


Lid for calorimeter insert


Calorimeter insert


Distillation insert

Over 14 experiments!

Advantages at a glance

- Demonstrative and transparent
- Versatile modular system, very easy to assemble
- Ideal for working with gases
- Manual with detailed instructions of experiments
- Uncomplicated, fast experiments
- Excellent results
- Can be stored completely assembled

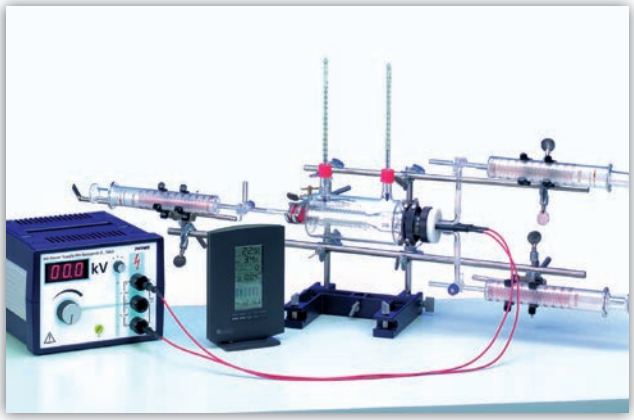
The perfect entry:

Set gas laws with glass jacket

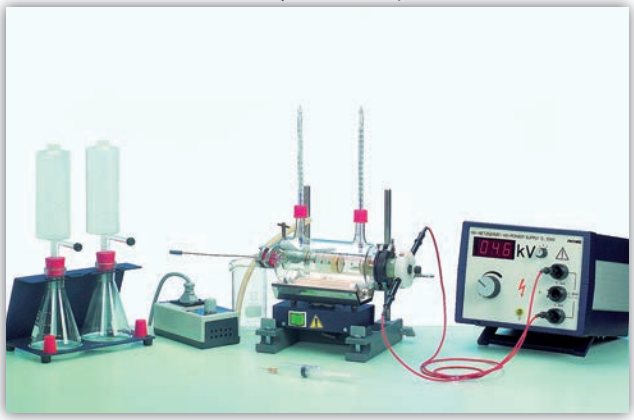
With this set you can do experiments on the following topics:

- Gas laws
- Determination of molar masses
- Quantitative gas reactions
- Calorimetry
- Steam distillation
- Gas chromatography

43003-88



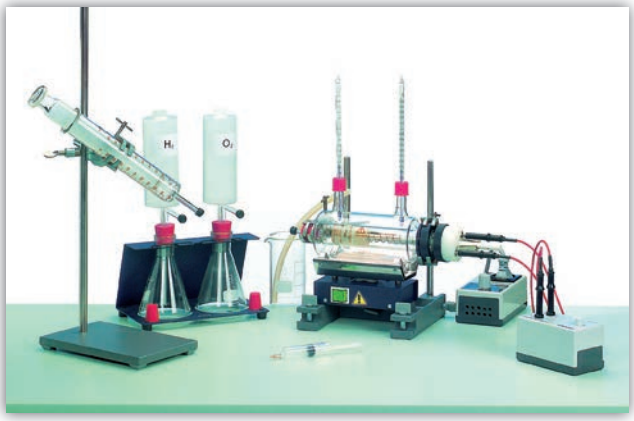
Energy balances at gas reactions (e.g. Determination of the heat of formation of water, P3021501)



Gas reactions (e.g. Emperical molecular formular of methane, P3110900)

Gas chromatography (P3031760)

Equation of state for ideal gases with Cobra4 (gas laws: Gay-Lussac, Amontons, Boyle) (P2320162)



Gas reactions (e.g. The law of Avogadro, P3111000)

Determination of molar masses (P3010501)

Calorimetry (e.g. Determination of calorific value of coal, P3021601)

Classic Cobra4 Set

Set gas laws with glass jackets and Cobra4 Mobile-Link 2

Complete device set for a comfortable way to derive the ideal gas laws experimentally with help of the Cobra4 Sensor-Unit Thermodynamics and the glass jacket system.

- The parameters are measured with a PC and can therefore easily be demonstrated, graphically displayed and analyzed
- Optional accessories: Digital large-scale display for demonstration experiments in the classroom or lecture hall

43021-00

Boiling point elevation - Raoult's law

The boiling point of a solution is always higher than that of the pure solvent. The dependence of the temperature difference (elevated boiling point) on the concentration of the solute can be determined using a suitable apparatus.

Benefits

- Simple presentation and execution by temperature meter 4-2
- Simultaneous display of current temperature and temperature difference
- Compact, easily transportable setup

Students learn about

- Raoult's law
- Henry's law
- Ebullioscopic constants
- Chemical potential
- Gibbs-Helmholtz equation
- Concentration ratio
- Degree of dissociation

P3021001

Steam distillation

An elegant and simple apparatus for carrying out water vapour distillations: the advantage of this arrangement is that it eliminates the need for a separate vapour generator, making it possible to operate with a single heat source (other set-ups require two). The vapour is generated in the outer chamber and then passes through the inner chamber. Due to the structural arrangement, the inner chamber is heated directly by the vapour generated in the outer chamber. This also eliminates the possibility of overheating the substances being extracted.
Parts of plants suitable for the extraction of essential oils include orange peel and cloves, for example.

Benefits

- Glass jacket system easily expandable
- No separate steam generator necessary
- Only one heat source needed

Students learn about

- Distillation
- Steam distillation
- Etheral oils
- Flavour

P3031251

Sulphur trioxide - the sulphuric acid contact process

The contact process is currently used in the chemical industry to produce sulphuric acid in the high concentrations needed for industrial processes. In this model experiment, platinum-palladium-aluminium-oxide beads are employed as a catalyst for the reaction.

Benefits

- Stable and safe setup due to solid stand material
- Secure connection of the items by GL screw joint system

Students learn about

- Sulphur trioxide
- Sulphuric acid
- Contact process
- Oxidation
- Redox reaction

P3110400

Air - a mixture of the gases oxygen and nitrogen

In this experiment the composition of air is investigated. Therefor soild copper is heated on air. Copper combines with the oxygen of air and forms copper oxide. If this reaction is performed in a closed apparatus and the air volume is measured before and after the experiment, the difference of the measured volume shows the oxygen content of the air.

Students learn about

- Composition of air
- Oxidation reaction

P1133400

Chemical fountain

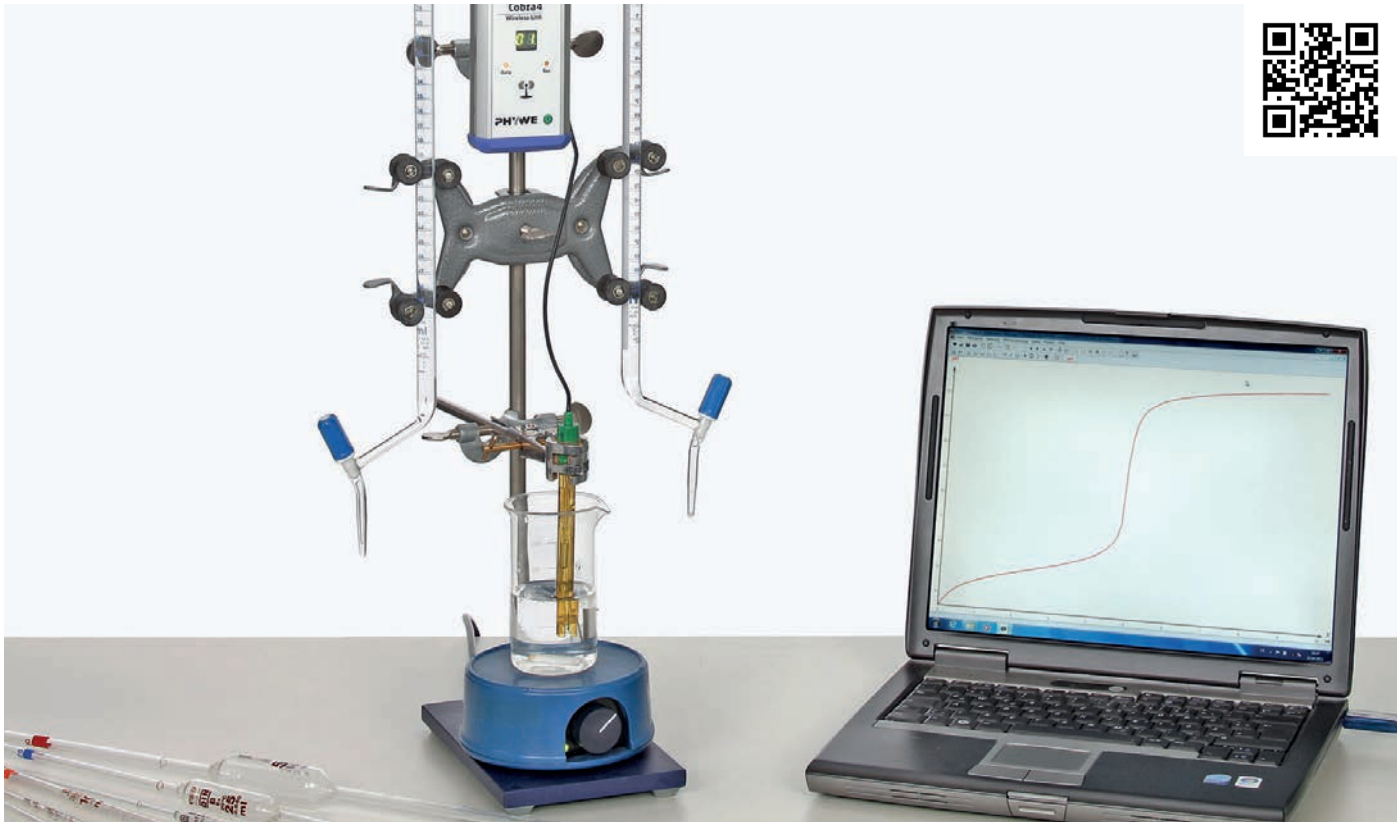
Some gases such as hydrogen chloride dissolve readily in water. For example, 1 litre of water at 20 °C can dissolve approximately 443 litres of hydrogen chloride. For example, vacuum builds up quickly in a closed flask when the gas comes in contact with water, because the gas dissolves in the water and additional water is drawn into the flask. This is the basis of how the chemical fountain works - an exciting way to demonstrate the solubility of gases in water.

Students learn about

- Solubility of hydrogen chloride
- Chemical fountain
- Different solubility of gases in water
- Introduction to the acid-base reaction
- Formation of a low pressure

P1310100

Demo advanced Basic Set pH Titration Cobra4



Laptop not included

Benefits

- Includes all you need for pH titrations
- Computer assisted measurements: show live titration curves
- Compact, easily transportable experimental setups
- Reliable and reproducible results
- All equipment in one package
- Suitable for demonstration and laboratory experiments

8 Experiments

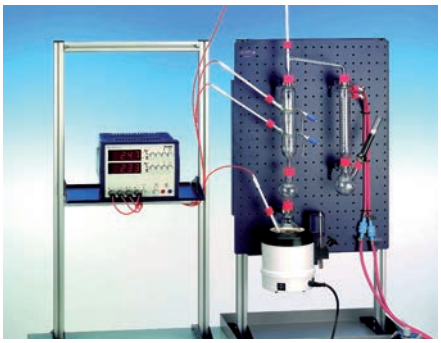
- Determination of pH values and calibration of pH-electrodes Basic principles of pH measurement
- Manual pH titration
- Titration curves and buffering capacity
- Potentiometric pH titration (phosphoric acid in soft drinks) with Cobra4
- Titration of a polyvalent acid with a strong base
- Titration of a weak organic acid with sodium hydroxide
- Titration of a weak base (ammonia) with a strong acid
- Titration of a weak base (ammonia) with a weak acid

12627-88

Necessary Equipment

Labware set for set pH titration Cobra4
12627-01
Chemicals and consumables for Set pH titration with Cobra4
12627-10

Model experiment on the fractional distillation of petroleum



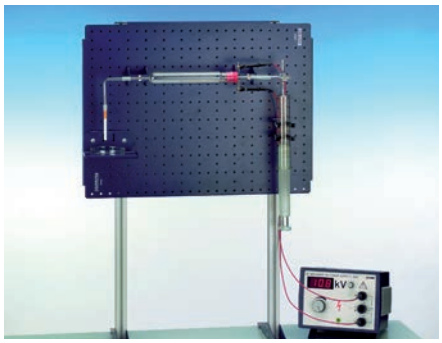
Crude oil, still one of the most important raw materials in the world, is a mixture of many hydrocarbons. Because the crude oil is a mixture of substances with different boiling temperatures, individual substances with different boiling ranges can be separated by distillation in fractions. In this experiment a model of crude oil is distilled.

Students learn about

- Distillative separation of a liquid mixture
- How a fractional distillation works
- Destillation of cruide oil
- Composition of cruide oil (this experiment examines a model of crude oil)

P1308600

Electrostatic flue gas cleaning



Smoke consists of particles of solid substances suspended in gas. Fog is made up of suspended droplets. In cigarette smoke, as in many industrial processes, smoke and fog are frequently present together. The removal of particles contained in gases - predominately waste gases - is increasingly gaining in importance, both in everyday life and industrially, because frequently the particles and the substances absorbed on them are toxic. Well known examples are adsorbed polycyclic aromatics on soot particles in diesel exhaust, and dioxins, heavy metals and radioactive elements in waste gases from power stations and waste incinerators.

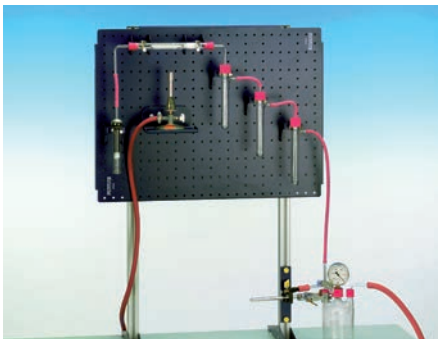
The deposited filter dusts are highly toxic, and must be treated as hazardous waste. The experimental set-up used here also enables constituents of cigarette smoke to be semi-quantitatively deposited even in quite large amounts, so that they can be extracted with light petrol and be examined.

Students learn about

- Introduction to gas purification systems
- Effect of an electrostatic filter for the separation process
- How an electrostatic flue gas cleaning works

P1309200

Model experiment on the desulphurisation of flue gas



German coal contains an average of one tonne of sulphur per 100 tons of coal. The combustion of this 100 tons of coal „produces“ about two tonnes of sulphur dioxide. In comparison a large 700 megawatt power plant which burns about 200 tons of coal per hour produces about 100 tons of sulphur dioxide per day. Due to the environmental hazard of sulphur dioxide these flue gases have to be desulphurised.

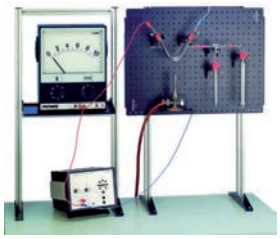
This experiment shows a simple demonstration of the chemical processes of flue gas desulphurisation like in power plants today.

Students learn about

- Environmental hazard due to sulfur dioxide
- Functioning of a flue gas desulphurisation plant
- Desulphurisation

P1310000

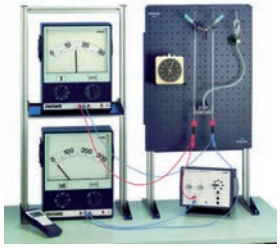
Molten-salt electrolysis



The electrolysis of molten sodium chloride to obtain chlorine and sodium, which can be used to produce sodium hydroxide, is an important industrial-scale process. The experiment is a simple demonstration of the important steps in this process. Due to the high melting point of sodium chloride, lead chloride (with a lower melting point) is used as starting material in the model experiment (instead of sodium chloride) sodium.

P1310500

Faraday's laws



Faraday's first law states that the mass of a material separated by electrolysis is proportional to the quantity of electricity which flowed through the solution. The second law states that the electrochemical equivalents are proportional to their equivalent masses (molar mass divided by valency). The experimental setup depicted here can be used to clearly derive the two laws experimentally.

P1309500

Water analysis excursion case

This excursion case enables students to actively participate in the measurement of water parameters in your immediate neighbourhood. Rapid chemical analyses provide meaningful results in a very short time. The colourimetric tests can be reproducibly and exactly evaluated by using the portable filter photometer.

Benefits

- Compact water laboratory for mobile use with photometer, reagents and accessories in a new robust case with a premium foamed plastic insert
- Increased accuracy and reproducibility by photometric evaluation of colourimetric tests
- Economic refill packs with up to 200 determinations per parameter

30839-01

Spectralphotometer, 340 - 1000 nm

The spectrophotometer is a single beam Visible Spectrophotometer with manual wavelength setting and is an easy to use device for measurement of the degree of absorption or transmission of liquid samples in the visible range (335...1000nm). This spectrophotometer is an economical visible spectrophotometer which is ideal for small laboratories, school & educational institution.

Benefits

- 1200 line grating monochromator to ensure high resolution, low stray and high parameters accuracy
- Spetrophotometer can be controlled by basic software through the USB port
- Auto Zero adjustments with one push button. Direct readout of Transmittance, Absorption and Concentration on the LCD Display

35668-93

Spectrophotometer 190-1100 nm

Benefits

- The UV-VIS spectral photometer is characterised by its compact design and due to its wide range of possible uses.
- Operation is via a clearly set out overlay keyboard on the screen dialogue.
- Current wavelengths and measured values can be displayed in large format.
- Alternatively, all measured values can also be presented graphically or in table format on the LCD screen with background lighting.
- Strong light, high performance optics enable absorption and transmission measurements to be taken in the whole wavelength range of 190 to 1100 nm with automatic switching between the two light sources.
- A high speed scanner minimises the susceptibility to errors during a wavelength changeover and thusenables very precise measurement.
- Storage of measurement parameters, data, calibration curves, spectra, etc.
- Spectral scanning of samples with freely selectable wave length range, automatic baseline correction and band/ trough identification.
- Production of a calibration curve withup to 10 concentration standards
- The device can be connected to a printer or computer with a serial port via USB

35655-99

X-rays in school education – fully equiped with one set!

The complete experiment set for schools includes 8 experiments and entirely covers the fundamental principles and areas of applications of X-rays.

Can be extended by upgrade sets for further applications and topics, including several chemical applications.

Your advantages

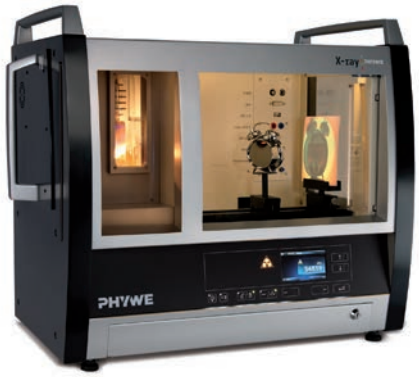
- **Complete set:**
  all required materials are included
- Specially suited for schools,
  curriculum compliant
- **8 experiments** can be conducted:
  - Counter tube characteristics
  - Bremsstrahlung
  - Bragg's law
  - Qualitative examination of the absorption
  - Quantitative examination of the absorption
  - Characteristic X-rays of copper
  - Radiographic examination of objects
  - Monochromatisation of X-rays
- **Upgrade sets** for special applications and und topics are available

Complete set	
09117-88	XRE 4.0 X-ray expert set for schools

Upgrade sets for chemistry education	
09140-88	XRS 4.0 X-ray Structural Analysis upgrade set
09160-88	XRM 4.0 X-ray Material upgrade set

XRE 4.0 X-ray expert set, with tungsten tube

Basic set covering the fundamental principles and areas of applications of X-rays, e.g. fluoroscopy experiments and X-ray photography. It can be extended by upgrade sets for specific applications and topics.



The set includes the following components:

- XR 4.0 expert unit
- XR 4.0 X-ray plug-in unit with a tungsten X-ray tube
- XR measure 4.0 X software
- TESS expert manual „Experiment with X-radiation" (English and German version) with more than 50 experiments
- USB cable
- Mains cable with adaptor
- Optical bech with
- Quick-start guide
- Operating instruction
- Fluorescent screen

09110-88

Giant Molecular Model Sets

Three sets of mocelular models for demonstrations of different organic molecules.

Benefits

- Very large diameter of the atom centers (5 cm), ideal for demonstrations
- Fast preparation and easy changes
- Great variety of molecules possible

Giant Molecular Model Set, basic set (organic chemistry)

This molecular model set for demonstration in the basic version is perfect for introducing fundamental concepts at the early stages of learning organic chemistry. A primer set that permits construction of many simple and complex organic compounds that are key to the understanding of this field of study. With our specially designed receptors you will be able to quickly change between skeleton structures during the course of your class. All atom centers are 2 inches (5 cm) in diameter and finished in durable enamel paint adherent to excepted international color standards.

M0L-19-V500

Giant Molecular Model Set (organic and inorganic chemistry)

Construct thousands of giant skeletal structures of organic and inorganic molecules. With our specially designed bond receptors you can easily and quickly change between chemical structures. The Original Giant Set includes 50 atom centers, 104 rigid bonds, 8 flexible bonds (a total of 56 bonds each in the scales of 8 cm/A and 20 cm/A). Includes The user's guide - an illustrated guide to concepts and model building. The atom centers have a diameter of 5 cm making this molecular model set ideal for demonstration.

M0L-19-V512

Giant Molecular Model Set, advanced set (organic chemistry)

With this molecular model set for demonstration you can construct more complex organic chemistry compounds. This makes it the perfect teaching and learning companion both for introductory AND higher level organic chemistry courses. Atom centers are easily visualized by students with their large 2 inch (5 cm) diameter and brightly finished enamel colors. Changing molecular structures is made easy with our specially designed bond receptors that continue to allow free rotation at the bond site after assembly.

M0L-19-V525

VSEPR model kit for demonstrations

Benefits

- Very large diameter of the atom centers and orbitals (7.5 cm resp. 5 cm), ideal for die demonstrations
- Molecular structures are easily build and quickly changed
- No connector elements need, therefor very uncomplicated

Create 13 model geometries predicted by VSEPR theory with the demonstration-size VSEPR theory kit. With these highly viable models illustrate the basic molecular shapes that are a result of electron repulsion. The following model geometries and variants can be created (as many as 6 simultaneously): linear, trigonal planar, angular, tetrahedral, trigonal pyramidal, angular (2 lone pairs), trigonal bipyrimidal, seesaw, T-shaped, linear (3 lone pairs), octahedral, square pyramidal, square planar. The specially designed „quick change" receptor allows for easy transition to other VSEPR predicted structures. These large models - the atomic centers have a diameter of 7.5 cm resp. 5 cm - are easily seen within the classroom or lecture hall.

M0L-20-S650

5. Demo – Teacher Experiments

5.5 Biology

You can find the curriculum overview for Biology in chapter **4.4 TESS Student Sets - Biology**

ZEISS Primo Star Full Koehler with integrated camera for the digital classroom

ideal for classes with tablet computers!

iPad is not included.

Function and Applications

The ZEISS Primo Star microscope with pre-set Full Köhler illumination and integrated 5 Megapixel camera is especially suited for schools and universities. The robust lab course microscope is built for long-term use.

It is particularly suited for use in a networked classroom and for classes using tablet computers. For example the live images can be transmitted to the iPads of students in real time.

Equipment and Technical Data

- Halogen-illumination, 6V 30W; LED-illumination, warm-light, 3200K
- Nosepiece turret, 4x, backwards
- Mechanical stage 75x30, drive right, specimen holder with spring lever left
- Binocular tube 30°/20 with integrated 5 Megapixel HD streaming camera
- Eyepieces 10x/20 Br. foc
- Objectives Plan-Achromat 10x, 20x, 40x and 100x Oil
- Condenser 0.9/ 1.25
- External power supply 100...240VAC/50...60Hz/30VA with country-specific adapter
- Dust cover
- 5 ml immersion oil
- Filter set blue, green, yellow
- Halogen bulb 6V 30W (replacement)

Specifications of the integrated camera:

- Sensor: Micron MT9P031, 5 Megapixel, color, CMOS
- Smooth full HD live-image: 1920 x 1080 pixels, 30 fps
- Pixel size of sensor: 2.2 µm x 2.2 µm
- Sensor size: 5.7 x 4.28 mm, equivalent to ½.5" (diagonal 7.1 mm)
- Interfaces: 1x SD-card slot (SD and SDHC), 1x USB 2.0 (including cable), 1x DVI-D (HDMI), 1x ethernet RJ45 100 Mbit, 1x IR sensor
- Spectral range: appr. 400 to 700 nm, IR-filter
- External power supply USB 2.0 5V/1A
- 100...240VAC/50...60Hz with country-specific adapter
- Buttons: Snap, white balance, contrast, brightness, menu
- Supported operating systems: iOS for iPad/iPhone, Windows
- The camera can be used with router and the free ZEISS iPad/iPhone/Windows imaging app Labscope and is therefore suited for classes with iPad/iPhones or Windows tablet computers.

62271-99

Vision defects (model experiment)

This experiment allows a vivid demonstration of short-sightedness and long-sightedness compared to the normal vision of the human eye and of how such defects can be corrected.

Benefits

- Graphic demonstration experiment
- Demonstration of the most frequent visual defects and their correction
- Easy to demonstrate
- Easy to understand

Students learn about

- Emmetropia
- Short-sightedness (myopia)
- Far-sightednes (hyperopia)
- Correction of visual defects
- Retina

P1054300

Subjective colour mixing with the colour wheel

If a circular disc separated into various differently coloured sectors is rotated by a motor so fast that the eye can no longer distinguish the colours, a mixed colour is then perceived. By varying the composition and size of the sectors, it is possible to give the impression of any colour at all. The colour triangle can be used to predict what the perceived colour will be.

Benefits

- Rotational speed of colour disk can be varied
- Percentage of the different colours of the colour disk can be adjusted

Students learn about

- Aligning discrimination
- Colour receptors
- Colour mixing
- Physiological impression of mixed colours

P0872500

Mechanism of diaphragmatic respiration

Mechanical model experiment for the demonstration of how the human lung work. The model shows the expansion of the lungs (rubber balloons) when the breast area (polystyrene jar) is expanded by sinking the diaphragm (rubber cloth). Air flows into the lungs through the windpipe and bronchi (Y-tube).

Benefits

- Graphic demonstration experiment
- Easy to demonstrate
- Easy to understand

Students learn about

- Lung
- Respiration
- Diaghragm

P1049300

Time resolving capability of the human eye

As excitation of the light-perceptive cells of the retina always takes a little longer than the light stimulus, only a limited number of stimuli per unit of time can be processed (time-related resolving power of the eye). If a light source is switched on and off periodically in increasingly rapid sequence the eye at first perceives the individual flashes, then the appearance of flicker occurs and finally the impression of a continuous light (fusion of the flicker).

Benefits

- Perimeter design semidiagnostic, appropriate for medical education

Students learn about

- Perimeter
- Time-related resolving power
- Flicker fusion frequency
- Light/dark adapted eye

P4070300

Osmosis - dependence of the osmotic pressure on the concentration

Osmosis describes the phenomenon that solvent molecules move through a partially permeable membrane into a region of higher solute concentration. Thus, the concentration of solute is equalized on both sides. The experimental set-up consists of seven chambers that are filled with solutions of sugar with different concentrations. The liquid column in the capillaries is determined and the dependence of the osmotic pressure on the concentration can easily be shown.

Benefits

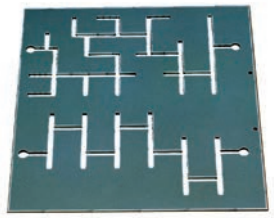
- Quantitative determination of the osmosis processes
- Multiple measurement points permit detailed analysis
- Scalable experiment: number of measurement points can be varied

Students learn about

- Osmosis
- Osmotic pressure
- Concentration

P1135700

Learning performance of humans



The blindfolded test subject has to find the way to the finish with a felt-tip pen in the slits of a finger labyrinth. Success and error are checked by placing a sheet of paper underneath. If a person has to find his way through a labyrinth, he will first of all attempt to obtain an overall view of the labyrinth. If, however, an overview of the labyrinth is prohibited, the test subject is obliged to find his way by trial and error. In the first attempt incorrect paths are frequently selected and the time taken to cross is relatively long. In subsequent practice crossings the number of errors as well as the time required are reduced steadily, until the values settle at a particular level.

Benefits

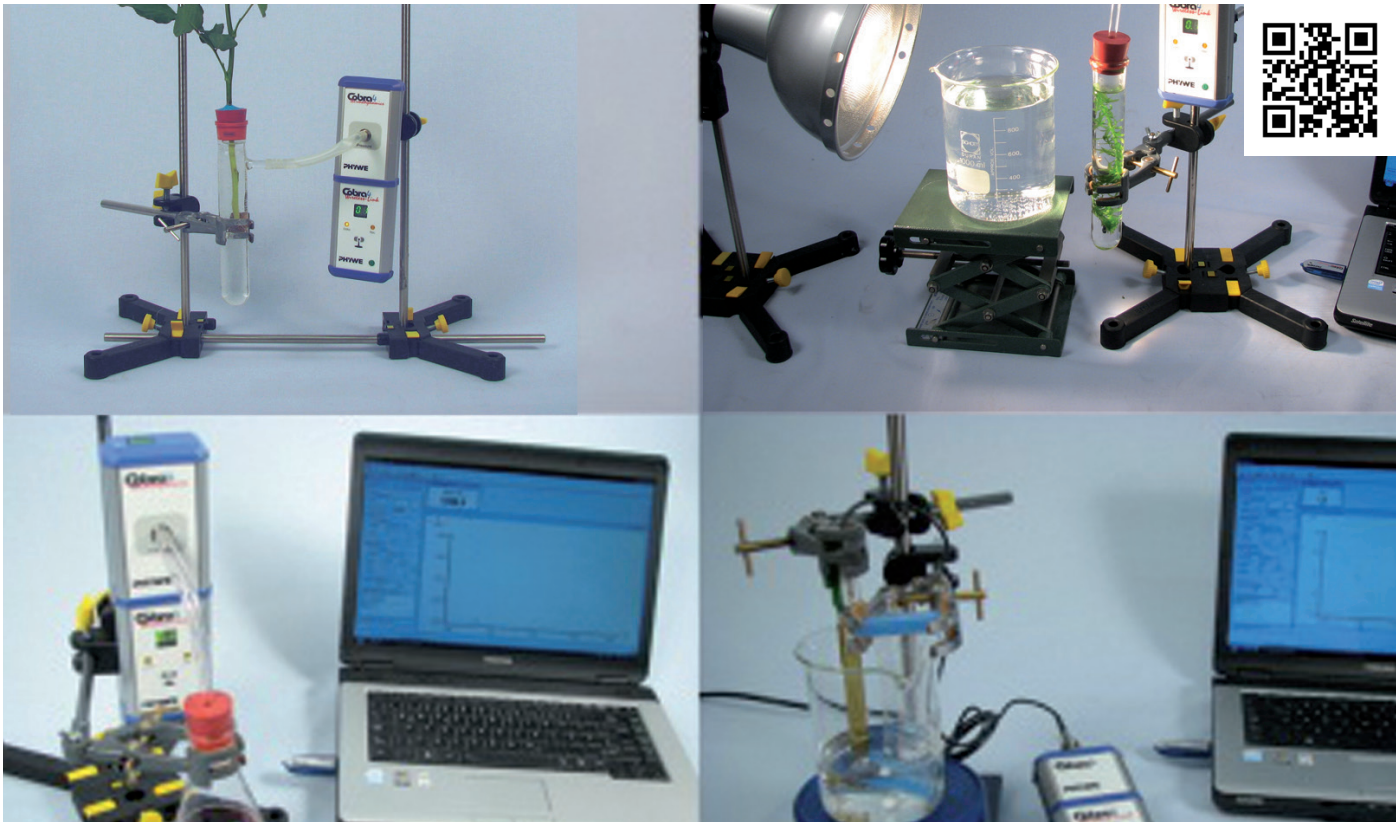
- Exciting student experiment
- Simple, but effective experiment to teach short-term and medium-term memory

Students learn about

- Finger labyrinth
- Learning behaviour
- Learning curve
- Short-term memory
- Medium-term memory

P4080300

Teacher Set Cobra4 Biochemistry and plant physiology



Laptop not included

Benefits

- Uniform computer interface: Cobra4
- Compact setup
- Reliable and reproducible results
- All components in one package
- For both demonstration and student experiments

10 Experiments

- Photosynthesis (bubble counting method)
- Photosynthesis (measurement of oxygen pressure)
- Transpiration of leaves
- Glycolysis (pressure measurement)
- Glycolysis (temperature measurement)
- Ionic permeability of the cell membrane
- Determination of the Michaelis constant
- Substrate inhibition of enzymes
- Enzyme inhibition (poisoning of enzymes)
- Enzymatic activity of catalase

15620-88

Necessary Equipment

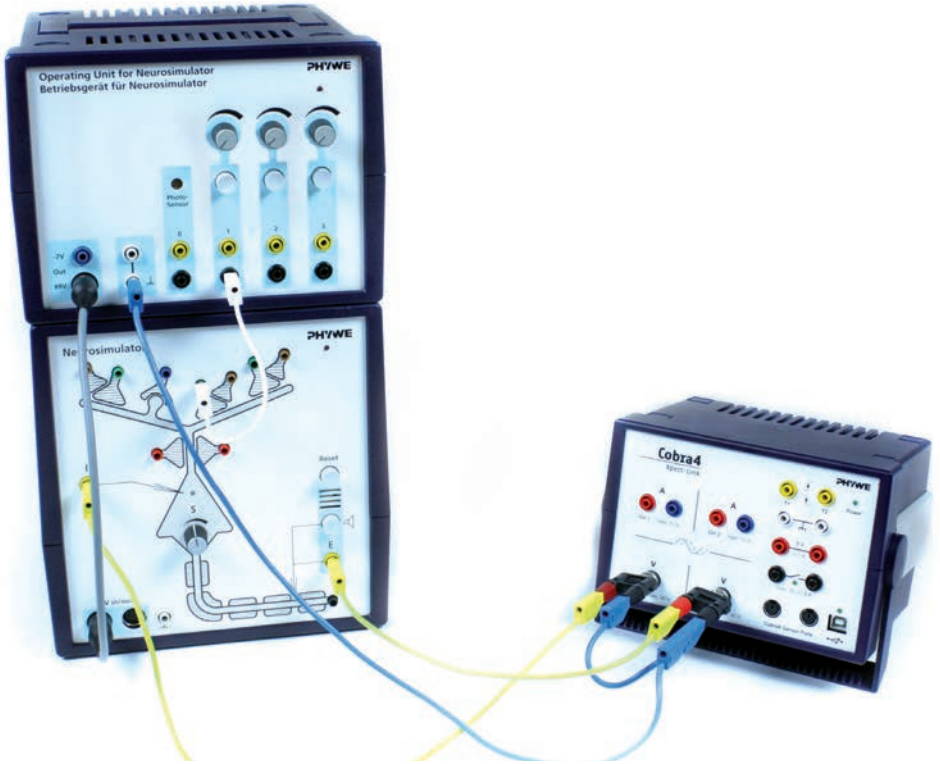
Necessary accessories for Basic set Biochemistry & plant physiology
65980-77
Chemicals set Biochemistry & plant physiology
65980-10

Recommended Equipment

curricuLAB® ActivityManager (online), site licence
14570-62
curricuLAB® LabManager, site licence
14590-61

Teacher Set Cobra4 Neurobiology with one nerve cell

EXCLUSIVE



Function and Applications

- Perform numerous demonstration experiments related to the topic "nerve cell"
- Can be easily upgraded to perform additional experiments about nerve cell interactions and neuronal networks
- Complete instrument set consisting of neuron unit, operating unit, computer interface, measureLAB software for data acquisition and analysis, diverse cables.
- The neuron unit simulates a nerve cell with an apical dentrite, a cell body and a nerve fiber
- Signal inputs: excitatory synapses, Hebb's synapse, inhibitory synapses, veto synapses als presynaptic inhibitors
- Signal outputs for membrane potential and action potential
- Acoustic monitor of the action potential
- Setting for firing threshold

Experiments

Experiments with one nerve cell:

- Mebrane potential and action potential
- Mebrane time constant
- Synapse types (excitatory synapse, Hebb's synapse, inhibitory synapse, veto synapse)

With additional nerve cells (Neurosimulators) further experiments can be performed:

- When using 2 nerve cells: motoneuron signals with recurrent inhibition by Renshaw cell, motoneuron signals without recurrent inhibition, functional characteristics of Renshaw inhibition, lateral inhibition, contrast improvement, conditioned reflex, reversed stimulus succession does not bring about a conditioned reflex.
- When using 3 nerve cells: transient (phasic) responses: focus on visual sense, body clock, short-term memory, special anatomical circuits: cerebral cortex and sensoric learning, functional characteristic of a triad.
- When using 4 nerve cells: direction selectivity by unilateral inhibition, self-calibration of paired sensory channels.

65964-11

Recommended Equipment

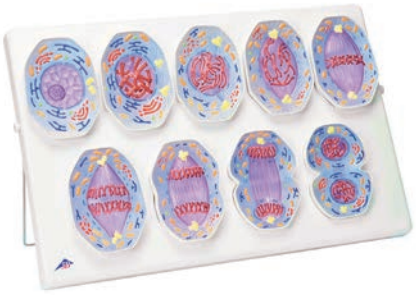
Can be complemented with additional nerve cells (Neurosimulators) for the described experiments:

Neurosimulator
65963-00 574,00€

curricuLAB® ActivityManager (online), site licence
14570-62

curricuLAB® LabManager, site licence
14590-61

Mitosis model



3BS-1013868

Classic human skull model, 3 part

3BS-1020159

Neuron Cell Body

3BS-1000233

Classic Heart, 2 part

3BS-1017800

Eye, 3 times full-size, 6 part

3BS-1000259

Australopithecus Boisei Skull, Replica

3BS-1001298

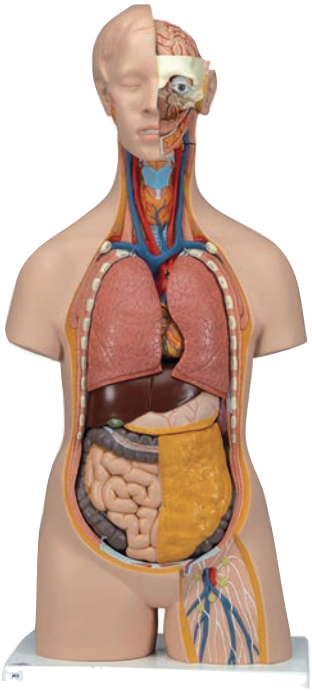
Giant Dental Care Model, 3 times life size

3BS-1000246

Skeleton Model - Stan

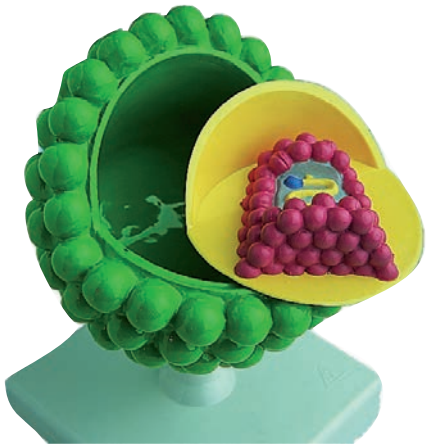
3BS-1020171

Classic Unisex Torso, 14-part



3BS-1000190

AIDS virus



87085-00

Apple Flower (Malus pumila)

3BS-1017829

Animal cell model

3BS-1000523

Plant Cell Model

3BS-1005487

Teaching Case "27 Invertebrates (Invertebrata)"

3BS-1005970

The Life of the Honey Bee (Apis cerana)

3BS-1005971

Visit our website www.phywe.com for all models on offer. Over 1.200 available!

6. STEM

Science, Technology, Engineering, Mathematics

Robot mBot, Bluetooth/PC

mBot is a low cost, easy-to-run robot kit for kids to get hands-on experience about graphical programming, electronics, robotics. It is an all-in-one solution for robotics learning and designed for STEM education.

- Easy to assemble within 10 minutes
- Electronics are based on Arduino open source platform
- Programming tools: mBlock (a drag-and-drop programming tool based on Scratch 2.0) and Arduino IDE
- Supports wireless connection via Bluetooth, no more limitation of wired connections
- Easy and intuitive wiring with color-coded RJ25 connectors
- Sturdy aluminium chassis with 2mm of thickness, compatible with Makeblock & Lego parts
- Achieve different fun projects like wall avoidance, line following, games with other mBots, using sensors to play games in Scratch

Equipment and Technical Data:

- Software and programming: mBlock (graphical) Mac, Windows, iPad mBlocky, Arduino IDE
- Inputs: Light sensor, button, infrared receiver, ultrasonic, sensor, line follower
- Outputs: Buzzer, RGB LED, infrared emitting, two motors, ports
- Microcontroller: Based on Arduino Uno
- Wireless Communication via Bluetooth

MAK-MBOT

Arduino Coding Set, Brick'R'knowledge

The Brick'R'knowledge Arduino Coding Set introduces you to digital electronics and programming with the Arduino Nano that is included in the kit. The set includes digital components such as 7-segment displays, OLED display, D/A converter or a I2C adapter that are complementary to all analog bricks also supplied in the set.

- Introductory coding of a microcontroller with LEDs and push buttons
- Analog/digital converter and digital/analog converter
- I2C bus
- Push buttons and bouncing
- Relais
- Rotary encoders
- OLED display
- Applications: measurement of a discharge function, diode characteristics, OLED and transistor as emitter circuit, switching of loads

BRK-125697

Internet of Things Set, Brick'R'knowledge

With the Internet of Things set it is possible to control your bricks via the Internet. With the included IoT Brick you will learn how to build your first website and control I/O pins via smartphone. Furthermore, the set contains a temperature and humidity sensor. To drive the 7-segment display, the so called I²C bus is used. With this set your first home automation project can be realised.

BRK-138090

Electronics and Electricity - Basics

NEW

This Student expermiment set covers the fundamentals of Electronics. The main topics are electrical circuits, series, parallel and three-way / four-way circuits and electronic components /circuits. The basics of electronics are clearly illustrated by simple circuits, series and parallel connection, electronic circuits with transistors, capacitors, resistors and LEDs. Models of the simple flashlight on ship swing, change indicator and adjustable fan can be set up with this experiment set.

FIS-533029

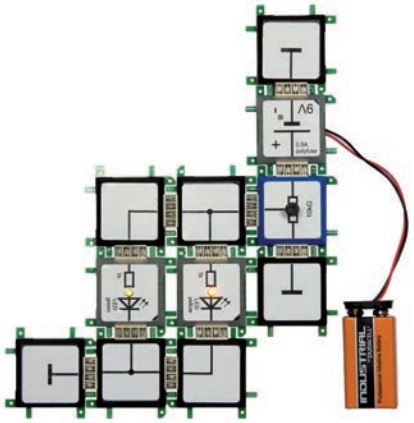
Electronics Basic Set, Brick'R'knowledge

NEW

The Electronics Basic set introduces you to the most important variables and functionalities of electronic circuits. The 19 bricks included in the kit help you understand more about electronics. For those of you who are interested in electronics and want to know more about it, the Basic Set is the adequate kit to start with.

- Save to use and robust
- Special plug contacts of the bricks to easily realise circuits with solid electric contacts
- Screen-printed electric symbols on top of each brick
- Closed circuits in more complex circuits can be easily realised
- Special ground brick helps reduce the number of bricks to build a closed circuit
- Special contact brick included for uncomplicated and quick installation of additional components
- No additional material required

The following experiments can be performed: power circuit, parallel, series circuit, the LED, the resistor, the potentiometer, the light-dependent resistor, the capacitor, the transistor. Numerous experiment variants are described in detail.



BRK-115589

You can find more experiments for Electricity in

chapter **4.2.6 TESS - Physics - Electricity**

and on **www.phywe.com**

Electronics Advanced Set, Brick'R'knowledge

The Electronics Advanced set enables users to rebuild basic cicuits of modern electronics and to further develop them. The included manual contains explanations of the 111 different bricks and experimental setups. The set includes a variety of switches and transistors, antenna and audio elements and special modules like the Timer 555.

- Save to use and robust
- Special plug contacts of the bricks to easily realise circuits with solid electric contacts
- Screen-printed electric symbols on top of each brick
- Closed circuits in more complex circuits can be easily realised
- Special ground brick helps reduce the number of bricks to build a closed circuit
- No additional material required

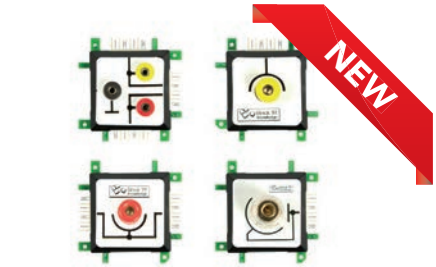
- Experiments relating to setting up circuits (8 experiments)
- Digital logic with buttons (4 experiments)
- Resistor (6 experiments)
- Capacitor (3 experiments)
- Inductance (4 experiments)
- Transistors (13 experiments) as well as JFET
- MOSFET (3 experiments)
- Special semiconductors (programmable unijunction transistor und thyristor)
- Timer 555 (6 experiments)
- Logic circuits (6 experiments)
- Oscillators (4 experiments)
- Operation amplifier (9 experiments)
- Audio amplifier with LM386 (9 experiments)
- Relais circuits (16 experiments)

BRK-118704

DIY Set, Brick'R'knowledge

The DIY Set by Brick'R'knowledge enables inventors and developers to design their own bricks. By using soldering iron and tin solder you can either rebuild standard bricks or design your own individual ones for special applications or even develop your own brick sets.

BRK-124343



Measurement Set One, Brick'R'knowledge

The Measurement set One enables you to measure the voltage, current and other measured variables with standard measuring instruments. The set includes a measuring adapter connector (3x2mm), a measuring adapter (4mm Closed End GND) with additional cable clamp and two additional measuring adapters (4mm Endpoint and 4mm Inline red). With this set voltage and current measurements can be taken with Cobra4 measurement devices, e.g. with the Cobra4 Xpert-Link or with the Wireless/USB-Link together with the Sensor-Unit Electricity.

BRK-136818

Measurement Set Two, Brick'R'knowledge

The Measurement Set Two includes the following 6 measurement bricks: 2 x black measuring adapters (4mm Closed End GND), 2 x red measuring adapters (4mm Inline) and 2 x black measuring adapters (4mm Open End GND). The Measurement Set Two enables you to measure the voltage, current and other measured variables with standard measuring instruments. With this set voltage and current measurements can be taken with Cobra4 measurement devices.

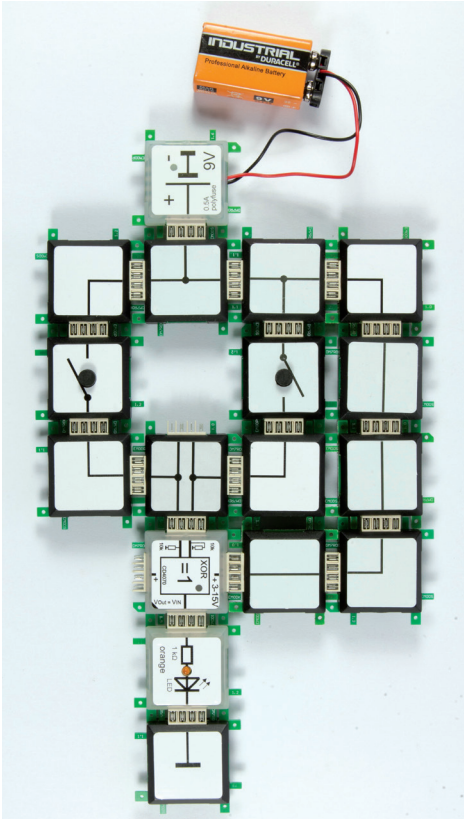
BRK-136820

Logic Set, Brick'R'knowledge

The Logic Set is ideally suited for a quick start into the digital circuit technology. While working with the manual, which includes didactically structured examples of circuits, students learn about Boolean algebra and its applications: the most important digital circuits like adder, shift register and numerator. The comprehensively equipped Logic Set provides teachers with a practical basis for daily teaching. Plugging the bricks together and experimenting with them is fun and encourages building your own circuit variants. The Logic Set's scope of supply ranges from easy logic bricks (AND, OR, NAND, NOR, XOR, XNOR, NOT), to a variety of flip flop bricks (D-, RS- and JK-type), to an impulse brick (alternatively a debounced switch for single pulses) up to a BCD counter brick with an integrated 7 segment display

The following projects can be realised:

- Basics of digital current sourcing logic (logic level, combinatorial circuit, sequential circuit, glitches)
- Programmable logic modules (PAL, GAL, CPLD, FPGA)
- Basic circuits (inverter, gates: AND, OR, NAND, NOR, XOR, XNOR)
- Debouncing circuit, digital counter (1-bit half-adder and 1-bit full-adder, 4-bit full-adder)
- Flipflop types
- Shift register
- Counter (binary, CBD, 3-bit, 4-bit)



The stable storage box includes the following bricks which can be easily attached to one another: AND gate, OR gate, inverter, NAND gate, NOR gate, XNOR gate, JK flipflop, D flipflop, D flipflop with set and reset, BCD counter, pulse relay, buttons (debounced, simple, dual), dual LEDs (red/yellow and green/orange), LEDs (red, yellow, green, blue), ground brick to realise closed circuits easily and to reduce the number of necessary connections, diverse connecting bricks, short-circuit-proof power supply (9V).

BRK-135006

Recommended equipment:

Item no.:	Description
BRK-124343	DIY Set, Brick'R'knowledge

STEM-Set „Electricity, Electronics, Energy, Power and Digital Communication

The STEM-Set focuses on electricity, electonics, energy and power and according the standards of ISTE and ITEEA. This STEM combines electricity, electronics, energy, power and digital communication andenables students to understand and explore many essential aspects of Science, Technolgy, Engeneering and Technology.

- Introduction to Energy and Power
- Energy Conversion Systems
- Conversion and Storage of Energy Mechanisms
- Basic Electricity
- Human & Machine Collaboration
- Introduction to Sensors Robotics
- Digital Communication and Programming Control Systems

FIS-STEM-PHYSICS

Mini-Bots - Introduction to Robotics

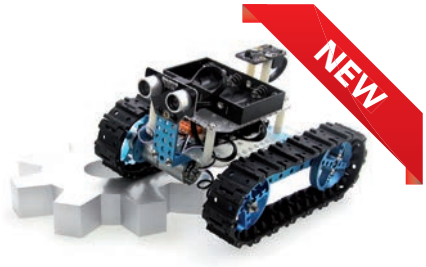
The Mini Bots are the ideal introduction to the Education of robotics. Five robots can be made from actuators and sensors, such as XS motors, IR trail sensor and push buttons. The clever robot models can follow lines and avoid hindrances. The programms to „control" the Mini Bot are allready on the robotics module and can be selected with the DIP switches (no software or programming is needed). The selection of available programs makes it easy to discover the world of robotics.

FIS-533923

Robot mBot, Bluetooth/PC

mBot is a low cost, easy-to-run robot kit for kids to get hands-on experience about graphical programming, electronics, robotics. It is an all-in-one solution for robotics learning and designed for STEM education.

MAK-MBOT



Robokit (Starter-Kit)

This Starter Robokit is ideal to learn about robotics, electronics and coding. With its mechanical parts and electronic modules students of all age groups can discover the world of robotics and build a robot tank and a three wheel robot car. The electronic modules are specially designed for beginners. Version with infrared remote control. Coding with PC (Arduino IDE or Scratch).

MAK-ROBOKIT

Robot mBot professional

This mBot professional kit is a 3-in-1 educational robot kit which supports 3 building forms:

- Off-Road Land Raider
- Self-Balancing Nervous Bird
- Dashing Raptor

You can program and control the mBot professional via smartphone, tablet, Mac or PC

MAK-MBOT-PRO

Sensing and Robotics

NEW

This set is an easy way to get started with programming and explains the basic principles of programming to students based on graphical programming software, which is used to control stationary and mobile. Students can use sensors and actuators to build and then control easy-to-understand models like hand dryers, a carousel, barriers, a conveyor belt with die-cutting machine, or mobile tracked vehicles. The »BT Smart Controller«, with 4 inputs for sensors and 2 outputs for motors or lights, has a USB interface and a Bluetooth 4.0 interface. The software (available for free download) allows even young students to quickly and simply get a handle on easy-to-understand programming. In addition, all models can also be controlled and programmed with a tablet (iOS/Android) using a free app. This Set can be used in supervised and unsupervised learning, and is an ideal and easy-to-understand way for young students to get their first taste of the world of programming.

- Learn about the basic principles of robotics
- Understand the focal points measuring, controlling, regulating, and programming
- Experience how controller and software work together
- Understand how actuators and sensors work
- Deepen and practice project and group work

FIS-540587

Application of robots - sensing

NEW

Professional introduction to the world of robots. Student set to explore the world of both stationary and mobile robotics. For middle school, high school and college robotics training. Ideal for robotics competitions.

- 310 parts for building 14 different robotic models
- USB camera, which allows images to be transferred via USB or WiFi, color recognition, line tracking and motion recognition
- ROBOTICS TXT controller has color 2.4 inch touch display, combined WLAN/Bluetooth module, micro SD card slot for additional memory space, IR receiver diode, integrated loud speaker, 4 motor outputs, 8 digital/analog inputs for sensors and 4 high speed numerical input
- ROBO Pro software helps program apps for controlling models with smartphone/tablet PC (presently for Android)
- Full-color assembly manual

FIS-533018

Necessary equipment:

Item no.:	Description
FIS-34969	Battery Set 220 V

Robots in Industry

This Robotics educational construction set is focused on constructing and programming robotics for true-to-life industrial applications. Four real-life, fully functional industrial robots: A high-bay shelving system, 3-axis robot, and two additional gripper arm robots can be built and programmed. Sturdy aluminum profiles are used in all of the models.

FIS-533020

Necessary equipment:

Item no.:	Description
FIS-522429	TXT Controller
FIS-93298	Robo Pro Software

STEM-Set „electricty, electronics, energy, power and digital communication

The STEM set focuses on electricity, electronics, energy and power according to the education standards ISTE and ITEEA. This STEM set combines electricity, electronics, energy, power and digital communication and enables students to understand and explore many essential aspects of science, technology, engineering and technology.

FIS-STEM-ENG

Robotic arm

Multifunctional desktop robotic arm for practical training education. Installed with different end-tools, DOBOT Magician can realize industrial-type functions such as 3D printing, laser engraving, writing and drawing. It supports secondary development by 13 extensible interfaces and over 20 programming languages, which really makes your creativity and imagination increase without any limitation.

ALL-146573

Drone

- 1 main module & 6 dynamic modules
- Plug & play using magnetic connection empowers Airblock creative transformation and infinite fun
- Programmable: Control and program your fancy flying through the Makeblock App
- Ensures safety with unexposed blades and soft but solid material preventing damage to walls or furniture when playing indoors.
- Multiple Forms: Flying drone & Flashing hovercraft, and more DIY use cases, have fun with 3 forms.
- No coding experience required: Graphical programming through the App. Program your Airblock to execute a sequence of actions.
- Supports both iOS & Android: Control remotely via Bluetooth. Also easily control it with joysticks using the App.

MAK-DROHNE

Simple Machines in Daily Use

This Student experminet set examines technology of everyday life. This set includes gearbox, pulley, steering, and winch. With this set you can build a variety of technical models such as vehicles with steering, bulldozers with caterpillar tracks, crane with winch, wind turbine with reduction gear. This experiments give students a fascinating insight into the world of technology. The large number of parts (gears, statics, building blocks, building boards u.v.m.) allows a plenty of experiments.

FIS-533506

Drive Systems - Basics

This student experSTEM set examines the basic principles of drive technology. The aim of these experiments are to understand the key points of wind and flexible shaft drives, balloons and reaction motors, and rubber and friction motors . Main questions are

- How does a reaction or a flexible shaft drive work?
- What's the difference between a friction motor and a rubber motor drive?
- How can wind be used for propulsion?

FIS-533028

Mechanics 2.0

This set introduces into the fundamentals of mechanics and structural engineering. This set is ideal for future mechanical engineers, technicians and engineers and contains 30 different models to answer fundamental questions from the world of mechanics and structural engineering, for example „How do you build a stable bridge". This experiments which can performed with this set, demonstrate mechanical and structural engineering and their effect of forces on bodies and objects. This experiment also simplify the entry into STEM education for teacher and is based of the idea of education interdisciplinary „real world" applications.

FIS-538423

Introduction to Pneumatics

This set is made for younger students to teach the principles of pneumatics, with realistic models to show how pneumatic valves and cylinders work. The experiments which can performed with this set, demonstrate the generation and distribution of compressed air and control of pneumatic cylinders. This experiment also simplify the entry into STEM education for teacher and is based of the idea of education interdisciplinary „real world" applications.

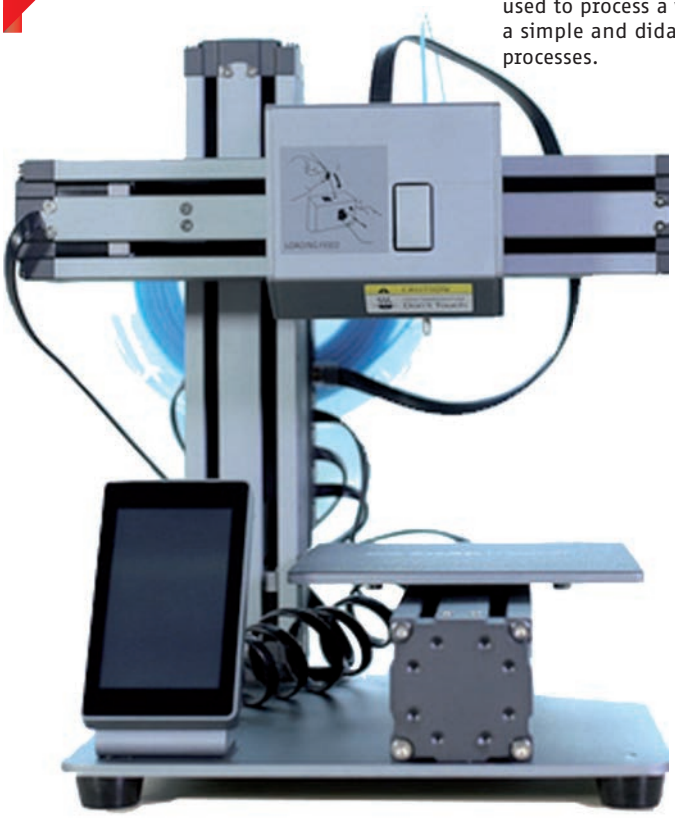
FIS-540946

You can find more experiments on Mechanics in

chapter **4.2.2 TESS - Physics - Mechanics**

and on **www.phywe.com**

NEW



3D printer (2-in-1): 3D print and CNC machine

Make guaranteed the right purchase decision with this multifunctional 3D printer of the highest quality at a sensationally attractive price. This 2-in-1 3D printer is the ideal solution for STEMteaching at schools and technical education at vocational schools (interdisciplinary teaching). This high-precision 3D printer is a 2-in-1-Printer with a CNC machine that can be used to process a variety of materials such as wood and acrylic. This 2-in-1 3D printer offers a simple and didactically intuitive way to introduce your students to modern manufacturing processes.

Benefits:

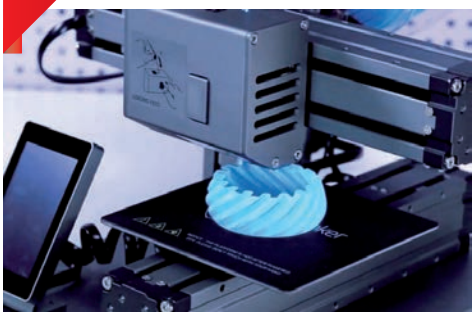
- 3D printer and CNC router in one device (2-in-1)
- Fantastic high precision: up to 50 micrometers minimum layer thickness
- Software intuitive and compatible with Cura, Simplify 3D and Slic3r
- Robust housing made of high quality aluminum
- Time-saving due to modular setup, simple control via touch-screen

Equipment and Technical Data:

- Robust aluminum housing - stable and durable
- Quickstart guide and manual
- Data storage and data transfer: MicroSD Card, USB cable
- Operating system Windows, MacOS control via detachable 3 „touch screen
- Weight: 4.5 kg

SNP-3D

NEW



3D printer (3-in-1): 3D print, laser engraving, CNC machine

In addition to the high-precision 3D printer and a CNC milling machine as well as a laser engraving module.

Function Laser engraving:

- Objects with a size up to 125 x 125 mm can be machined
- 200 mW laser (class 3B laser)
- Usable materials: wood, bamboo, leather, acrylic materials and paper
- Supported file formats: SVG, JPEG, PNG, PDF, CDR

Function 3D printer (also included in 2-in-1):

- Print objects with a size up to 12.5 x 12.5 x 12.5 cm
- Minimum layer thickness: 50 micrometers to 300 micrometers
- Supported file formats: STL and OBJ Compatible with Cura, Simplify 3D or Slic3r
- Supported materials: non-proprietary 1.75 mm PLA, ABS, etc.

Function CNC milling machine (also included in 2-in-1):

- High quality - up to 16,000 RPM
- Objects with a size of up to 90 x 90 x 50 mm can be machined
- Shank diameter: 3.175 mm
- Usable materials: wood, acrylic materials and carbon fiber sheet or similar
- Supported file formats: SVG, STEP, IGES, DWG, DXF

SNP-3D3

3D printer Panospace ONE

NEW

The 3D printer Panospace ONE is delivered fully assembled and comes with a pre-leveled printing bed, so it is just to plug in and print. The colour touch screen makes it even easier to use. Panospace 3D printer is also one of the most efficient desktop 3D printers in the market considering both the printing speed and the print quality.

Benefits

- Top in class for ease of use
- Get results fast
- Very high printing speed - ideal for use in schools
- Completely assembled
- Start immediately: just plug in and print, because no pre-calibrations required

Equipment and Technical Data

- High speed printing
- Wide viewing window
- One-click print
- Maintenance free
- Colour touch screen
- 15 micron X and Y positioning accuracy
- Filament: PLA - standard 1.75 mm, in 326 g rolls
- Build volume: 150 x 150 x 150 mm
- Layer resolution: 0.25 mm
- Extruder quantity: 1
- Nozzle diameter: 0.4 mm
- Printer dimensions: 407 x 288 x 333 mm
- Net weight: 7.8 kg
- Includes: 1 filament roll, scraper, glue stick & adjustment wrench

ALL-147271

PLA filaments in many colours

PLA filaments for all 3D printers!

Filaments made of biodegradable PLA with a diameter of 1,75 mm in eight different colours, for true to dimension and precise print results. Contaminant- and heavy metal-free bio-plastic product on 500 g coil.

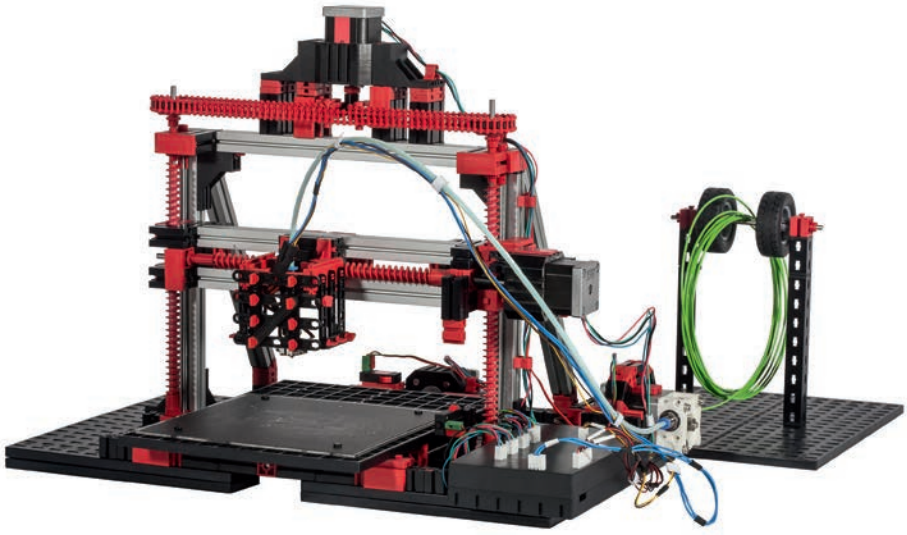
- Colours: black, green, blue, white, silver, transparent, red, yellow
- Material: PLA (Polylactate), synthetic polymer, biodegradable
- Diameter: 1.75 mm
- Weight (without coil): 500 g
- Filament wound on a carrier coil

Item no.:	Description
FIS-539138	Filament (black) for 3D printer, 500 g
FIS-539136	Filament (green) for 3D printer, 500 g
FIS-539137	Filament (blue) for 3D printer, 500 g
FIS-539139	Filament (white) for 3D printer, 500 g
FIS-539141	Filament (silver) for 3D printer, 500 g
FIS-539142	Filament (transparent) for 3D printer, 500 g
FIS-539143	Filament (red) for 3D printer, 500 g
FIS-539144	Filament (yellow) for 3D printer, 500 g

NEW

3D printer

This 3D printer kit provides users easy access to the forward-thinking and fascinating technology of 3D printing. Print parts yourself anytime - customized, simple, and totally flexible. The easy to build and sturdy 3D printer allows you to print many different parts. Users learn the basic principles of 3D printing and get an insight into this revolutionary technology with major potential for the future. The 3D printer is controlled with PC software via USB interface.



Innovative learning materials support you in teaching technical concepts in a practical way and introducing them to your secondary school and college students or your apprentices. The included didactic activity booklet with teacher and instructional materials offers display models and tasks to help you quickly prepare lessons, and includes problems with solutions, handouts, and copy templates.Teaching materials are available for free download. Everything is delivered in a sturdy storage box, along with easy to understand assembly instructions for the 3D printer.

Technical data:

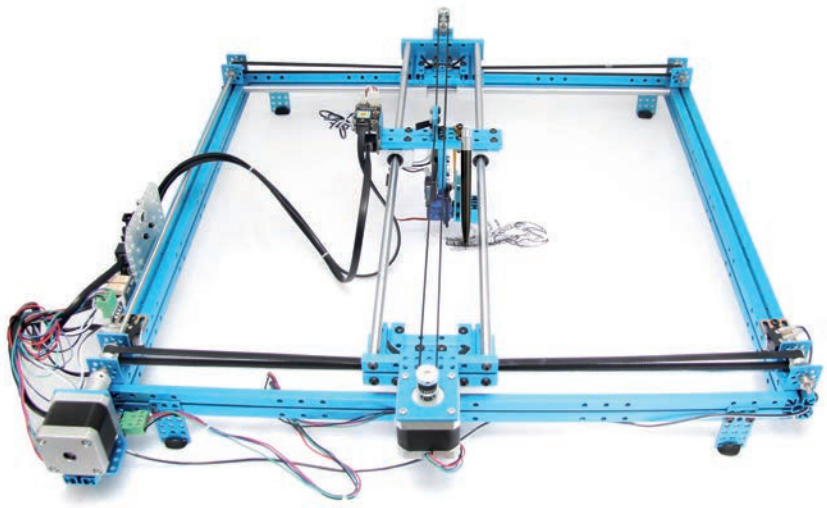
- Build volume: 115x100x65mm
- Layer thickness: 0,2mm
- Filament diameter: 1,75mm
- Nozzle diameter: 0,5mm
- Material: PLA (polylactide)

FIS-536624 **700,00€**

NEW

XY plotter

This XY Plotter Robot Kit is a drawing robot that can move a pen or other instrument to draw digital artwork on flat surface.



- The XY Plotter is compatible with both mDraw and Benbox software - you can choose what's more suitable to your needs. The plotter's software suite lets you use SVG and BMP files (mDraw) or edit designs before engraving (Benbox).
- You can produce detailed designs (up to 0.1mm XY accuracy).
- The XY Plotter has a maximum working speed of 50mm/s, for quickly finishing larger projects

Technical data:

- Frame: Anodized aluminum
- Dimensions (L×W×H): 620mm × 620mm×140mm
- Working area (X×Y): 310mm×390mm XY
- Accuracy: 0.1mm
- Max Working Speed: 50mm/s
- Power: 100-240 V~50/60Hz AC/DC Power adapter, 12V/3.0A
- Main Controller: Arduino UNO compatible
- Software: draw Supported file types: .SVG, .BMP

MAK-XY-PLOTTER **299,00€**

Hydrogen technology set, leXsolar

The experiment set provides the complete bandwidth of current fuel cell technology. Solar module, electrolyzer, and fuel cell permit the assembling and examination of a solar-hydrogen cycle. Working principles, efficiency and characteristics curves of electrolyzer and fuel cell are just some of the topics covered. In addition to a PEM fuel cell an ethanol fuel cell is also included so that different technologies can be compared with one another. Hydrogen can also be produced and stored.

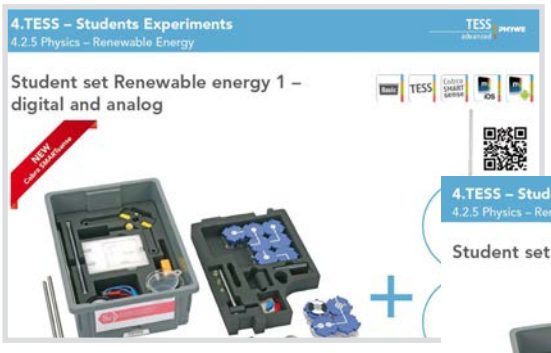
- Ideal for vocational schools, colleges and engineering degree courses
- Connector system for easy and fast assembly
- Learn about different fuel cell types
- Build a fuel cell stack
- All necessary equipment already included
- Can be used everywhere since all componentes are provided in a transport case

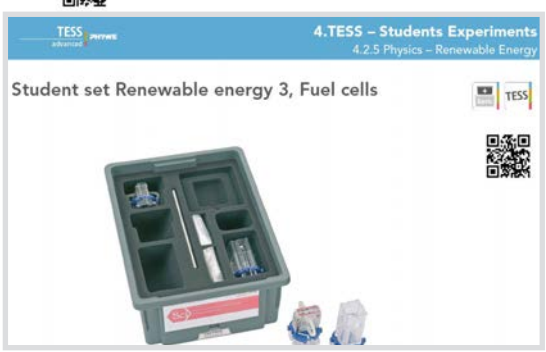
In the transport case (dimensions: 64 x 37 x 17 cm) all items to perform the following experiments are provided so that no additional accessories are needed:

- Set up of an electrolyzer and the different fuel cells
- Properties of an electrolyzer, a PEM fuel cell and an ethanol fuel cell
- Characteristic curve of an electrolyzer, a PEM fuel cell and an ethanol fuel cell
- Hydrogen production and storage
- Faraday and energy efficiency of the electrolyzer and of the PEM-fuel cell
- Parallel- and series connection of PEM-fuel cells

06765-00

You can find more renewable energy experiments in chapter:
4.2.5 TESS - Physics - Renewable Energy and online on **www.phywe.com**





NEW

Renewable energy - Basics

Student Set for topic „Basics of regenerative energies“. This set covers the curriculum topics storage and use of electric power from water, wind and sun as well as the fuel cell. In all experiments students examine the main question how to generate electricity in an environmentally friendly way. The storage and use of electricity from the natural energy sources like water, wind and sun is explained in detail using various models and numerous experiments. The fuel cell shows how water is split into the two components hydrogen and oxygen.

FIS-533022

NEW

Fundamentals of Solar Technology

Renewable energy is an important source of power today, and will become even more important in the future. This educational construction set is perfectly designed to help students understand the possibilities of solar energy. They can make solar-powered boats and cars run by generating electricity from the sun using a solar module. Solar Beginner can be used in supervised and unsupervised learning, and is one of the most popular sets in many schools.

FIS-540947

NEW

Solar Set, Brick'R'knowledge

The Brick'R'knowledge Solar Set guarantees fun with experiments for students on a level which introduces renewable energies in a playful and easy way. How does a solar cell work? How can an accumulator store energy? How can you build a night light with a motion detector? These questions and many more will be answered with the set.

- Generate and store electrical energy for supplying your Brick'R'knowledge projects
- Numerous accessories for real-life applications, like charging your mobile phone and supply a fan with electrical power
- Save to use and robust
- Special plug contacts of the bricks to easily realise circuits with solid electric contacts
- Screen-printed electric symbols on top of each brick
- No additional material required

The following projects can be realised with numerous variants which are documented in the user manual in detail:

- Supply LEDs with electrical energy
- Run a portable fan
- Motion detector, Bewegungsmelder, buzzer and alarm system
- Morse circuit
- Charging an accumulator and using it for mobile applications

BRK-133574

Photovoltaics set, leXsolar

Photovoltaics is an important element in decentralized energy supply. With this complete experiment set students can learn about all aspects of a solar cell - from simple experiments to demonstrate solar energy with a motor and other loads to experiments to determine the characteristic curves of different solar cell types or their efficiencies as a function of temperature.

- Fully equipped experiment system which does not require any additional material
- All aspects of solar cells covered
- Qualitative and quantitative experiments
- Connector system for easy and fast assembly

06761-00

leXsolar-PV Large

Correlating school physics with practical usage of the photovoltaic cells is a specialty of this system. These unique didactic innovations are the premier choice when it comes to experiments related to solar energy since it has won the Worlddidac Award. The system has been conceived in such a way that most experiments can be conducted in normal room lighting. An external power supply is not necessary for these experiments. The leXsolar lighting module (included) is required only for a few experiments - which can be operated with a student?s power supply.

LEX-1103

leXsolar-PV Basic

What is a solar cell and what is a solar panel? What can be powered with a solar cell? How should you align the solar cell to the sun? These questions and many more can be answered using leXsolar-PV Basic. All experiments are designed in a qualitative way and are specifically adapted for young students in Elementary School as well as Junior High School. For using this product you additionally need the leXsolar-Minikit Basic in primary school and the leXsolar-Kit Basic in Junior High School, each of which contains all necessary accessories.

LEX-1130

Solar heat set, leXsolar

This experimentation system concerning the cutting-edge topic of solar thermal energy conversion provides you with quantitative experiments for different collector systems for flexible and location-independent usage.

- Absorptivity and reflectivity of different materials
- Focusing of light by a Fresnel lens
- Thermal convection and layering
- Thermal conduction
- Thermal insulation
- Solar thermal collector with pump circulation
- Solar thermal collector with thermosiphon circulation
- Variation of the flow speed
- Collector circuit with heat exchanger
- Collector circuit with paraffin heat reservoir
- Parabolic trough collector with pump cycle
- Defocussing
- Qualitative demonstration of the functional principle Investigating the thermoelectric generator
- Quantitative determination of the electrical power

06758-00

Biofuel set, leXsolar

The whole process of producing biodiesel is exemplified in this interdisciplinary complete experiment set. The transport case is equipped with all required components to perform the following experiments: production of bioethanol by biotechnological processes, production of biodiesel, alcoholic fermentation, distillation. What is more, with this experiment set it is possible to generate electrical energy from the produced bioethanol using the included ethanol fuel cell and measuring its yield with the potentiometer module and motor module.

66012-00

Necessary equipment:

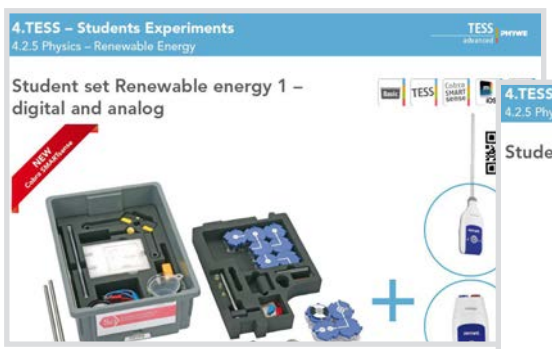
Item no.:	Description
66012-88	Biofuel set, Necessary equipment / Chemicals

leXsolar-BioFuel Large

he entire process of producing biofuels can be demonstrated with leXsolar-BioFuel Large. It starts with the biological step of alcoholic fermentation. Afterwards the produced mash will be distilled with the help of the leXsolar-condenser, which was developed just for this experiment. The last step demonstrates the conversion of the produced biofuel into usable energy, such as electrical energy, using the provided Ethanol-fuel cell. leXsolar-BioFuel Large does not only cover the topic of the production of bioethanol, but also the production of biodiesel through transesterification of fats.

LEX-1702

You can find more renewable energy experiments in chapter:
4.2.5 TESS - Physics - Renewable Energy and online on **www.phywe.com**



Hydropower set, leXsolar

A significant percentage of power from renewable energies originates from hydropower. To familiarize students with this important topic, this experimenting kit offers both introductory experiments on hydroenergy in general as well as fundamental quantitative experiments on the physics of water turbines. Different types of turbines are used: from a simple water wheel to a modern, highly efficient Pelton turbine.

05755-00

leXsolar-Hydropower Basic

leXsolar-Hydropower Basic is the optimal beginner package for the topic of hydroelectric power. By playful experiments, students learn the basic characteristics of a hydropower plant. With the Pelton turbine and the attached hose qualitative and quantitative experiments can be carried out in the classroom but also outdoors. For using this product you additionally need the leXsolar-Minikit Basic in primary school and the leXsolar-Kit Basic in Junior High School, each of which contains all necessary accessories.

LEX-1930

Wind energy set, leXsolar

Wind energy has become the most important renewable energy form apart from hydropower. The experiment set makes understanding wind energy easy, covering all topics from basic physics principles of wind energy to its applications. Numerous experiments are possible so that all requirements for a wind energy experiment set can be met, including the calculation of the efficiency of a wind turbine and influence of the rotor blade shape and pitch.

05754-00

leXsolar-Wind Large

This system provides you with all the answers you need concerning the basics of using wind energy. With the help of curriculum-based trials, it discusses different topics which are necessary for understanding the functions of wind power plants. The study of how wind speed, wind direction or rotor type influences the power output are only some examples of possible experiments. Both qualitative experiments for students from age of 11 to 13, and complete quantitative trials for physics lessons until the age of 19 are described in detail.

LEX-1404

leXsolar-Wind Basic

leXsolar-Wind Basic is the optimal beginner package for the topic of wind energy. Even for a small price it allows the most important basic experiments regarding wind energy. Thus, various parameters such as number or shape of rotor blades and rotor blade pitch can be studied with the help of the innovative leXsolar-wind rotors. Therefore, the product playfully provides an understanding of the operation of wind turbines. For using this product you additionally need the leXsolar-Minikit Basic in primary school and the leXsolar-Kit Basic in Junior High School, each of which contains all necessary accessories.

LEX-1430

E-mobility set, leXsolar

The future of road traffic belongs to battery-powered electrical cars which are about to establish themselves against other trend-setting alternatives like fuel cell-powered cars. The E-mobility set teaches the physical and technical foundations and applications of different battery technologies used in cars. Eight different battery types like lithium-polymer battery, capacitor or fuel cell allow for the study of characteristics like lifespan and charging methods. Qualitative and quantitative experiments are used to explore the properties of various battery types. The electric car can be run with all storage types. With the integrated charging module batteries are always ready to use and battery charging methods can be addressed in experiments.

07491-00

leXsolar-E-Mobility Basic

The electric model car can rush through the classroom with the supercapacitor or can be powered by the solar module directly from the sun. Thus, leXsolar-EMobility Basic combines storage technologies and an electric vehicle in one experimental kit. Based on illustrative experiments the kit imparts the basic knowledge about those topics. Combined with leXsolar-H2 Basic a fuel cell car can be built. For using this product you additionally need the leXsolar-Minikit Basic in primary school and the leXsolar-Kit Basic in Junior High School, each of which contains all necessary accessories.

LEX-1830

leXsolar-E-Mobility Large

This product teaches students the physical and technical foundations and applications of different battery technologies. The highly-topical issue of electric mobility is explored with an electric model car. Dimensioning and application of different battery types are just as much a topic as life expectancy or charging methods. The characteristics of various battery types are analyzed with qualitative and quantitative experiments. The product is expandable with a Lithium-Polymer and a lead battery module. onsidering the storage problems with renewable energies, these topical issues should find their way into the curriculum.

LEX-1802

Smart grid set, leXsolar

The complete set allows the construction of a smart grid with a variety of renewable energy sources on a laboratory scale. It is possible to choose different energy generation profiles and observe their effects on the system. The various storage units and consumers make for a complex smart grid and a multitude of possible scenarios to analyze. The energy flows within the smart grid can be read from the displays of the smart-meters directly. All necessary components for measuring and control are already included. The package includes wind and solar power as well as fuel cell, storage technology and e-mobility components and, thus, also the foundation for a variety of basic experiments.

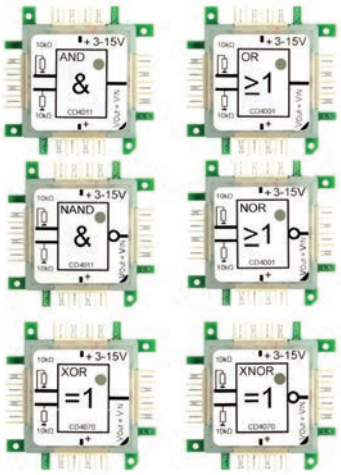
- Fully equipped experiment system for a variety of renewable energy technologies (solar,wind, fuel cell, storage technogy, e-mobilty)
- Setup of a complete smart grid in the lab
- Generation of different energy source and load profiles
- All necessary equipment already included

04376-00

leXsolar-Esave Ready-to-go

This student set covers one of the most important aspects of energy: how to save energy. The students focus first on issues like global energy consumption, climate change or energy consumption at private households. Based on the question at hand, students will make measurements based on the problem. For instance things like room temperature or clima-te, water and energy consumption. The goal is to foster the ability to identify potentials for improvements and savings.

LEX-1502



Logic Set, Brick'R'knowledge

The Logic Set is ideally suited for a quick start into the digital circuit technology. While working with the manual, which includes didactically structured examples of circuits, students learn about Boolean algebra and its applications: the most important digital circuits like adder, shift register and numerator. The comprehensively equipped Logic Set provides teachers with a practical basis for daily teaching. Plugging the bricks together and experimenting with them is fun and encourages building your own circuit variants. The Logic Set's scope of supply ranges from easy logic bricks (AND, OR, NAND, NOR, XOR, XNOR, NOT), to a variety of flip flop bricks (D-, RS- and JK-type), to an impulse brick (alternatively a debounced switch for single pulses) up to a BCD counter brick with an integrated 7 segment display.

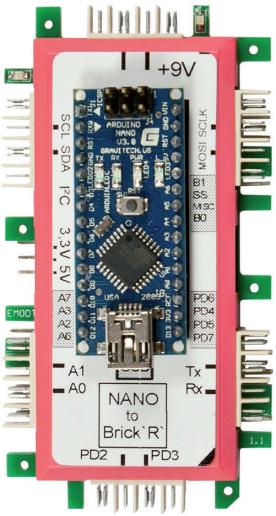
The following projects can be realised:

- Basics of digital current sourcing logic (logic level, combinatorial circuit, sequential circuit, glitches)
- Programmable logic modules (PAL, GAL, CPLD, FPGA)
- Basic circuits (inverter, gates: AND, OR, NAND, NOR, XOR, XNOR)
- Debouncing circuit, digital counter (1-bit half-adder and 1-bit full-adder, 4-bit full-adder)
- Flipflop types
- Shift register
- Counter (binary, BCD, 3-bit, 4-bit)

BRK-135006

Recommended equipment:

Item no.:	Description
BRK-124343	DIY Set, Brick'R'knowledge



Arduino Coding Set, Brick'R'knowledge

The Brick'R'knowledge Arduino Coding Set introduces you to digital electronics and programming with the Arduino Nano that is included in the kit. The set includes digital components such as 7-segment displays, OLED display, D/A converter or a I2C adapter that are complementary to all analog bricks also supplied in the set.

Realise the following coding tasks:

- Introductory coding of a microcontroller with LEDs and push buttons
- Analog/digital converter and digital/analog converter
- I2C bus
- Push buttons and bouncing
- Relais
- Rotary encoders
- OLED display
- Applications: measurement of a discharge function, diode characteristics, OLED and transistor as emitter circuit, switching of loads

BRK-125697

Recommended equipment:

Item no.:	Description
BRK-124343	DIY Set, Brick'R'knowledge

7. Laboratory equipment

7.1 Power supplies

PHYWE Power supplies – details at a glance selected from PHYWE's wide range of devices

	Standard power supply				Regulated und specialized power supply
					
Article	PHYWE power supply	PHYWE power supply, universal	PHYWE Power supply, universal, analogue display	PHYWE variable transformer with digital display	PHYWE power supply, regulated
TECHNICAL SPECS					
Direct current (DC):	0 ... 12 V / 0 ... 2 A, max. 24 W, ripple max. 1 mV	0...18 V, 0...5 A, continuously adjustable	0...18 V, 0...5 A, continuously adjustable	0...20 V /12 A	0 ... 12 V / 5 A
Alternating current (AC):	6 V / 12 V, 5 A, series circuit possible	2/4/6/8/10/12/15 V, 5 A	2/4/6/8/10/12/15 V, 5 A	0...25 V /12 A; 6 V and 12 V je 6 A	0 ... 15 V / 5 A; 6 V / 6 A
Same-time load on all outputs:	✓	✓	✓	✓	✓
Shor-circuit-proof:	✓	✓	✓	✓	✓
Display:	-	-	✓	✓	-
Output voltage smoothed:	✓	✓	✓	-	-
Power input:	68 VA	295 VA	295 VA	375 VA	ca. 190 VA
Dimensions (mm):	206 x 130 x 160	230 x 236 x 168	230 x 236 x 168	230 x 236 x 168	230 x 236 x 168
Weight (kg):	3,2	7,8	7,9	8,5	7,5
CHARACTERISTICS					
	▪ Thermal circuit breaker (no replacements needed) ▪ Outputs secure from overload, short circuit and external voltage ▪ Current limitation adjustable ▪ Ideal for student experiments	▪ Versatile heavy duty power supply for DC and AC ▪ Also usable as constant current source ▪ Outputs galvanically isolated	▪ Analogue display for current and voltage ▪ Versatile heavy duty power supply for DC and AC ▪ Also usable as constant current source ▪ Outputs galvanically isolated	▪ Digital display for current and voltage ▪ Continuously adjustable AC and DC ▪ 2 fixed voltage settings	▪ Continuously adjustable AC and DC ▪ 2 fixed voltage settings
ITEM NO.:	13506-93	13504-93	13503-93	13542-93	13540-93

PHYWE power supply

High-quality power supply specially suited for student experiments in electricity and electronics as well as for demonstration.

Ideal supplement device for TESS sets.

- Stabilised
- Short circuit-proof, external voltage-protected, floating ground
- Output voltage: 1...12 V DC, 6 V / 12 V AC
- Rated current: DC 0...2 A / AC 5 A
- Ripple: max 1 mV
- Internal Resistance: 10 m0hm
- Mains voltage: 230 V
- Dimensions: 194 x 140 x 130 mm
- Weight: 3.2 kg

13506-93

PHYWE power supply, universal

Versatile heavy-duty power supply which can also be used as a constant current supply in schools, laboratories or workshops.

Ideal supplement device for DEMO sets.

- Direct current source: stabilised, regulated output direct voltage, continuously adjustable from 0 to 18 V
- Adjustable current limit between 0 to 5 A
- LED for constant current operation
- Permanently short circuit proof & protected against exterior voltages
- Alternative voltage output:
- Multitap transformer 2...15 V, outputs galvanically separated from main grid
- Full load capacity (5 A), even if direct current is supplied simultaneously
- Short-circuit protection through overcurrent circuit breaker
- All output voltages available with 4 mm safety plug sockets

13504-93

PHYWE Power supply, universal, analogue display

Versatile heavy-duty power supply with analogue display.

Ideal supplement device for DEMO sets.

- Direct current source: stabilised, regulated output direct voltage, continuously adjustable from 0 to 18 V
- Adjustable current limit between 0 to 5 A
- LED for constant current operation
- Permanently short circuit proof & protected against exterior voltages
- Alternative voltage output:
- Multitap transformer 2...15 V, outputs galvanically separated from main grid
- Full load capacity (5 A), even if direct current is supplied simultaneously
- Short-circuit protection through overcurrent circuit breaker
- All output voltages available with 4 mm safety plug sockets.
- Analogue display instrument with measuring ranges of 0...18 V and 0..5 A and a commutating switch for voltage/current measurement.

13503-93

PHYWE power supply, variable

Continuously adjustable AC and DC voltages, as well as two fixed voltages.

Ideal supplement device for DEMO sets.

- AC output: 0...12 V / 5 A
- DC output: 0...15 V / 5 A; 6 V / 6 A
- Short term: 0...12 V- / 15 V~ /6 A
- Short term: 6/12 V~ /10 A
- 3 automatic fuses: 6A / 10A / 10A
- Floating output
- 4 mm safety sockets
- Mains switch / power indicator
- Impact-resistant, stackable plastic case with carrying handle and stand
- Primary side fuse
- Supply voltage: 230 V AC
- Dimensions (mm): 230 x 236 x 168

13540-93

PHYWE variable transformer with digital display

Standard heavy duty power supply unit for low voltage. Supplies continously adjustable DC and AC voltages & 2 frequently required-fixed voltages.

Ideal supplement device for DEMO sets.

- AC output: 0...25 V/12 A
- DC output: 0...20 V/12 A
- Max. current (short-term): 13 A
- Add. fixed voltages: 6 V AC/6 A12 V AC/6 A
- Max. current (short-term): 10 A
- Max. power: 375 VA
- Fuses: one 13 A and two 10 A
- Displays: 2 digital meters for current and voltage
- Supply voltage: 230 V AC
- Dimensions (mm): 230 x 236 x 234

13542-93

PHYWE power supply, regulated

Power supply with 5 output voltages especially designed for experiments with tubes, fine beams and conducting the Frank-Hertz experiment.

Ideal supplement device for DEMO sets.

- Output 1: 0...12 V-/0.5 A
- Stability: < 0.1 %
- Residual ripple: < 5 mV
- Output 2: 0...50 V-/50 mA
- Stability: < 0.01 %
- Residual ripple: < 5 mV
- Outputs 3/4: 300 V-/0...300 V-/50 mA
- Stability: < 0.01 %
- Residual ripple: < 20 mV
- Output 5: 6.3 V~/2 A
- Power consumption: 100 VA approx.
- Mains voltage: 230 V~
- Impact-resistant, stackable plastic case with carrying handle and stand
- Dimensions (mm): 230 x 236 x 168

13672-93

Find more power supplies and devices on **www.phywe.com**

8. Appendix

8.1 Ordering Overview
8.2 General Notes on Safety
8.3 General Terms and Conditions

Student set Substances in everyday use digital (15234-88D)

1	Conductors/non-conductors,l-50 mm	06107-01
4	Alligator clip	167700
1	Magnet, d=8 mm, l=60 mm	06317-00
2	Beaker, 250 ml, low-form	46054-00
1	Graduated cylinder, 25 ml, transparent, PP	36635-00
5	Test tube, 160 x 16 mm	167704
5	Rub.stop.d=12.5/16.5mm,w/o hole	39249-00
1	Test tube holder, up to d 22mm	38823-00
1	Spoon,stainless steel,210mm	40874-00
1	Dropping pipette with bulb, 10pcs	47131-01
1	Students thermometer, -10...+110°C, l = 230 mm	38005-10
2	Watch glass, dia.100 mm	34574-00
1	Funnel, d.40 mm, f.burettes	36888-00
1	Bimetal strip	05913-00
1	Crucible tongs, 200 mm, stainless steel	33600-00
1	Portable Balance, OHAUS YA302	49213-00
1	Knife, stainless	33476-00
1	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
1	Test tube rack f. 6 tubes, wood	37685-10
1	Protecting glasses, clear glass	39316-00
1	Marking pencils,water soluble, 3 pcs., black, blue, red	38710-03
1	Laboratory pen, waterproof, black	38711-00
4	Connecting cord, 32 A, 250 mm, black	07360-05
1	Lamp holder, E10, with sockets	09390-06
1	Aluminium column	03903-00
1	Steel Column nickel-plated	03913-00
1	Lamp 4 V/0,04 A,E 10	06154-00
1	Digital stop watch, 24 h, 1/100 s, 1 s	24025-00
1	Sieve, fine mesh, d=60 mm	40968-00
1	Insert for 15234-88	173091
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Lid for TESS box, plastic	15205-00
1	Sticker for 15234-88	173093
1	Storage information for 15234-88	173096
1	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00

Student set Substances in everyday use, necessary accessories (13430-88)

1	Iron powder, techn. 500 g	30067-50
1	Sea sand, purified 1000 g	30220-67
1	Stearic acid 250 g	30228-25
1	pH test sticks 0-14, 100 sticks	30301-08
1	Water, distilled 5 l	31246-81
1	Chromatographic paper 100 stripes	32972-00
1	Circular filter,d 70 mm,100 pcs	32977-02
1	AQUADUR-Test sticks Water hardne.	47020-01
1	Flat battery, 4.5 V	07496-01
1	Flat battery, 4.5 V	07496-01
1	Iron powder, techn. 500 g	30067-50
1	Sea sand, purified 1000 g	30220-67

Student set Electrical and magnetic devices in everyday use digital (15238-88D)

2	Polypropylene rod, l=175mm, d=10 mm	13027-09
1	Acrylic resin rod, l=175 mm, d=8 mm	13027-08
1	Clip for rods, with cord	13027-16
1	Neon tube	06656-00
1	Flat battery, 4.5 V	07496-01
6	Connecting cord, 32 A, 250 mm, black	07360-05
4	Alligator clip	167700
2	Lamp holder, E10, with sockets	09390-06
2	Lamp 4 V/0,04 A,E 10	06154-00
1	Lamp 4 V/0.1 A, E10	06151-00
1	On/off switch for sciences sets	09390-07
1	Changeover switch for sciences sets	09390-08
1	Digital multimeter for students AmpSafe, electronic overload protection	07127-00
1	Conductors/non-conductors,l-50 mm	06107-01
1	Beaker, 50 ml, low form	46273-01
1	Students thermometer, -10...+110°C, l = 230 mm	38005-10
1	Constantan wire, 15.6 Ohm/m, d = 0.2 mm, l = 100 m	06100-00
1	Jumper wire, isolated, 1m	330790
2	Magnet, d=8 mm, l=60 mm	06317-00
1	Iron wire, 5 pcs.	326875
1	Drawing compass , 1 units	06350-03
1	Insert for 15238-88	173092
1	Sticker for 15238-88	173095
1	Storage information for 15238-88	173098
1	Carton 430 x 310 x 160mm	171673
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Lid for TESS box, plastic	15205-00
1	Cobra SMARTsense - Voltage, ± 30 V	12901-00
1	Cobra SMARTsense - Current, ± 1 A	12902-00

Set Mechanical devices in everyday use digital (15239-88D)

1	Spring balance,transparent, 1 N	03065-02
1	Spring balance,transparent, 2 N	03065-03
1	Helical spring, 3 N/m	02220-00
1	Weight holder for slotted weights, 10 ghts	02204-00
9	Slotted weight, black, 10 g	02205-01
1	Measuring tape, l = 2 m	09936-00
1	Support base, variable	02001-00
1	Support rod, l = 600 mm, d = 10 mm, split in 2 rods with screw threads	02035-00
1	Boss head	02043-00
1	Lever	03960-00
1	Holding pin	03949-00
1	Fishing line, l. 20m	02089-00
1	Rod for pulley	02263-00
1	Pulley,movable,dia.65mm,w.hook	02262-00
1	Pulley,movable,dia.40mm,w.hook	03970-00
1	Friction block	02240-01
1	Roadway for magnets	11066-00
1	Stairs for roadway	11066-01
1	Magnetic roller, spare	11065-01
1	Magnet, d=8 mm, l=60 mm	06317-00
1	Digital stop watch, 24 h, 1/100 s, 1 s	24025-00
1	Insert for 15239-88	173090
1	Sticker for 15239-88	173094
1	Storage information for 15239-88	173097
1	Carton 430 x 310 x 160mm	171673
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Lid for TESS box, plastic	15205-00
1	Cobra SMARTsense - Force, ± 50 N	12904-00

Student set Light, Air, Soil (15243-88)

2	Tea light, dia = 3.6 cm	13241-31
1	Rubber stopper 26/32 , without hole	39258-00
1	Silk thread, l = 200 m	02412-00
1	Adhesive tape, 19 mm	170455
1	Scissors, straight, l=125mm	46970-00
1	Ruler, plastic, 200 mm	09937-01
2	Mirror, 80x50 mm	08209-01
1	Plastilina	167707
1	Beaker, 100 ml, low form, plastic	36011-01
2	Beaker, 250 ml, low form, plastic	36013-01
1	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
3	Petri d., plast.,ster.,60mm,25	64710-01
1	Erlenmeyer flask 100 ml, narrow neck, PN 19	36418-00
1	Rubber stopper, d = 22/17 mm, 1 hole	39255-01
1	Glass tube L= 80mm	322298
1	PVC tubing, i.d. 7 mm	03985-00
1	Digital stop watch, 24 h, 1/100 s, 1 s	24025-00
1	Graduated cylinder, 50 ml, plastic	36628-01
1	Magnifier, plastic, 5x, d=35mm	88002-01
1	Funnel, plastic, dia.50mm	36890-00
1	Circular filter,d 90 mm,100 pcs	32977-03
1	White screen 12 x 12 cm	13243-04
1	Cress seads	13243-03
1	Paperclips, 25 mm, copper-plated, 100/pkg	13231-30
1	Balloons, rubber, 10 pcs	02620-03
1	Spoon, special steel	33398-00
1	Sign holder	02066-00
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331585
1	Storage information for 15243-88	171622
1	Foam insert for 15243-88	171521
1	Sticker for 15243-88	171542
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Lid for TESS box, plastic	15205-00
1	Carton 430 x 310 x 160mm	171673

Student set Optics (15237-88)

1	Dice, transparent, red	170577
1	Dice, transparent, green	170578
1	Dice, transparent, yellow	170579
1	Flashlight with batteries	170580
1	Kaleidoscope, l = 150 mm, d = 45 mm	170581
1	Tablespoon	170582
2	CD, blank , 700 MB in slimcase	170583
2	Paper, DIN A4, white	170584
1	Adhesive tape, textile, b= 19 mm	171589
3	Mirror tile 150 mm x 150 mm	330633
1	Mirror tile, with hole, 150mm x 150 mm	330634
1	Mirror mat, 325 mm x 325 mm	330635
1	Mirror film, 250 mm x 200 mm	330636
5	Mirror on block, 50 mm x 20 mm	08318-00
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331585
1	Foam insert for 15237-88	171500
1	Sticker for 15237-88	171537
1	TESS box, plastics, low	15201-00
1	Lid for TESS box, plastic	15205-00
1	Storage information for 15237-88	171620
1	Carton 430 x 310 x 85mm	171672

Student set Senses (15241-88)

1	Marking pencils,water soluble, 3 pcs., black, blue, red	38710-03
1	Beaker, 100 ml, low form, plastic	36011-01
1	Silk thread, l = 200 m	02412-00
1	Cotton bud, 100 pcs.	13241-10
5	Watch glass, dia.100 mm	34574-00
1	PVC tubing, ID 6 mm	47527-00
1	Tuning fork 440 Hz	03424-00
1	Ruler, plastic, 200 mm	09937-01
1	Knife, stainless	33476-00
1	Scissors, straight, l=125mm	46970-00
1	Press, manual	64154-00
1	Touching bristle	64928-00
1	Knitting needle	13241-40
1	Mirror, 80x50 mm	08209-01
1	Magnifier, plastic, 5x, d=35mm	88002-01
1	Set of cards "sight", e.g. blind spot	13241-20
1	Tea light, dia = 3.6 cm	13241-31
1	Sign holder	02066-00
1	Storage information for 15241-88	171621
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331585
1	Foam insert for 15241-88	171520
1	Sticker for 15241-88	171541
1	TESS box, plastics, low, 305x425x75 mm	15201-00
1	Lid for TESS box, plastic	15205-00
1	Carton 430 x 310 x 85mm	171672

Student set Water digital (15233-88D)

2	Beaker, 100 ml, low form, plastic	36011-01
1	Beaker, 250 ml, low form, plastic	36013-01
1	Graduated cylinder, 50 ml, plastic	36628-01
1	Funnel, plastic, dia.50mm	36890-00
1	Circular filter,d 90 mm,100 pcs	32977-03
1	Erlenmeyer flask 100 ml, wide-neck SB 29	36428-00
1	Dish, 200 x 150 x 20 mm, plastics, white	85110-00
2	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
3	Screw cap jar, clear, 30 ml, 72 x 27,5 mm	46216-00
3	Screw cap G24	162421
1	Dropping pipette with bulb, 1 pcs of 47131-01	168736
2	Students thermometer,-10...+110°C, l = 180 mm	38005-02
1	Spoon + spatula, steel, l=120mm	46949-00
1	Spatula, double blade, 150 mm	33460-00
1	Laboratory pen, waterproof, black	38711-00
1	Cork powder 20 ml, in screw cap jar	46217-01
1	Washing powder 20 ml in screw cap jar	46217-02
1	Detergent 10 ml, in pipette bottle, round, clear	64785-01
1	Oil 10 ml, in pipette bottle	64785-02
1	Rubber stopper, d = 32/26 mm, 1 hole 7 mm, 1 hole 12 mm	39258-19
1	Foam insert for 15233-88	171518
1	Sticker for 15233-88	171539
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Lid for TESS box, plastic	15205-00
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331585
1	Storage information for 15233-88	171618
1	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00

Student set Heat digital (15235-88D)

2	Lab thermometer,-10..+100 °C	38056-00
1	Stirring thermometer non-graduat.	38003-00
1	Beaker, 100 ml, low form, plastic	36011-01
2	Capillary tube, straight, l 250mm	36709-00
2	Screw cap jar, 40 ml	170462
2	Screw cap	162407
2	Gasket for GL 25-8	162405
3	Felt sheet, 100 x 100 mm	04404-20
1	Holder for fixing tape	170454
1	Adhesive tape, 19 mm	170455
1	Rubber bands, 50 pieces	03920-00
1	Funnel, plastic, dia.50mm	36890-00
1	Insulating foam for screw-top jar 40 ml	04410-00
1	Sticker for 15235-88	171540
1	Foam insert for 15235-88	171519
1	TESS box, plastics, low, 305x425x75 mm	15201-00
1	Lid for TESS box, plastic	15205-00
1	Software interTESS DVD, complete version with all experiment	331585
1	Storage information for 15235-88	171619
1	Carton 430 x 310 x 85mm	171672
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00

Student set Mechanics 1 digital (15271-88D)

1	Support base, variable	02001-00
1	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00
2	Support rod with hole, stainless steel, 10 cm	02036-01
2	Boss head	02043-00
1	Fishing line, l. 20m	02089-00
2	Weight holder for slotted weights, 10 ghts	02204-00
4	Slotted weight, black, 10 g	02205-01
3	Slotted weight, black, 50 g	02206-01
1	Helical spring, 3 N/m	02220-00
1	Helical spring, 20 N/m	02222-00
1	Pulley,movable,dia.65mm,w.hook	02262-00
1	Rod for pulley	02263-00
1	Spring balance,transparent, 1 N	03065-02
1	Spring balance,transparent, 2 N	03065-03
2	Spring balance holder	03065-20
1	Aluminium column	03903-00
1	Steel Column nickel-plated	03913-00
1	Holding pin	03949-00
2	Balance pan, plastic	03951-00
1	Lever	03960-00
1	Pointer for lever	03961-00
1	Plate with scale	03962-00
1	Pulley,movable,dia.40mm,w.hook	03970-00
1	Steel pellets, d = 2 mm, 120 g	03990-00
1	Wood column	05938-00
1	Glass tube holder with tape measure clamp	05961-00
1	Measuring tape, l = 2 m	09936-00
2	Pulleys, double in line	02266-00
1	Beaker, 100 ml, low form, plastic	36011-01
1	Beaker, 250 ml, low form, plastic	36013-01
1	Graduated cylinder, 50 ml, plastic	36628-01
2	Glass tubes, L 250MM	322289
1	Set of precision weights,1g-50g	44017-00
1	Pipette with rubber bulb	64701-00
1	Vernier calliper, plastic	03011-00
1	Digital stop watch, 24 h, 1/100 s, 1 s	24025-00
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15271-88	171573
1	Sticker for 15271-88	171642
1	Storage information for 15271-88	171649
1	Carton 430 x 310 x 160mm	171673

3	Support rod 300 mm with thread M6	331590
3	Support rod 300 mm with threaded hole M6	331591
1	Test tube, 160 x 16 mm	167704
1	Cobra SMARTsense - Force, ± 50 N	12904-00

Mechanics 1 consumables for 10 groups (13450-88)

1	Sodium chloride 1000 g	30155-50
1	Petroleum ether, 40-60 °C, 500 ml	30184-50

Student set Mechanics 2, (15272-88)

1	Leaf spring	02228-00
1	Leaf spring attachment	02228-05
1	Friction block	02240-01
1	Gear wheel, 20 teeth	02350-13
1	Gear wheel, 40 teeth	02351-03
2	Shaft, dia.12mm, l.45mm	02353-00
1	Wheel and axle	02360-00
1	Syringe 20ml	167705
5	Rubber cap	167706
1	Probes for hydrostatic pressure	02634-00
1	Spring balance,transp.,2N,non-adj	03065-09
2	Glass bell with tube	03917-00
2	Rubber ball,diam.15 mm	03921-00
2	Plastilina, 1 Stck.	167707
1	Beaker, 600 ml, low-form	46056-00
1	Glass tubes hook-shaped, 160 x 30	322299
1	Glass tube L= 80mm	322298
1	Tubing connect.,T-shape,ID 8-9 mm	47519-03
1	Rubber stopper, d=9/5mm, w/o hole	39250-00
2	Rubber stopper 26/32, 1 hole 7 mm	39258-01
1	Rubber stopper 26/32, 2 holes 7 mm	39258-02
1	Rubber tubing, i.d. 3 mm	39279-00
1	Capillary tube, 4, 0.5 to 1.2mm	40581-00
1	Overflow vessel 250 ml	02212-00
3	Silicone tubing i.d. 7mm, 1 m	39296-00
2	Glass tubes, L 250MM	322289
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Lid for TESS box, plastic	15205-00
1	Foam insert for 15272-88	171574
1	Sticker for 15272-88	171643
1	Storage information for 15272-88	171650
1	Carton 430 x 310 x 160mm	171673

Mechanics 2 consumables for 10 groups (13451-88)

1	Glycerin, 250 ml	30084-25

Student set Linear motion Dynamics, digital (15283-88D)

1	Cobra SMARTsense - Photogate, 0 ... ˆž s, Satz von 2 StÃ¼ck	12909-00
1	Cobra SMARTsense - Motion, 0,2 ... 2 m	12908-00
1	Support base, variable	02001-00
1	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00
1	Support rod with hole, stainless steel, 10 cm	02036-01
2	Boss head	02043-00
4	Slotted weight, black, 10 g	02205-01
3	Slotted weight, black, 50 g	02206-01
1	Pulley,movable,dia.65mm,w.hook	02262-00
1	Rod for pulley	02263-00
1	Weight holder, silver bronze, 1 g	02407-00
1	Silk thread, l = 200 m	02412-00
1	Steel ball, d = 19 mm	02502-01
1	Ball release unit	02505-00
4	Slotted weight, blank, 1 g	03916-00
1	Holding pin	03949-00
1	Pulley,movable,dia.40mm,w.hook	03970-00
2	Connecting cord, 32 A, 1000 mm, red	07363-01
2	Connecting cord, 32 A, 1000 mm, yellow	07363-02
2	Connecting cord, 32 A, 1000 mm, blue	07363-04
1	Measuring tape, l = 2 m	09936-00
1	Cart for measurements and experiments	11060-00
1	Shutter plate for cart	11060-10
2	Light barrier, compact	11207-20
2	Adapter plate for Light barrier compact	11207-22
1	Track, l 900 mm	11606-00
1	Timer 2-1	13607-99
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Lid for TESS box, plastic	15205-00
1	Foam insert for 15283-88	171640
1	Sticker for 15283-88	171648
1	Storage information for 15283-88	171657
1	Carton 430 x 310 x 160mm	171673
1	Support rod 300 mm with thread M6	331590
1	Support rod 300 mm with threaded hole M6	331591
1	Box, PP (98x73x20mm)	172059
1	Carton 1050X350X250 MM	161532

Mechanics linar motion optional accessories for 1 group (13453-88)

1	Plug 4 mm, for cart, 2 pcs.	11060-11
1	Car, motor driven	11061-00
1	Shutter plate for car, motor driven	11061-03
1	Equiforce launcher	11311-00
2	Battery cell, 1.5 V, baby size, type C	07922-01

Student set Acoustics 1 (15289-88)

1	Ruler, plastic, 200 mm	09937-01
2	Tuning fork 440 Hz	03424-00
1	Tuning fork 880 Hz	03421-00
1	Striking hammer	03429-00
1	Styrofoam sphere with hook	13289-13
1	Frame drum, d = 20 cm	13289-11
1	Silk thread, l = 200 m	02412-00
0.5	Silicone tubing, inner diameter 3 mm	39292-00
1	PVC tubing, i.d. 7 mm	03985-00
2	Filter funnel, d = 75 mm, PP	46895-00
1	Beaker, 100 ml, low form, plastic	36011-01
1	Measuring tape, l = 2 m	09936-00
1	Software "Measure Acoustics", single user license	14441-61
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15289-88	171571
1	Sticker for 15289-88	171590
1	Storage information for 15289-88	171631
1	Carton 430 x 310 x 160mm	171673

Student set Acoustics 1, necessary accessories for 1 group (15289-77)

1	Stereo loudspeakers to connect to a PC	15289-10
1	Stereo headset, on-ear, with microphone	15289-20

Student set Acoustics 2 (15321-88)

1	Glass tube, d(outside) = 44 mm, l = 340 mm	13289-20
1	Felt sheet, 100 x 100 mm	04404-20
1	Helical spring, 3 N/m	02220-00
1	Weight holder for slotted weights, 10 ghts	02204-00
2	Slotted weight, black, 50 g	02206-01
1	Digital stop watch, 24 h, 1/100 s, 1 s	24025-00
1	Tuning fork with pen	13289-00
1	Doppler source for TESS Acoustics	13289-30
2	Metal angle bracket for glass tube o.d. = 44 mm	13289-16
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, low, 305x425x75 mm	15201-00
1	Foam insert for 15321-88	171572
1	Sticker for 15321-88	171591
1	Storage information for 15321-88	171632
1	Carton 430 x 310 x 85mm	171672

Student set Heat 1 digital (15274-88D)

1	Support base, variable	02001-00
1	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00
2	Boss head	02043-00
1	Fishing line, l. 20m	02089-00
1	Lid for student calorimeter	04404-01
1	Agitator rod	04404-10
1	Heating coil with sockets	04450-00
1	Glass tube holder with tape measure clamp	05961-00
1	Measuring tape, l = 2 m	09936-00
1	Wire gauze with ceramic, 160 x 160 mm	33287-01
1	Beaker, 100 ml, low form, plastic	36011-01
1	Beaker, 400 ml, low-form	46055-00
1	Erlenmeyer wide neck, 250 ml	46152-00
1	Erlenmeyer flask 100 ml, wide-neck SB 29	36428-00
1	Graduated cylinder 100 ml, PP transparent	36629-01
1	Glass tube L= 80mm	322298
2	Glass tubes, L 250MM	322289
1	Universal clamp	37715-00
1	Students thermometer, -10...+110°C, l = 230 mm	38005-10
1	Spoon, with spatula end, 18 cm, plastic	38833-00
1	Rubber stopper 26/32, 1 hole 7 mm	39258-01
1	Rubber stopper 26/32, 2 holes 7 mm	39258-02
2	Silicone tubing i.d. 7mm, 1 m	39296-00
1	Pipette with rubber bulb	64701-00
2	Felt sheet, 100 x 100 mm	04404-20
2	Connecting cord, 32 A, 500 mm, blue	07361-04
1	Ring with boss head, i. d. = 10 cm	37701-01
1	Beaker, 250 ml, low-form	46054-00
1	Students thermometer,-10...+110°C, l = 180 mm	38005-02
1	Digital stop watch, 24 h, 1/100 s, 1 s	24025-00
1	Thermometer, non-graduated	04256-00
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15274-88	171929
1	Sticker for 15274-88	171933
1	Storage information for 15274-88	171937
2	Support rod 300 mm with thread M6	331590
2	Support rod 300 mm with threaded hole M6	331591
1	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00

Heat 1 necessary accessories for 1 group (13455-88)

1	Butane burner with cartridge,	32180-00
1	PHYWE power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93

Heat 1 consumables for 10 groups (13456-88)

1	Glycerol, 250 ml	30084-25
1	Sodium chloride, 500 g	30155-50
1	Boiling beads, 200 g	36937-20
1	Patent Blue V (sodium salt), 25 g	48376-04

Student set Heat 2 (15275-88)

1	Boss head	02043-00
1	Steel pellets, d = 2 mm, 120 g	03990-00
1	Collar for linear expansion	04231-55
1	Brass tube	04234-11
1	Iron tube	04234-12
1	Aluminium tube	04234-13
1	Rotating shaft with pointer	04236-01
1	Heat sensitive paper	04260-00
1	Metal bodies, set of 3	04406-00
1	Tube, plastic, d. 30mm, l. 500mm	04446-00
1	Beaker, aluminum, polished	05903-00
1	Beaker, black	05904-00
1	Aluminium rod,U-shaped	05910-00
1	Copper rod, U-shaped	05910-01
1	Copper rod, U-shape,d 3mm,w.175mm	05910-03
1	Copper rod, U-shape,d.5mm,w.120mm	05910-04
1	Bimetal strip	05913-00
2	Alligator clip	167700
1	Test tube,200x30 mm,DURAN	36304-01
1	Rubber stopper 26/32 , without hole	39258-00
1	Rubber stopper 26/32, 1 hole 7 mm	39258-01
1	Connecting cord, 32 A, 500 mm, red	07361-01
1	Lab thermometer,-10..+50C	38055-00
1	Constantan wire, 4 0hm/m, d = 0.4 mm, l = 50 m	06102-00
1	Iron wire, d = 0.5 mm, l = 50 m	06105-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Lid for TESS box, plastic	15205-00
1	Foam insert for 15275-88	171930
1	Sticker for 15275-88	171934
1	Storage information for 15275-88	171938

Heat 2 necessary accessories for 1 group (15274-88)

1	Multi-range meter, analogue	07028-01

Heat 2 consumables for 10 groups (13457-88)

1	Constantan wire, 4 0hm/m, d = 0.4 mm, l = 50 m	06102-00
1	Iron wire, d = 0.5 mm, l = 50 m	06105-00

Student set Renewable energy 1, necessary accessories for 1 group (13480-88)

2	DMM with NiCr-Ni thermo couple	07122-00
1	PHYWE power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93

Student set Renewable energy 1, Basics and thermal energy digital (15287-88D)

1	Support base, variable	02001-00
1	Fishing line, l. 20m	02089-00
1	Felt sheet, 100 x 100 mm	04404-20
4	Angled connector module, SB	05601-02
1	Interrupted connector module, SB	05601-04
4	Junction module, SB	05601-10
1	Socket module for incandescent lamp E10, SB	05604-00
1	Motor with indicating disc, SB	05660-00
1	Generator with metrical thread axis and nut	05751-01
1	Solar collector for student experiments	05760-00
1	Thermal generator for student experiments	05770-00
1	Halogen lamp with reflector, 12V / 20W	05780-00
1	Mount for halogen lamp with reflector	05781-00
1	Beaker, aluminum, polished	05903-00
1	Beaker, black	05904-00
1	Filament lamp 1,5 V/0,15 A, E10	171970
1	Lamp 4 V/0,04 A,E 10	06154-00
1	Solar cell 2.5 x5 cm, with plugs	06752-11
1	Holder for solar cell 2.5 x5 cm, with plugs	06752-12
1	Double sockets,1 pair,red a.black	07264-00
2	Connecting cord, 32 A, 250 mm, red	07360-01
2	Connecting cord, 32 A, 250 mm, blue	07360-04
2	Connecting cord, 32 A, 500 mm, red	07361-01
1	Connecting cord, 32 A, 500 mm, blue	07361-04
1	Slide mount for optical bench	09822-00
1	Measuring tape, l = 2 m	09936-00
1	Digital stop watch, 24 h, 1/100 s, 1 s	24025-00
1	Filament lamp 6 V/0,5 A, E 10	171971
1	Beaker, 100 ml, low form, plastic	36011-01
1	Beaker, 400 ml, low-form	46055-00
2	Lab thermometer,-10..+100 °C	38056-00
1	Silicone tubing i.d. 7mm, 1 m	39296-00
1	Flow indicator for liquids	46434-00
1	Filter funnel, d = 75 mm, PP	46895-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Lid for TESS box, plastic	15205-00
1	Foam insert for 15287-88	171931
1	Sticker for 15287-88	171935
1	Storage information for 15287-88	171939
2	Support rod 300 mm with thread M6	331590
2	Support rod 300 mm with threaded hole M6	331591
1	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Voltage, ± 30 V	12901-00
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00
1	Cobra SMARTsense - Current, ± 1 A	12902-00

Student set Renewable energy 2, Solar / Water / Wind, (15288-88)

1	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00
1	Boss head	02043-00
1	Syringe 20ml	167705
1	Blower, 12V	05750-00
1	Rotor, 2 pieces	05752-01
1	Water pump/ water turbine/ generator	05753-00
1	clamp, d = 16 mm, with mounting rod	05764-00
1	Cardboard, black, 200 x 300 mm	171968
1	Solar cell 2.5 x5 cm, with plugs	06752-11
1	Holder for solar cell 2.5 x5 cm, with plugs	06752-12
1	Solar battery, 4 cells, with cable and connectors	06752-20
1	Double sockets,1 pair,red a.black	07264-00
1	Concentrated solar power unit	05765-00
1	Ni-MH accus, size AA, 1.3 Ah / 1.2V, 1 pair	07922-03
1	Connecting cord, 32 A, 500 mm, blue	07361-04
1	Dish, plastic, 150x150x65 mm	33928-00
1	On-off switch module, SB	05602-01
2	Straight connector module, SB	05601-01
1	Light emitting diode module red , SB	05654-00
1	Capacitor (gold cap), 1F, SB	05650-10
1	Potentiometer module 250 Ohm, SB	05623-25
1	Battery holder module (AA type), SB	05606-00
2	Interrupted connector module, SB	05601-04
1	Connecting cord, 32 A, 500 mm, red	07361-01
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15288-88	171932
1	Sticker for 15288-88	171936
1	Storage information for 15288-88	171940
1	Carton 430 x 310 x 160mm	171673

Student set Renewable energy 3, Fuel cells, (15286-88)

1	PEM fuel cell for hydrogen/oxygen and hydrogen/air operation, SB	05661-00
1	PEM electrolyser, SB	05662-00
2	Gas storage, SB, incl. tubes and plugs	05663-00
1	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00
1	Boss head	02043-00
1	Solar battery, 4 cells, with cable and connectors	06752-20
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15286-88	171956
1	Sticker for 15286-88	171955
1	Storage information for 15286-88	171954
1	Carton 430 x 310 x 160mm	171673

Student set Electricity / Electronics 1 with Building Blocks digital (15264-88D)

4	Straight connector module, SB	05601-01
4	Angled connector module, SB	05601-02
2	T-shaped connector module, SB	05601-03
2	Interrupted connector module, SB	05601-04
2	Junction module, SB	05601-10
2	Straight connector module with socket, SB	05601-11
2	Angled connector module with socket, SB	05601-12
2	On-off switch module, SB	05602-01
2	Change-over switch module, SB	05602-02
2	Socket module for incandescent lamp E10, SB	05604-00
2	Battery holder module (C type), SB	05605-00
1	Resistor module 50 Ohm, SB	05612-50
1	Resistor module 100 Ohm, SB	05613-10
1	Resistor module 10 kOhm, SB	05615-10
1	Resistor module 47 kOhm, SB	05615-47
1	Potentiometer module 250 Ohm, SB	05623-25
1	NTC-resistor module, SB	05630-01
1	PTC-resistor module, SB	05631-00
1	Bell gong on 4-mm-plug	05673-02
1	Model person for electrical safety, SB	05680-00
1	Bimetal strip	05913-00
1	Conductors/non-conductors, l = 150 mm	06107-50
1	Alligator clips, bare, 10 pcs	07274-03
1	Connecting plug, 2 pcs.	07278-05
2	Connecting cord, 32 A, 250 mm, red	07360-01
2	Connecting cord, 32 A, 250 mm, blue	07360-04
2	Connecting cord, 32 A, 500 mm, red	07361-01
2	Connecting cord, 32 A, 500 mm, blue	07361-04
1	Trough, grooved, w/o lid	34568-01
2	Copper electrode, 76 mm x 40 mm	45212-00
1	Zinc electrode, 76 mm x 40 mm	45214-00
2	Lead electrode, 76 mm x 40 mm	45215-00
2	Iron electrode, 76 x 40 mm	45216-00
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15265-88	171515
1	Sticker for 15264-88	173178
1	Storage information for 15264-88	173177
1	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Voltage, ± 30 V	12901-00
1	Cobra SMARTsense - Current, ± 1 A	12902-00

Student set Electrics /Electronics 1, necessary accessories for 1 group, (13470-88)

2	DMM with NiCr-Ni thermo couple	07122-00
2	Battery cell, 1.5 V, baby size, type C	07922-01
1	PHYWE power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93

Student set Electrics / Electronics 1, consumables for 10 groups (13471-88)

3	Denaturated alcohol (spirit for burning), 1000 ml	31150-70
1	Water, distilled 5 l	31246-81
1	Sodium hydroxide sol.,10%, 1000ml	31630-70
1	Sulphuric acid, 10%, tech.gr., 1000 ml	31828-70
1	Filament lamp 6 V/3 W, E10, 10 pcs.	35673-03
1	Sodium sulphate dried 250 g	48344-25
1	Emery paper, medium, 5 sheets	01605-02
1	Constantan wire, 15.6 Ohm/m, d = 0.2 mm, l = 100 m	06100-00
1	Constantan wire, 6.9 Ohm/m, d = 0.3 mm, l = 100 m	06101-00
1	Constantan wire, 4 Ohm/m, d = 0.4 mm, l = 50 m	06102-00
1	Iron wire, d = 0.2 mm, l = 100 m	06104-00
1	Copper wire, d = 0.2 mm, l = 100 m	06106-00
1	Filament lamps 1.5V/0.15A,E10,10 pieces	06150-03
1	Filament lamps 4V/0.04A, E10, 10	06154-03
1	Filament lamps 12V/0.1A, E10, 10 pieces	07505-03

Student set Electricity / Electronics 2 with Building Blocks, Electromagnetism and Induction (15266-88)

1	Universal holder module, SB	05603-00
1	Coil holder module, SB	05672-00
1	Contact spring with armature	05673-00
1	Contact element on 4-mm-plug	05673-01
1	Relais module 6 V, SB	05674-00
1	Neon lamp 110 V AC, E10	07506-90
1	Bar magnet, l = 72mm	07823-00
2	Coil, 400 turns	07829-01
1	Coil, 1600 turns	07830-01
1	U-core	07832-00
1	Yoke	07833-00
1	Tightening screw	07834-00
1	Rotating stem	07836-00
1	Motor model for student experiments	07850-10
1	Galvanometer movement	07875-00
1	Galvanometer scale	07876-00
1	Notch bearing with plug	07877-00
1	Drawing compass , 1 units	06350-03
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15266-88	171948
1	Sticker for 15266-88	171950
1	Storage information for 15266-88	171952
1	Carton 430 x 310 x 160mm	171673

Student set Electricity/Electronics 3 with Building Blocks, Electronics (15267-88)

2	T-shaped connector module, SB	05601-03
1	On-off switch module, SB	05602-01
1	Resistor module 100 Ohm, SB	05613-10
1	Resistor module 500 Ohm, SB	05613-50
1	Resistor module 1 kOhm, SB	05614-10
1	Potentiometer module 10 kOhm, SB	05625-10
1	Capacitor module 47 nF, SB	05642-47
1	Capacitor module 47 µF non-polar electrolytic, SB	05645-47
1	Capacitor module 100 µF non-polar electrolytic, SB	05646-10
1	Capacitor module 470 µF non-polar electrolytic, SB	05646-47
1	Silicon-diode module 1N4007, SB	05651-00
1	Z-diode module ZF4.7, SB	05652-00
1	Photodiode module, SB	05653-00
1	Light emitting diode module red , SB	05654-00
1	Bridge rectifier module, SB	05655-00
1	NPN transistor module BC337, SB	05656-00
1	Solar cell 2.5 x5 cm, with plugs	06752-11
1	Holder for solar cell 2.5 x5 cm, with plugs	06752-12
1	Earphones, 2k0hm,with 4mm-plugs	06811-00
1	Coil, 400 turns	07829-01
1	Coil, 1600 turns	07830-01
1	U-core	07832-00
1	Yoke	07833-00
1	Tightening screw	07834-00
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15267-88	171949
1	Sticker for 15267-88	171951
1	Storage information for 15267-88	171953
1	Carton 430 x 310 x 160mm	171673

Student set Magnetism digital (15230-88D)

1	Iron wire, 5 pcs.	326875
1	Conductors/non-conductors,l-50 mm	06107-01
1	Sprinkler w. iron powder, 20 ml	06305-10
1	Earth globe model f.magnet 8x60mm	06308-00
1	Magnetic field sensor	06309-00
1	Magnet, d=8 mm, l=60 mm	06317-00
1	Pocket compass	06350-00
2	Bar magnet l 50 mm	07819-00
1	Polycarbonate plate, 136x112x1 mm	13027-05
1	Storage information for 15230-88	171625
1	TESS box, plastics, low, 305x425x75 mm	15201-00
1	Lid for TESS box, plastic	15205-00
1	Foam insert for 15230-88	171512
1	Sticker for 15230-88	171545
1	Carton 430 x 310 x 85mm	171672
1	Cobra SMARTsense - Magnetic field, ± 64 mT	12911-00

Magnetism consumables for 10 groups (13409-88)

1	Iron powder, techn. 500 g	30067-50
1	Iron wire, notched, d = 1,2 mm, 2 kg	06343-03

Student set Electrostatics (15240-88)

1	Acetate foil, 105 x 148 mm	326869
1	CONDUCTING FOIL 2 CUTS, 3X60MM	326870
1	Support rod, stainless steel, d = 8 mm, l = 175 mm	02038-00
1	Neon tube	06656-00
1	Electroscope w. metal pointer	13027-01
1	Faraday pail, d. 40mm, h. 75mm	13027-03
1	Polycarbonate plate, 136x112x1 mm	13027-05
2	Polypropylene rod, l=175mm, d=10 mm	13027-09
1	Acrylic resin rod, l=175 mm, d=8 mm	13027-08
1	Electrostatic ind.plate,30mmx60mm	13027-12
1	Pendulums, pair, f.electrostatics	13027-15
1	Clip for rods, with cord	13027-16
1	Rubber stopper,d=49/41mm, 1 hole	39263-01
1	Storage information for 15240-88	171626
1	TESS box, plastics, low, 305x425x75 mm	15201-00
1	Lid for TESS box, plastic	15205-00
1	Foam insert for 15240-88	171513
1	Sticker for 15240-88	171546
1	Carton 430 x 310 x 85mm	171672

Electrostatics consumables for 10 groups

1	Film, transparent, DIN A4, 100 sheets	08186-10

Student set Electric motor / Generator digital (15211-88D)

1	Electric motor/ Generator, EMG	15221-00
2	Connecting cord, 2 mm-plug, 5A, 250 mm, red	07355-01
2	Adaptor 4 mm plug / 2 mm socket	39161-02
2	Connecting cord, 2 mm-plug, 5A, 250 mm, blue	07355-04
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15221-88	171509
1	Sticker for 15221-88	171547
1	Storage information for 15221-88	171627
1	Lid for TESS box, plastic	15205-00
1	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Voltage, ± 30 V	12901-00
1	Cobra SMARTsense - Current, ± 1 A	12902-00

Student set Electric Motor / Generator, necessary accessories for 1 group (13412-88)

2	Junction module, SB	05601-10
1	Socket module for incandescent lamp E10, SB	05604-00
1	Pocket compass	06350-00
1	DMM with NiCr-Ni thermo couple	07122-00
1	Connecting cord, 19A ,50 cm, red	07314-01
1	Connecting cord,19A,50cm, blue	07314-04
1	PHYWE power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93

Student set Electric Motor / Generator, consumables for 10 groups (13413-88)

1	Silicone tubing i.d. 2mm	39298-00
1	Filament lamps 1.5V/0.15A,E10,10 pieces	06150-03

Student set Equipotential lines and electric fields (15250-88D)

1	Mounting plate r, 16cmx21cm	13002-00
2	Universal holder for equipotential lines	13024-13
1	Polycarbonate plate, 136x112x1 mm	13027-05
1	Set of electrodes with holder for set equipotential lines	13027-24
1	Carbon paper f.Equipot.30 sheets	13027-29
3	Alligator clip	167700
2	Knitting needle 1 pc.	167703
1	Storage information for 15250-88	171624
1	TESS box, plastics, low, 305x425x75 mm	15201-00
1	Lid for TESS box, plastic	15205-00
1	Foam insert for 15250-88	171511
1	Sticker for 15250-88	171544
1	Carton 430 x 310 x 85mm	171672
1	Cobra SMARTsense - Voltage, ± 30 V	12901-00

Equipotential lines necessary accessories for 1 group (13411-88)

1	PHYWE power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93
1	DMM with NiCr-Ni thermo couple	07122-00
2	Connecting cord, 32 A, 250 mm, red	07360-01
2	Connecting cord, 32 A, 250 mm, blue	07360-04

Student set Optics 1, necessary accessories for 1 group (13460-88)

2	DMM with NiCr-Ni thermo couple	07122-00
3	Connecting cord, 32 A, 750 mm, red	07362-01
2	Connecting cord, 32 A, 750 mm, blue	07362-04
1	PHYWE power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93

Student set Optics 1, consumables for 10 groups (13461-88)

1	Glycerol, 250 ml	30084-25

Student set Optics 2 digital (15277-88D)

1	Optical profile-bench for student experiments, l = 600 mm	08376-00
1	Ground glass screen,50x50x2 mm	08136-01
2	Polarising filter, 50 mm x 50mm	08613-00
1	Bottom with stem for light box	09802-20
1	Diaphragms, d 1, 2, 3, 5 mm	09815-00
1	Diaphragm with hole, d=20mm	09816-01
1	Diaphragm with slit	09816-02
1	Diaphragm with square	09816-03
1	Lens on slide mount, f=+50mm	09820-01
1	Lens on slide mount, f=+100mm	09820-02
1	Lens on slide mount, f= -50mm	09820-06
1	Concave/convex mirror with rod	09821-00
2	Slide mount for optical bench	09822-00
1	Mount with scale on slide mount	09823-00
1	Table with stem	09824-00
1	Model earth/moon	09825-00
1	Screen, white, 150x150 mm	09826-00
1	Grating, 80 lines/mm	09827-00
2	Diaphragm holder, attachable	11604-09
1	Object -L-, glass bead	11609-00
1	Slide -Emperor Maximilian-	82140-00
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15277-88	172290
1	Sticker for 15277-88	171615
1	Storage information for 15277-88	173052
1	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Light, 1 ... 128 kLX	12906-00

Student set Optics 2, consumables for 10 groups (13462-88)

1	Stearin candles, d 13mm, 20 pcs	09901-02

Student set Optics 3, Wave optics (15280-88)

2	Lens on slide mount, f=+300mm	09820-04
1	Mount with scale on slide mount	09823-00
1	Photoelastic model	09829-00
2	Plate mount for three objects	09830-00
1	Measuring magnifier	09831-00
1	Slit, width adjustable up to 1 mm	11604-07
1	Aperture, d 0.4mm	08206-04
1	Diaphragm with single slit, bar and edge	08521-00
1	Diaphragm, 3 single slits	08522-00
1	Diaphragm, 4 double slits	08523-00
1	Diffraction grating, 4 lines/mm	08532-00
1	Diffraction grating, 8 lines/mm	08534-00
1	Diffraction grating,10 lines/mm	08540-00
1	Measuring tape, l = 2 m	09936-00
1	Beaker, 250 ml, low-form	46054-00
1	Microscopic slides, 50 pcs	64691-00
1	Diaphragm, 4 multiple slits	08526-00
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15280-88	171570
1	Sticker for 15280-88	171616
1	Storage information for 15280-88	171652
1	Carton 430 x 310 x 160mm	171673

Wave Optics/Optics 3 consumables for 10 groups (13463-88)

1	Cardboards 200x300 mm, black, 10 pieces	06306-01

Student set Optics / Atomic physics digital (15350-88D)

1	Optical profile-bench for student experiments, l = 600 mm	08376-00
2	Slide mount without angle scale	09851-02
2	Mount with scale on slide mount	09823-00
4	Diaphragm holder, attachable	11604-09
1	Lens on slide mount, f=+50mm	09820-01
1	Lens on slide mount, f=+100mm	09820-02
1	Screen, semitransparent, 150x150mm²	09851-03
1	Cuvette, plastic, W x D x H: 99 x 59 x 42 mm	09851-05
4	Macro-cuvettes, PS, 4ml	172119
1	Universal bench	09840-10
1	Cuvette holder for universal bench	09840-11
1	Ruler, l = 30 cm	09851-40
5	Foil filter grey 50% in slide frame glasless	09851-11
1	Illumination slit, 0.5 mm, hardpaper	09851-12
1	Lambda/4 film, in slide frame, glassless	09851-13
2	Polarisation filter, in slide frame, glassless	09851-14
1	Diffraction objects acc.Koppelmann, in slide frame, glassles	09851-15
1	Grating, 500 lines/mm, in slide frame, glassless	09851-16
1	Plate, fluorescent, red	09851-19
1	Plate, fluorescent, yellow	09851-20
1	Plate, fluorescent, green	09851-21
1	Plate, fluorescent, blue	09851-22
1	Solar cell 2.5 x5 cm, with plugs	06752-11
1	Halogen lamp, 12 V/10 W, mounted with 4 mm plugs	09852-00
1	LED - IR, with series resistor and 4 mm plugs	09852-10
1	LED - red, with series resistor and 4 mm plugs	09852-20
1	LED - green, with series resistor and 4 mm plugs	09852-30
1	LED - blue, with series resistor and 4 mm plugs	09852-40
1	LED - UV, with series resistor and 4 mm plugs	09852-50
1	LED - white, with series resistor and 4 mm plugs	09852-60
1	Light sensor with amplifier, adjustable	09852-70
1	Power supply, 5 V DC	09852-99
1	Stray light tube	09852-71
1	Stray light tube for LED, Di = 8 mm, l = 40 mm	09852-01
1	Angular scale, laminated	09851-01
1	CD, blank , 700 MB in slimcase	170583
1	Measuring tape, l = 2 m	09936-00
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15350-88	171984
1	Sticker for 15350-88	171985
1	Storage information for 15350-88	171986
1	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Voltage, ± 30 V	12901-00
1	Cobra SMARTsense - Current, ± 1 A	12902-00

Optics / Atomphysics necessary accessories for 1 group (13466-88)

2	DMM with NiCr-Ni thermo couple	07122-00
3	Connecting cord, 32 A, 750 mm, red	07362-01
2	Connecting cord, 32 A, 750 mm, blue	07362-04
1	PHYWE power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93

Student set General Chemistry digital (15300-88D)

1	Support base, variable	02001-00
1	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00
1	Boss head	02043-00
1	Cubes, set of 8	02214-00
1	Digital stop watch, 24 h, 1/100 s, 1 s	24025-00
4	Alligator clip	167700
1	Connecting cord, 19A ,50 cm, red	07314-01

1	Connecting cord,19A,50cm, blue	07314-04
1	Flat battery, 4.5 V	07496-01
1	Magnet, d=8 mm, l=60 mm	06317-00
3	Porcelain dish, 75ml, d = 80 mm	32516-00
1	Mortar w. pestle, 70ml, porcelain	32603-00
1	Triangle w.pipeclay, l 50mm	33277-00
1	Circular filter,d 150 mm,100 pcs	32977-06
2	Wire gauze with ceramic, 160 x 160 mm	33287-01
1	Combustion spoon, l=300 mm	33346-00
1	Spatula, powder, steel, l=150mm	47560-00
1	Crucible tongs, 200 mm, stainless steel	33600-00
1	Dish, plastic, 150x150x65 mm	33928-00
1	Filter funnel, PP, d=60 mm	47318-00
1	Trough, grooved, w/o lid	34568-01
2	Watch glass, dia.60 mm	34570-00
1	Beaker, 150ml, low-form	46060-00
4	Beaker, 100 ml, low form, plastic	36081-00
2	Beaker, 50 ml, low form, plastic	36080-00
1	Erlenmeyer flask 100 ml, wide-neck SB 29	36428-00
1	Graduated cylinder, 25 ml, transparent, PP	36635-00
1	Grad.cylinder,high,PP,50ml	46287-01
1	Glass tube, 85 x 60 mm	322287
1	Test tube rack f. 6 tubes, wood	37685-10
1	Ring with boss head, i. d. = 10 cm	37701-01
1	Universal clamp	37715-00
1	Lab thermometer,-10..+150C	38058-00
1	Test tube holder, up to d 22mm	38823-00
5	Rubber stopper, d=22/17 mm, without hole	39255-00
1	Rubber stopper 26/32 , without hole	39258-00
1	Rubber stopper 26/32, 2 holes 7 mm	39258-02
1	Protecting glasses, clear glass	39316-00
2	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
2	Copper electrode, 76 mm x 40 mm	45212-00
1	Tweezers, l = 130 mm, straight, blunt	64610-00
1	Scissors, l = 110 mm, straight, point blunt	64616-00
2	Pipette, w. rubber bulb, long tip	64838-00
2	Pipette with rubber bulb, long	64821-00
1	Test tube brush w. wool tip,d25mm	38762-00
1	Rubber gloves, size S (7)	39325-00
1	Wash bottle, 250 ml, plastic	33930-00
1	Polypropylene rod, l=175mm, d=10 mm	13027-09
1	Laboratory pen, waterproof, black	38711-00
1	Indicator paper, pH1-14, roll	47004-02
1	Stopcock, 1-way, Luer-Lock	02594-00
2	Lid for TESS box, plastic	15205-00
2	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15300-88	171502
1	Sticker for 15300-88	171592
1	Sticker for 15300-88	171977
1	Storage information for 15300-88 box 1	171633
1	Storage information for 15300-88 box 2	171978
2	Carton 430 x 310 x 160mm	171673
1	Syringe 20ml	167705
5	Test tube, 180x18 mm	172070
1	Canula, 0,9 x 70 mm LUER	168921
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00

General Chemistry, consumables and chemicals for 10 groups (13300-10)

1	Acetone, extra pure, 1000 ml	30004-70
1	Potassium aluminium sulphate 250g	30018-25
1	Ammonium chloride 250 g	30024-25
1	Petroleum ether, 100-140 C,500 ml	30037-50
1	Calcium, granular 50 g	30049-05
1	Iron powder, techn. 500 g	30067-50
1	Gelatin powder 250 g	30083-25
1	Glycerol, 250 ml	30084-25
1	Potassium sodium tartrate 250 g	30105-25
1	Potassium permanganate, chem. pur., 250 g	30108-25
1	Magnesium, ribbon, roll, 25 g	30132-00
1	Sodium hydroxide, pellets, 500 g	30157-50
1	Stearic acid 250 g	30228-25
1	Zinc, sheet 250x125x0.5 mm, 200 g	30245-20
1	Benzoic acid 100 g	30251-10
1	Sulphur, pieces, 500 g	30277-50
1	Denaturated alcohol (spirit for burning), 1000 ml	31150-70
1	Stand.petrol b.p.65-95 C 1000 ml	31311-70
1	Phenolphthalein, 0,5% soution in ethanol, 100 ml	31715-10
1	Quartz glass wool 10 g	31773-03
1	Standard sand,coarse 2500 g	31826-79
1	Rock salt, granular, 1 kg	31851-70
1	Boiling beads, 200 g	36937-20
1	Wood splints, package of 100	39126-10

General Chemistry, necessary accessories for 1 group (13431-88)

1	Butane burner with cartridge	32180-00

Student set Inorganic chemistry digital (15301-88D)

1	Support base, variable	02001-00
3	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00
3	Boss head	02043-00
1	Syringe 50 ml, Luer-lock	02592-00
1	Stopcock, 1-way, Luer-Lock	02594-00
1	Canula, 0,60 x 60 mm, LUER	172261
1	Litmus paper, red, 1 box	30678-02
1	Porcelain dish, 75ml, d = 80 mm	32516-00
1	Mortar w. pestle, 70ml, porcelain	32603-00
1	Porcelain crucible,dia.34mm,25 ml	32683-00
1	Circular filter,d 125 mm,100 pcs	32977-05
1	Triangle w.pipeclay, l 60mm	33278-00
1	Wire gauze with ceramic, 160 x 160 mm	33287-01
1	Combustion spoon, l=300 mm	33346-00
1	Knife, stainless	33476-00
1	Crucible tongs, 200 mm, stainless steel	33600-00
1	Dish, plastic, 150x150x65 mm	33928-00
1	Wash bottle, 250 ml, plastic	33930-00
1	Funnel, glass, top dia. 80 mm	34459-00
1	Powder funnel, upper dia. 65mm	34472-00
3	Watch glass, dia.60 mm	34570-00
1	Beaker, 50 ml, high-form	46025-00
1	Beaker, 250 ml, high-form	46027-00
1	Beaker, 250 ml, low-form	46054-00
1	Beaker, 250 ml, low form, plastic	36013-01
2	Test tube,180x20 mm,DURAN, PN19	36293-00
1	Test tube,180x20 mm,side arm,PN19	36330-00
1	Erlenmeyer flask 100 ml, wide-neck SB 29	36428-00
1	Graduated cylinder, 10 ml, plastic	36636-00
1	Glass tube, 85 x 60 mm	322287
1	Glass tube, right-angled	36701-07
1	Glass tube, right-angled 230x 55	322293
1	Grad. Pipette D=8, L=65mm	167554
1	Grad. Pipette D=8, L=200mm	167557
2	Glass tube L= 80mm	322298
1	Glass tube L =200 mm	322307
1	Dropping funnel with drip nozzle, 50ml	36912-00
1	Combustion tube, l 120mm, DURAN	37029-01
6	Test tube, 180x18 mm	172070
2	Test tube,200x30 mm	37660-01
1	Test tube rack f. 6 tubes, wood	37685-10
1	Ring with boss head, i. d. = 10 cm	37701-01
3	Universal clamp	37715-00
1	Students thermometer,-10...+110°C, l = 180 mm	38005-02
1	Laboratory pen, waterproof, black	38711-00
1	Magnesia rods, 25 pcs	38718-04
1	Test tube brush w. wool tip,d25mm	38762-00
1	Test tube holder, up to d 22mm	38823-00
3	Rubber stopper, d=22/17 mm, without hole	39255-00
2	Rubber stopper, d = 22/17 mm, 1 hole	39255-01
2	Rubber stopper 26/32 , without hole	39258-00
1	Rubber stopper 26/32, 2 holes 7 mm	39258-02
1	Rubber tubing, i.d. 6 mm	39282-00
1	Rubber bulb, double	39287-00
1	Protecting glasses, clear glass	39316-00
1	Rubber gloves, size S (7)	39325-00
1	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
1	Grad.cylinder,high,PP,50ml	46287-01
1	Spatula, powder, steel, l=150mm	47560-00
1	Scissors, l = 110 mm, straight, point blunt	64616-00
2	Pipette with rubber bulb	64701-00
2	Lid for TESS box, plastic	15205-00
2	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15301-88	171585
1	Sticker for 15301-88, box 1	171593
1	Sticker for 15301-88, box 2	171979
1	Storage information for 15301-88, box 1	171634
1	Storage information for 15301-88, box 2	171980
2	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00

Inorganic Chemistry, consumables and chemicals for 10 groups (13301-10)

1	Acetaldehyde, 98-100% 250 ml	30001-25
1	Acetone, extra pure, 1000 ml	30004-70
1	Ethanol extra pure ab.95% 1000 ml	30008-70
1	Activated carbon, granular 250 g	30011-25
1	Aluminium oxide 250 g	30020-25
1	N-butyric acid 100 ml	30047-10
1	Calcium acetate 100 g	30050-10
1	Citric acid 250 g	30063-25
1	Iron-III chloride, 250 g	30069-25
1	Ethyl acetate 250 ml	30075-25
1	Fehling's solution I 250 ml	30079-25
1	Fehling's solution II 250 ml	30080-25
1	Glycerol, 250 ml	30084-25
1	Ethylene glycol 250 ml	30085-25
1	Urea, 250 g	30086-25
1	Charcoal powder 250 g	30087-25
1	Isopropyl alcohol, extra pure, 1000 ml	30092-70
1	Iodine potassium iodide solution	30094-10
1	Potassium carbonate,98-100% 250 g	30096-25
1	Potassium permanganate, chem. pur., 250 g	30108-25
1	Copper-II oxide,powder 100 g	30125-10
1	Litmus solution 100 ml	30127-10
1	Magnesium, ribbon, roll, 25 g	30132-00
1	Methanol 500 ml	30142-50
1	Litmus paper, red, 1 booklet	30207-00
1	Sulphuric acid, 95-98% 500 ml	30219-50
1	Stearic acid 250 g	30228-25
1	D(+)-glucose 1-hydr. 250 g	30237-25
1	Sulphur, pieces, 500 g	30277-50
1	Aluminium carbide 25 g	31016-04
1	Aluminium sulphate 500 g	31022-50
1	N-amyl alcohol 500 ml	31051-50
1	N-butanol 250 ml	31142-25
1	Denaturated alcohol (spirit for burning), 1000 ml	31150-70
1	Casein, alkali-soluble 100 g	31188-10

2	Water, distilled 5 l	31246-81
1	Acetic acid 99...100%, 500 ml	31301-50
1	Stand.petrol b.p.65-95 C 1000 ml	31311-70
1	n-hexane 250 ml	31369-25
1	Isobutyl alcohol 250 ml	31393-25
1	Calcium hydroxide solution 1000ml	31458-70
1	Copper-II sulphate, anhydr. 250 g	31495-25
1	Magnesium chloride 500 g	31540-50
1	Phenolphthalein, 0,5% soution in ethanol, 100 ml	31715-10
1	Polyvinyl chloride,powder 250 g	31745-25
1	Propionic acid, 500 ml	31753-50
1	Propyl alcohol,normal 250 ml	31754-25
1	Crude oil (petroleum),synthetic, 500 ml	31808-50
1	Schiff's reagent 250 ml	31827-25
1	Silver foil, 150 x150 x 0.1 mm, 25 g	31839-04
1	Sudan-III solution,alcohol 250 ml	31861-25
1	Cotton wool, white 200 g	31944-10
1	Iron wool 200 g	31999-20
1	Indicator paper, pH1-11, book	47006-01
1	Calcium carbide,granul. 250 g	48018-25
1	Wood splints, package of 100	39126-10
1	Formic acid 75% 250 ml	30023-25

Inorganic Chemistry, necessary accessories for 1 group (13433-88)

1	Butane burner with cartridge,	32180-00
1	Rubber tubing,vacuum,i.d.6mm	39286-00
1	Portable Balance, OHAUS YA302	49213-00
1	Water jet pump, plastic	02728-00

Student set Acids, Bases, Salts digital (15302-88D)

1	Support base, variable	02001-00
3	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00
4	Boss head	02043-00
1	Digital stop watch, 24 h, 1/100 s, 1 s	24025-00
2	Graphitelektrode, d = 7 mm, l = 150, 1	172068
1	Lamp 4 V/0,04 A,E 10	06154-00
2	Alligator clip	167700
2	Connecting cord, 19A ,50 cm, red	07314-01
1	Connecting cord,19A,50cm, blue	07314-04
1	Flat battery, 4.5 V	07496-01
1	Lampholder E10, case G1	17049-00
1	Porcelain boat	172069
3	Porcelain dish, 75ml, d = 80 mm	32516-00
1	Mortar w. pestle, 70ml, porcelain	32603-00
1	Circular filter,d 110 mm,100 pcs	32977-04
1	Wire gauze with ceramic, 160 x 160 mm	33287-01
1	Combustion spoon, l=300 mm	33346-00
1	Spatula, powder, steel, l=150mm	47560-00
1	Knife, stainless	33476-00
1	Crucible tongs, 200 mm, stainless steel	33600-00
1	Dish, plastic, 150x150x65 mm	33928-00
1	Wash bottle, 250 ml, plastic	33930-00
1	Filter funnel, PP, d=60 mm	47318-00
6	Watch glass, dia.60 mm	34570-00
1	Beaker, 50 ml, high-form	46025-00
2	Beaker, 100 ml, low form, plastic	36081-00
1	Beaker, 250 ml, low-form	46054-00
2	Test tube,180x20 mm,DURAN, PN19	36293-00
2	Erlenmeyer flask, narrow neck, PN 29	36424-00
1	Graduated cylinder, 10 ml, plastic	36636-00
2	Grad.cylinder,high,PP,50ml	46287-01
1	U-tube w. 2 lat tubulure PN19	36966-00
2	Glass tube, 85 x 60 mm	322287
1	Glass tube, right-angled 230x 55	322293
1	Grad. Pipette D=8, L=65mm	167554
1	Grad. Pipette D=8, L=200mm	167557
1	Dropping funnel with drip nozzle, 50ml	36912-00
12	Test tube, 180x18 mm	172070
1	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10
1	Ring with boss head, i. d. = 10 cm	37701-01
3	Universal clamp	37715-00
1	Students thermometer,-10...+110°C, l = 180 mm	38005-02
1	Test tube holder, up to d 22mm	38823-00
1	Protecting glasses, clear glass	39316-00
2	Rubber stopper, d=22/17 mm, without hole	39255-00
2	Rubber stopper, d = 22/17 mm, 1 hole	39255-01
2	Rubber stopper 26/32 , without hole	39258-00
1	Rubber stopper 26/32, 2 holes 7 mm	39258-02
1	Rubber tubing, i.d. 6 mm	39282-00
1	Rubber gloves, size S (7)	39325-00
1	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
2	Iron rod, d = 2 mm, l = 200 mm	331660
1	Holder for two electrodes	45284-01
1	Magnifier, 3x and 6x	64601-00
1	Tweezers,straight,blunt, 160 mm	64610-02
1	Scissors, l = 110 mm, straight, point blunt	64616-00
6	Pipette with rubber bulb	64701-00
2	Petri dish, d 100 mm	64705-00
1	Test tube,180x20 mm,side arm,PN19	36330-00
1	Test tube brush w. wool tip,d25mm	38762-00
1	Laboratory pen, waterproof, black	38711-00
1	Pipette with rubber bulb, long	64821-00
2	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
2	Lid for TESS box, plastic	15205-00
2	Carton 430 x 310 x 160mm	171673
1	Foam insert for 15302-88	171586
1	Sticker for 15302-88	171612
1	Sticker for 15302-88, box 2	171981
1	Storage information for 15302-88, box 1	171635
1	Storage information for 15302-88, box 2	171982
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00
1	Cobra SMARTsense - pH, 0 ... 14	12921-00

Acids, Bases, Salts, necessary accessories for 1 group (13435-88)

1	Butane burner with cartridge	32180-00
1	Portable Balance, OHAUS CS200E, 200 g / 0,1 g	48910-00

Acids, Bases, Salts, consumables and chemicals for 10 groups (13436-88)

1	Acetone, chemical pure, 250 ml	30004-25
2	Aluminium sheet, 0.2mm 50 g	30017-05
1	Ammonium chloride 250 g	30024-25
1	Barium hydroxide 250 g	30034-25
1	Calcium, granular 50 g	30049-05
1	Citric acid 250 g	30063-25
1	Iron powder extra pure, 250 g	30068-25
1	Iron-III chloride, 250 g	30069-25
1	Iron-II sulphate 500 g	30072-50
1	Glycerol, 250 ml	30084-25
1	Iodine resublimed 25 g	30093-04
1	Potassium carbonate,98-100% 250 g	30096-25
1	Potassium chloride 250 g	30098-25
1	Potassium hydroxide pellets,500 g	30103-50
1	Potassium permanganate, chem. pur., 250 g	30108-25
1	Copper-II oxide,powder 100 g	30125-10
1	Litmus solution 100 ml	30127-10
2	Magnesium, ribbon, roll, 25 g	30132-00
1	Sodium hydrogen carbonate 500 g	30151-50
1	Sodium hydroxide, pellets, 500 g	30157-50
1	Ortho-phosphoric acid 85% 250 ml	30190-25
1	Sulphuric acid, 95-98% 500 ml	30219-50
1	Zinc, sheet 250x125x0.5 mm, 200 g	30245-20
1	Sulphur, pieces, 500 g	30277-50
4	Litmus paper, blue, 1 box	30678-01
4	Litmus paper, red, 1 box	30678-02
1	Ammonia solution, 25% 1000 ml	30933-70
1	Aluminium chloride 250 g	31017-25
1	Denaturated alcohol (spirit for burning), 1000 ml	31150-70
2	Water, distilled 5 l	31246-81
1	Acetic acid 99...100%, 500 ml	31301-50
1	Calcium hydroxide solution 1000ml	31458-70
1	Copper-II sulphate, anhydr. 250 g	31495-25
1	Lithium metal, bottle w.can, 25 g	31523-03
1	Magnesium chloride 500 g	31540-50
1	Magnesium oxide 100 g	31546-10
1	Manganese-II chloride,crys. 250 g	31556-25
1	Methyl orange soln., 0.1% 250 ml	31573-25
1	Sodium silicate solution 500 ml	31653-50
1	Phenolphthalein, 0,5% soution in ethanol, 100 ml	31715-10
1	Polyvinyl chloride,powder 250 g	31745-25
1	Crude oil (petroleum),synthetic, 500 ml	31808-50
1	Standard sand,fine 2500 g	31825-79
1	Sulphurous acid,5-6%,g.r. 1000 ml	31832-70
1	Hydrogen peroxide,30%,tech.gr.,1l	31942-70
1	Cotton wool, white 200 g	31944-10
1	Zinc, powder 100 g	31978-10
4	Indicator paper, pH1-14, roll	47004-02
1	Liquid Indicator pH1-13 UNISOL113	47014-02
1	Bromothymol blue, 0.1% sol. 50 ml	48004-05
1	Iron-III oxide, red 500 g	48114-50
1	Wood splints, package of 100	39126-10

Student set Titration and analytical chemistry (15303-88D)

1	Burette, 10 ml, grad. 0.05 ml	47152-01
6	Pipette with rubber bulb	64701-00
2	Volumetric flask 100 ml, IGJ12/21	36548-00
1	Erlenmeyer, wide neck, 100 ml	46151-00
2	Beaker, 50 ml, low form, plastic	36080-00
1	Funnel, d.40 mm, f.burettes	36888-00
1	Graduated pipette, 5 ml : 0,1	36599-00
1	Protecting glasses, clear glass	39316-00
1	Pipettor,bulb,3 valves,100ml max.	47127-02
1	Burette clamp, roller mount.,1pl.	37720-01
1	Support base, variable	02001-00
1	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00
9	Watch glass,dia.40 mm	34569-00
1	Cobalt glass plate, 50x50 mm	38770-00
1	Spatula, double blade, 150 mm	33460-00
1	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
1	Wash bottle, 250 ml, plastic	33930-00
1	Grad.cylinder,high,PP,50ml	46287-01
1	Test tube rack f. 6 tubes, wood	37685-10
1	Laboratory pen, waterproof, black	38711-00
1	Test tube brush w. wool tip,d25mm	38762-00
6	Test tube, 180x18 mm	172070
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert	172253
1	Storage information for 15303-88	172275
1	Sticker for 15303-88	172276
1	Carton 430 x 310 x 160mm	171673

Analytic Chemistry, consumables and chemicals for 10 groups (13439-88)

1	Magnesia rods, 25 pcs	38718-04
1	Eosin for microscopy 25 g	31296-04
1	Hydrochloric acid 37 %, 1000 ml	30214-70
1	Sulphuric acid, 10%, tech.gr., 1000 ml	31828-70
1	Acetic acid 99...100%, 500 ml	31301-50
1	Sodium hydroxide, pellets, 500 g	30157-50
1	Ammonia solution, 25%, 250 ml	30933-25
1	Sodium acetate trihydrate, 250 g	30149-25
1	Litmus solution 100 ml	30127-10
1	Liquid Indicator pH1-13 UNISOL113	47014-02
1	Phenolphthalein, 0,5% soution in ethanol, 100 ml	31715-10
1	Methyl orange soln., 0.1% 250 ml	31573-25
1	Bromothymol blue, 0.1% sol. 50 ml	48004-05
1	pH test sticks 0-14, 100 sticks	30301-08
1	Buffer solution, pH 7.01, 1000 ml	46271-12
1	Sodium chloride 250 g	30155-25
1	Sodium sulphate 500 g	30166-50
1	Sodium carbonate, anhyd. 250 g	30154-25
1	Sodium bromide 100 g	30153-10
1	Strontium chloride-6-hydrate 250g	31853-25
1	Lithium chloride 100 g	31526-10
1	Potassium chloride 250 g	30098-25
1	Copper-II sulphate,cryst. 250 g	30126-25
1	Ammonium chloride 250 g	30024-25
1	Water, distilled 5 l	31246-81
1	Barium chloride 250 g	30033-25
1	Copper-II chloride 100 g	30121-10
1	Silver nitrate solution 5% 100 ml	30223-10
1	Magnesium chloride 500 g	31540-50
1	Potassium hydroxide pellets,500 g	30103-50
1	Potassium carbonate,98-100% 250 g	30096-25
1	Potassium nitrate 250 g	30106-25
1	Aluminium chloride 250 g	31017-25

Analytical Chemistry, necessary accessories for 1 group (13440-88)

1	Magnetic stirrer without heating, 3 ltr., 230 V	35761-99
1	Butane burner f.cartridge 270+470	47536-00
1	Butane cartridge CV 300 Plus, 240 g	47538-01
1	Portable Balance, OHAUS YA102	49212-00
1	Magnetic stirring bar 15 mm, cylindrical	46299-01

Student set Analytical Chemistry with Cobra4 Mobile-Link (15303-77)

1	Burette, 10 ml, grad. 0.05 ml	47152-01
6	Pipette with rubber bulb	64701-00
2	Volumetric flask 100 ml, IGJ12/21	36548-00
1	Erlenmeyer, wide neck, 100 ml	46151-00
2	Beaker, 50 ml, low form, plastic	36080-00
1	Funnel, d.40 mm, f.burettes	36888-00
1	Graduated pipette, 5 ml : 0,1	36599-00
1	Protecting glasses, clear glass	39316-00
1	Pipettor,bulb,3 valves,100ml max.	47127-02
1	Burette clamp, roller mount.,1pl.	37720-01
1	Support base, variable	02001-00
1	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00
1	Boss head	02043-00
1	Cobra4 Sensor-Unit pH, BNC connector	12631-00
1	Cobra4 Mobile-Link 2 incl. accessories: battery, USB cable, charger and SD memory card	12620-10
9	Watch glass,dia.40 mm	34569-00
1	Cobalt glass plate, 50x50 mm	38770-00
1	Spatula, double blade, 150 mm	33460-00
1	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
1	Wash bottle, 250 ml, plastic	33930-00
1	Grad.cylinder,high,PP,50ml	46287-01
1	Test tube rack f. 6 tubes, wood	37685-10
1	Laboratory pen, waterproof, black	38711-00
1	Test tube brush w. wool tip,d25mm	38762-00
6	Test tube, 180x18 mm	172070
1	pH-electrode, plastic, refillable, BNC	46266-15
1	Support rod with hole, stainless steel, 10 cm	02036-01
1	Spring balance holder	03065-20
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert	172253
1	Storage information for 15303-77	172254
1	Sticker for 15303-77	172255
1	Carton 430 x 310 x 160mm	171673

Student set Organic chemistry digital (15304-88D)

1	Support base, variable	02001-00
3	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00
3	Boss head	02043-00
1	Digital stop watch, 24 h, 1/100 s, 1 s	24025-00
4	Porcelain dish, 75ml, d = 80 mm	32516-00
2	Wire gauze with ceramic, 160 x 160 mm	33287-01
1	Combustion spoon, l=300 mm	33346-00
1	Spoon, special steel	33398-00
1	Crucible tongs, 200 mm, stainless steel	33600-00
1	Dish, plastic, 150x150x65 mm	33928-00
1	Wash bottle, 250 ml, plastic	33930-00
1	Glass tube,straight,400 mm,8 mm	64132-00
1	Funnel, plastic, dia.50mm	36890-00
2	Watch glass, dia.60 mm	34570-00
1	Round bottom flask w. side arm, 100 ml, PN19	34885-00
2	Beaker, 150ml, low-form	46060-00
1	Beaker, 250 ml, low-form	46054-00
1	Test tube,180x20 mm,DURAN, PN19	36293-00
2	Erlenmeyer flask 100 ml, narrow neck, PN 19	36418-00
1	Graduated cylinder, 10 ml, plastic	36636-00
1	Grad.cylinder,high,PP,50ml	46287-01
1	Glass tube, 85 x 60 mm	322287
1	Glass tube, hooked shape with tip	322288
2	Glass tube, right-angled 230x 55	322293
1	Grad. Pipette D=8, L=200mm	167557
1	Glass tube 200 mm ext. d=8 mm	64807-00
1	Dropping funnel with drip nozzle, 50ml	36912-00
2	Safety tube,-fermentation tube-	36935-00
8	Test tube, 180x18 mm	172070
2	Test tube,180x20 mm,side arm,PN19	36330-00
1	Test tube brush w. wool tip,d25mm	38762-00
1	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10
1	Ring with boss head, i. d. = 10 cm	37701-01
3	Universal clamp	37715-00
1	Test tube,200x30 mm	37660-01
1	Lab thermometer,-10..+150C	38058-00
1	Test tube holder, up to d 22mm	38823-00
1	Laboratory pen, waterproof, black	38711-00
6	Rubber stopper, d=22/17 mm, without hole	39255-00
3	Rubber stopper, d = 22/17 mm, 1 hole	39255-01
1	Rubber tubing, i.d. 6 mm	39282-00
1	Rubber bulb, double	39287-00
1	Protecting glasses, clear glass	39316-00
1	Rubber gloves, size S (7)	39325-00
1	Glass rod, boro 3.3, l=200mm, d=6mm	40485-04
1	Tweezers, l = 130 mm, straight, blunt	64610-00
1	Scissors, l = 110 mm, straight, point blunt	64616-00
4	Pipette with rubber bulb	64701-00
1	Pipette bottle DIN 18, 10 ml, clear	172110
2	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
2	Lid for TESS box, plastic	15205-00
1	Schaumstoffeinsatz fÃ¼r 15304-88 TESS advanced Chemie Set Organische Chemie, CH-4	172030
1	Storage information for 15304-88, box 1	172031
1	Storage information for 15304-88, box 2	172100
1	Sticker for 15304-88, box 1	172032
1	Sticker for 15304-88, box 2	172101
2	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00

Organic Chemistry, consumables and chemicals for 10 groups (13438-88)

1	Acetaldehyde, 98-100% 250 ml	30001-25
1	Acetone, extra pure, 1000 ml	30004-70
1	Ethanol extra pure ab.95% 1000 ml	30008-70
1	Activated carbon, granular 250 g	30011-25
1	Aluminium oxide 250 g	30020-25
1	N-butyric acid 100 ml	30047-10
1	Calcium acetate 100 g	30050-10
1	Citric acid 250 g	30063-25
1	Iron-III chloride, 250 g	30069-25
1	Ethyl acetate 250 ml	30075-25
1	Fehling's solution I 250 ml	30079-25
1	Fehling's solution II 250 ml	30080-25
1	Glycerol, 250 ml	30084-25
1	Ethylene glycol 250 ml	30085-25
1	Urea, 250 g	30086-25
1	Charcoal powder 250 g	30087-25
1	Isopropyl alcohol, extra pure, 1000 ml	30092-70
1	Iodine potassium iodide solution	30094-10
1	Potassium carbonate,98-100% 250 g	30096-25
1	Potassium permanganate, chem. pur., 250 g	30108-25
1	Copper-II oxide,powder 100 g	30125-10
1	Litmus solution 100 ml	30127-10
1	Magnesium, ribbon, roll, 25 g	30132-00
1	Methanol 500 ml	30142-50
1	Litmus paper, red, 1 booklet	30207-00
1	Sulphuric acid, 95-98% 500 ml	30219-50
1	Stearic acid 250 g	30228-25
1	D(+)-glucose 1-hydr. 250 g	30237-25
1	Sulphur, pieces, 500 g	30277-50
1	Aluminium carbide 25 g	31016-04
1	Aluminium sulphate 500 g	31022-50
1	N-amyl alcohol 500 ml	31051-50
1	N-butanol 250 ml	31142-25
1	Denaturated alcohol (spirit for burning), 1000 ml	31150-70
1	Casein, alkali-soluble 100 g	31188-10
2	Water, distilled 5 l	31246-81
1	Acetic acid 99...100%, 500 ml	31301-50
1	Stand.petrol b.p.65-95 C 1000 ml	31311-70
1	n-hexane 250 ml	31369-25
1	Isobutyl alcohol 250 ml	31393-25
1	Calcium hydroxide solution 1000ml	31458-70
1	Copper-II sulphate, anhydr. 250 g	31495-25

1	Magnesium chloride 500 g	31540-50
1	Phenolphthalein, 0,5% soution in ethanol, 100 ml	31715-10
1	Polyvinyl chloride,powder 250 g	31745-25
1	Propionic acid, 500 ml	31753-50
1	Propyl alcohol,normal 250 ml	31754-25
1	Crude oil (petroleum),synthetic, 500 ml	31808-50
1	Schiff's reagent 250 ml	31827-25
1	Silver foil, 150 x150 x 0.1 mm, 25 g	31839-04
1	Sudan-III solution,alcohol 250 ml	31861-25
1	Cotton wool, white 200 g	31944-10
1	Iron wool 200 g	31999-20
1	Indicator paper, pH1-11, book	47006-01
1	Calcium carbide,granul. 250 g	48018-25
1	Wood splints, package of 100	39126-10
1	Formic acid 75% 250 ml	30023-25

Student set Chemistry of polymers digital (15305-88D)

1	Support base, variable	02001-00
1	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00
1	Boss head	02043-00
1	Porcelain dish, 75ml, d = 80 mm	32516-00
1	Iron basin, d 100 mm	33201-00
1	Triangle w.pipeclay, l 50mm	33277-00
1	Wire gauze with ceramic, 160 x 160 mm	33287-01
1	Spoon, special steel	33398-00
1	Knife, stainless	33476-00
2	Crucible tongs, 200 mm, stainless steel	33600-00
1	Dish, plastic, 150x150x65 mm	33928-00
1	Wash bottle, 250 ml, plastic	33930-00
1	Mold, spherical, diameter 40mm	35033-00
1	Beaker, 150ml, low-form	46060-00
1	Beaker, 400 ml, low-form	46055-00
1	Beaker, 100 ml, low form, plastic	36081-00
2	Beaker, 250 ml, low form, plastic	36082-00
3	Test tube,180x20 mm,DURAN, PN19	36293-00
1	Test tube,180x20 mm,side arm,PN19	36330-00
1	Erlenmeyer flask 100 ml, narrow neck, PN 19	36418-00
1	Graduated pipette, 1 ml	36595-00
1	Graduated pipette, 5 ml : 0,05	36598-00
1	Graduated cylinder, 10 ml, plastic	36636-00
1	Glass tube, 85 x 60 mm	322287
3	Glass tube, right-angled	36701-07
12	Test tube, 180x18 mm	172070
1	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10
1	Ring with boss head, i. d. = 10 cm	37701-01
1	Universal clamp	37715-00
1	Students thermometer,-10...+110°C, l = 180 mm	38005-02
1	Lab thermometer,-10..+250C	38065-00
1	Test tube brush w. wool tip,d25mm	38762-00
1	Test tube holder, up to d 22mm	38823-00
2	Rubber stopper, d=22/17 mm, without hole	39255-00
3	Rubber stopper, d = 22/17 mm, 1 hole	39255-01
1	Protecting glasses, clear glass	39316-00
1	Rubber gloves, size S (7)	39325-00
2	Glass rod, boro 3.3, l=200mm, d=6mm	40485-04
1	Sieve, fine mesh, d=60 mm	40968-00
1	Grad.cylinder,high,PP,50ml	46287-01
1	Pipettor,bulb,3 valves, 10ml max.	47127-01
1	Tweezers, l = 130 mm, straight, blunt	64610-00
1	Scissors, l = 110 mm, straight, point blunt	64616-00
2	Pipette with rubber bulb	64701-00
2	Petri dish, d 40 mm	64704-00
2	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
2	Lid for TESS box, plastic	15205-00
1	Foam for 15305-88	172036
1	Storage information for 15305-88, box 1	172037
1	Storage information for 15305-88, box 2	172075
1	Sticker for 15305-88, box 1	172038
1	Sticker for 15305-88, box 2	172076
2	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00

Chemistry of polymers, necessary accessories for 1 group (13482-88)

1	Portable Balance, OHAUS JE120	48910-00
1	Butane burner with cartridge	32180-00

Chemistry of polymers, consumables and chemicals for 10 groups (13483-88)

1	Acetaldehyde, 98-100% 250 ml	30001-25
1	Fehling's solution I 250 ml	30079-25
1	Fehling's solution II 250 ml	30080-25
1	Glycerol, 250 ml	30084-25
1	Urea, 250 g	30086-25
1	Iodine potassium iodide solution	30094-10
1	Potassium permanganate, chem. pur., 250 g	30108-25
1	Copper foil, 0.1 mm, 100 g	30117-10
1	Copper-II oxide,powder 100 g	30125-10
1	Sodium carbonate, anhyd. 250 g	30154-25
1	Sodium chloride, 500 g	30155-50
1	Sodium hydroxide, pellets, 500 g	30157-50
1	Resorcin,recryst. 50 g	30209-05
1	Hydrochloric acid 37 %, 1000 ml	30214-70
1	Sulphuric acid, 95-98% 500 ml	30219-50
1	Starch,soluble 100 g	30227-10
1	D(+)-glucose 1-hydr. 250 g	30237-25
10	Zinc, sheet 250x125x0.5 mm, 200 g	30245-20
1	Oxalic acid cryst. 100 g	30268-10
1	AH-salt 100 g	30910-10
1	Benzine, tech.gr.,100-140C,1000ml	30037-70
1	Benzoyl peroxide/25% H20 25 g	30977-04
1	Acrifix 190, 1000 g	31003-70
1	Denaturated alcohol (spirit for burning), 1000 ml	31150-70
1	Casein, alkali-soluble 100 g	31188-10
2	Water, distilled 5 l	31246-81
1	Acetic acid 99...100%, 500 ml	31301-50
1	Dyestuffs, set of 9	31329-00
1	Hexamethylene diamine 25 g	31367-04
1	Calcium hydroxide solution 1000ml	31458-70
1	Copper-II sulphate, anhydr. 250 g	31495-25
1	Phenol,liquefied 250 ml	31713-25
1	Phenolphthalein, 0,5% soution in ethanol, 100 ml	31715-10
1	Sample set for study of plastics, 60 pcs. of each species	31730-00
1	Polyvinyl chloride,powder 250 g	31745-25
2	PVC-plates,pack.5 pcs.	31751-02
1	Standard sand,fine 2500 g	31825-79
1	Sebacoyn dichloride f.synth.25 ml	31833-04
1	Silicone oil 500 ml	31849-50
1	Styrene 250 ml	31858-25
8	Cardboard beakers, 580 ml, 5 pcs	32991-00
1	Boiling beads, 200 g	36937-20
1	Test tube, 180x18 mm,100pcs	37658-10
2	PVC tubing, i.d.19mm	39293-00
5	Indicator paper, pH1-14, roll	47004-02
2	Moltoprene A+B, 500 ml each	48294-70
2	Styropor P, 250 g	48492-25

Student set Food chemistry digital (15306-88D)

1	Support base, variable	02001-00
1	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00
1	Boss head	02043-00
1	Porcelain dish, 75ml, d = 80 mm	32516-00
1	Mortar w. pestle, 70ml, porcelain	32603-00
1	Wire gauze with ceramic, 160 x 160 mm	33287-01
1	Spoon, special steel	33398-00
1	Knife, stainless	33476-00
1	Crucible tongs, 200 mm, stainless steel	33600-00
1	Wash bottle, 250 ml, plastic	33930-00
1	Dish, plastic, 150x150x65 mm	33928-00
2	Filter funnel, d = 75 mm, PP	46895-00
3	Watch glass, dia.100 mm	34574-00
3	Beaker, 100 ml, low form, plastic	36081-00
1	Beaker, 250 ml, low-form	46054-00
1	Beaker, 400 ml, low-form	46055-00
1	Beaker, 250 ml, low form, plastic	36082-00
1	Test tube,180x20 mm,DURAN, PN19	36293-00
1	Erlenmeyer nar.neck.,100ml	46141-00
1	Graduated cylinder, 10 ml, plastic	36636-00
1	Graduated cylinder 100 ml, PP transparent	36629-01
10	Test tube, 180x18 mm	172070
1	Test tube brush w. wool tip,d25mm	38762-00
1	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10
1	Ring with boss head, i. d. = 10 cm	37701-01
1	Universal clamp	37715-00
1	Students thermometer,-10...+110°C, l = 180 mm	38005-02
1	Laboratory pen, waterproof, black	38711-00
1	Test tube holder, up to d 22mm	38823-00
3	Rubber stopper, d=22/17 mm, without hole	39255-00
1	Protecting glasses, clear glass	39316-00
1	Rubber gloves, size S (7)	39325-00
3	Glass rod, boro 3.3, l=200mm, d=6mm	40485-04
1	Magnifier, 3x and 6x	64601-00
1	Tweezers, l = 130 mm, straight, blunt	64610-00
10	Pipette with rubber bulb	64701-00
2	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
2	Lid for TESS box, plastic	15205-00
1	Foam insert for 15306-88	172039
1	Storage information for 15306-88	172040
1	Storage information for 15306-88, box 2	172078
1	Sticker for 15306-88, box 1	172041
1	Sticker for 15306-88, box 2	172079
2	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00

Student set Food chemistry, necessary accessories for 1 group (13484-88)

1	Butane burner with cartridge	32180-00
1	Compact Balance, OHAUS TA 302, 300 g / 0.01 g	49241-93

Student set Food chemistry, consumables and chemicals for 10 groups (13485-88)

1	Acetone, extra pure, 1000 ml	30004-70
1	Ethanol extra pure ab.95% 1000 ml	30008-70
1	Activated carbon, granular 500 g	30011-50
1	Ammonia solution, 25% 1000 ml	30933-70
1	Ammonium chloride 250 g	30024-25
1	Ammonium molybdate 50 g	30025-05
1	Citric acid 250 g	30063-25
1	Iron-III chloride 6-hydr. 500 g	30069-50
1	Fehling's solution I 1000 ml	30079-70
1	Fehling's solution II 500 ml	30080-50
1	Gelatin powder 250 g	30083-25
1	Iodine potass.iodide sol., 250 ml	30094-25
1	Potassium permanganate, chem. pur., 250 g	30108-25
1	D-fructose -laevulose- 25 g	30128-04
1	Marble, pieces 1000 g	30140-70
1	Methanol 500 ml	30142-50
1	Methyl red solution (alc.) 50 ml	30145-05
1	Sodium chloride, 500 g	30155-50
1	Sodium hydroxide, pellets, 1000 g	30157-70
1	Trisodium phosphate 12-hydr.250 g	30164-25
1	Nessler's reagent 100 ml	30171-10
1	Pepsin powder,soluble 100 g	30181-10
1	Petroleum ether, 40-60 gr 1000 ml	30184-70
1	Ortho-phosphoric acid 85% 250 ml	30190-25
1	Resorcin,recryst. 50 g	30209-05
1	D (+)-Sucrose 250 g	30210-25
1	Nitric acid 1,40 g/ml, 65%, 500 ml	30213-50
1	Sulphuric acid, 95-98% 500 ml	30219-50
1	Silver nitrate solution 5% 100 ml	30223-10
1	Starch,soluble 250 g	30227-25
1	Stearic acid 250 g	30228-25
1	D(+)-glucose 1000 g	30237-70
1	Caustic soda sol. 32% 1000 ml	30266-70
1	Oxalic acid cryst. 100 g	30268-10
1	Nitrate, nitrite, tester, 100pcs	30346-07
1	L(+) ascorbic acid,cryst. 100 g	31067-10
1	Denaturated alcohol (spirit for burning), 1000 ml	31150-70
2	Water, distilled 5 l	31246-81
1	Acetic acid 99...100%, pure 1 l	31301-70
1	Potass.hydrogen sulphate 250 g	31439-25
1	Calcium hydroxide solution 1000ml	31458-70
2	Magnesium oxide 100 g	31546-10
1	Methylene blue sol.,alkal. 250 ml	31568-25
1	Ninhydrin 10 g	31666-03
1	Hydrochloric acid 25% 1000 ml	31822-70
1	Schiff's reagent 250 ml	31827-25
1	Sudan-III solution,alcohol 250 ml	31861-25
1	Hydrogen peroxide, 30%, 250 ml	31710-25
2	Boiling beads, 200 g	36937-20
5	Indicator paper, pH1-14, roll	47004-02
1	Liquid Indicator pH1-13 UNISOL113	47014-02
5	Indicator paper f.water roll 5m	47015-00
1	Circular filter,d 125 mm,100 pcs	32977-05
2	folded filter,qual.,150 mm,100pcs	47580-04
1	2,6-Dichlorophenol indophenol,5 g	31277-02

TESS Electrochemical measurement set digital (30505-88D)

1	TESS Electrochemical...	30505-88
1	Cobra SMARTsense - Voltage, ± 30 V	12901-00
1	Cobra SMARTsense - Current, ± 1 A	12902-00

Chemistry Electrochemical measurement set necessary accessories for 1 group (13422-88)

1	PHYWE power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93

Electrochemical measurement set, consumables and chemicals for 10 groups (30505-10)

1	Iron-III chloride, 250 g	30069-25
1	Iron-II sulphate 500 g	30072-50
1	Potassium chloride 250 g	30098-25
1	Sodium hydroxide, pellets, 500 g	30157-50
1	Zinc, sheet 250x125x0.5 mm, 200 g	30245-20
1	Zinc oxide 250 g	30248-25
1	Ammonia solution, 25% 1000 ml	30933-70
1	Aluminium, sheet,1x20x200mm,5 pcs	31074-00
1	Water, distilled 5 l	31246-81
1	Silver foil, 150 x150 x 0.1 mm, 25 g	31839-04
1	Zinc chloride, dry, 250 g	31983-25
1	Filter paper,580x580 mm,10 sheets	32976-03
2	Graphite electrode,d=5,l=150,6pc	44510-00
1	Hydrochloric acid,0.1M 1000 ml	48452-70
1	Hydrochloric acid, 1.0 mol/l, 1000 ml	48454-70
1	Sulphuric acid,0.5M 1000 ml	48462-70
5	Emery cloth,158x224mm,2 pieces	01606-00
1	Sheet metal strips, 20 pcs	06532-00

Student set Microscopy (15290-88)

1	Microscopic slides, 50 pcs	64691-00
2	Cover glasses 18x18 mm, 50 pcs.	64685-00
12	Beaded rim glass, 30 x 50 mm	33624-01
10	Reagent bottle,scr.cap,cl.,30ml	46190-00
1	Dissecting needle, pointed	64620-00
1	Dissecting needle, lancet-shaped	64621-00
1	Scalpel holder	64615-00
1	Scalpel blades,rounded tip,10 off	64615-02
1	Tweezers,straight,pointed,120mm	64607-00
1	Blood lancets, sterile, 200/pkg	64217-00
1	Scissors,straight,pointed,l 110mm	64623-00
1	Spatula, powder, steel, l=150mm	47560-00
1	Dropping pipette with bulb, 10pcs	47131-01
2	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
3	Beaker, 100 ml, low form, plastic	36081-00
3	Beaker, 250 ml, low form, plastic	36082-00
1	Beaker, 1000 ml, low form, plastic	46275-01
1	Graduated cylinder 100 ml, PP transparent	36629-01
1	Petri dishes, plast.,d94mm,20 off	64709-04
1	Funnel, plastic, dia.50mm	36890-00
1	Test tube holder, up to d 22mm	38823-00
1	Magnifier, plastic, 5x, d=35mm	88002-01
1	Graduated pipette 10 ml	36600-00
1	Pipettor,bulb,3 valves, 10ml max.	47127-01
1	Labels for microscopic slides, 120/pkg	64703-00
1	Microscopic slides, in box	13290-11
1	Storage information for 15290-88	171655
1	Foam insert for 15290-88	171641
1	Lid for TESS box, plastic	15205-00
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Sticker for 15290-88	171646
1	Carton 430 x 310 x 160mm	171673

Student set Microscopy, necessary accessories for 1 group (13443-88)

1	Portable Balance, OHAUS JE120	48895-00
1	Euromex BioBlue BB.4250 microscope	EUR-BB-4250
1	Knife, stainless	33476-00

Student set Microscopy, consumables for 10 groups (13444-88)

1	Chemicals set for TESS advanced Microscopy	13290-10
1	Entellan, quick-embedding, 100 ml	31294-10
1	Elder pith, 10 sticks	31372-00
1	Chromatographic paper 100 stripes	32972-00
1	Weighing dishes, square shape, 84 x 84 x 24 mm, 500 pcs.	45019-50

Student set General biology digital (15296-88D)

6	Petri dish, d 100 mm	64705-00
4	Bottle,nar.mouth,100ml,clear,p.st	41101-01
3	Watch glass, dia.60 mm	34570-00
3	Graduated pipette 10 ml	36600-00
1	Clinical thermometer, digital	04166-00
2	Test tube holder, up to d 22mm	38823-00
2	Pipette with rubber bulb	64701-00
1	Support base, variable	02001-00
1	Rubber bands, 50 pieces	03920-00
1	Mortar w. pestle, 70ml, porcelain	32603-00
1	Circular filter,d 90 mm,100 pcs	32977-03
1	Wire gauze with ceramic, 160 x 160 mm	33287-01
1	Knife, stainless	33476-00
1	Snap-cap vial, d=30mm, h=100mm	171972
1	Filter funnel, PP, d=60 mm	47318-00
1	Beaker, 100 ml, high-form	46026-00
3	Beaker, 250 ml, low form, plastic	36082-00
1	Beaker, 600 ml, high-form	46029-00
2	Glass tube L= 80mm	322298
1	Rubber bulb, with glass tube	64170-00
1	Graduated pipette, 1 ml	36595-00
1	Graduated cylinder 100 ml, PP transparent	36629-01
8	Test tube, 160 x 16 mm	167704
1	Test tube rack f. 6 tubes, wood	37685-10
1	Support ring, i.d. 130mm,w.boss	37722-03
1	Students thermometer,-10...+110°C, l = 180 mm	38005-02
1	Laboratory pen, waterproof, black	38711-00
1	Spoon, with spatula end, 18 cm, plastic	38833-00
1	Protecting glasses, clear glass	39316-00
1	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
1	Rubber stopper, d = 22/17 mm, 1 hole	39255-01
1	Pipettor,bulb,3 valves, 10ml max.	47127-01
1	Tweezers,straight,pointed,120mm	64607-00
1	Dissecting needle, pointed	64620-00
1	Scissors,straight,pointed,l 110mm	64623-00
1	Rubber tubing, i.d. 6 mm	39282-00
1	Physiological vision figures	64949-00
1	Optical illusion figures	64948-00
1	Magnifier, plastic, 5x, d=35mm	88002-01
1	Support rod 300 mm with thread M6	331590
1	Support rod 300 mm with threaded hole M6	331591
2	Lid for TESS box, plastic	15205-00
2	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Foam insert for 15296-88	171639
1	Sticker for 15296-88, box 1	171647
1	Sticker for 15296-88, box 2	171983
1	Storage information for 15296-88, box 1	171656
1	Storage information for 15296-88, box 2	171987
2	Carton 430 x 310 x 160mm	171673
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00

Student set General biology, necessary accessories for 1 group (13486-88)

1	Butane burner with cartridge	32180-00
1	Portable Balance, OHAUS JE120	48895-00

Student set General biology, consumables for 10 groups (13487-88)

1	Fehling's solution I 250 ml	30079-25
1	Fehling's solution II 250 ml	30080-25
1	Glycerol, 250 ml	30084-25
1	Iodine potass.iodide sol., 250 ml	30094-25
1	D-fructose -laevulose- 25 g	30128-04
1	Sodium chloride, 500 g	30155-50
1	Sodium hydroxide, pellets, 500 g	30157-50
1	Pepsin powder,soluble 100 g	30181-10
1	D(+)-glucose 1-hydr. 250 g	30237-25
1	Hydrochloric acid,approx.5% 250ml	30315-25
2	Litmus paper, red, 1 box	30678-02
1	Denaturated alcohol (spirit for burning), 1000 ml	31150-70
1	Water, distilled 5 l	31246-81
1	Ox gall, desiccated 100 g	31310-10
1	Calcium hydroxide solution 1000ml	31458-70
1	D(+)-Lactose, powder 100 g	31577-10
1	Pancreatin 25 g	31699-04
1	Peptone,dry,from meat 50 g	31708-05
1	Fuchsine acid -rubin s-, 25 g	31813-04
1	Sudan-III solution,alcohol 250 ml	31861-25
1	Cotton wool, white 200 g	31944-10
1	Filter paper,580x580 mm,10 sheets	32976-03
1	Wire gauze squ., copper, 150x150 mm	33290-00
1	Indicator paper f.water roll 5m	47015-00

Student set Biochemistry and plant physiology digital (15260-88D)

1	Cobra SMARTsense - pH, 0 ... 14	12921-00
1	Cobra SMARTsense - Light, 1 ... 128 kLX	12906-00
1	Cobra SMARTsense - Pressure, 20 ... 400 kPa	12905-00
2	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00
1	Cobra SMARTsense - Conductivity, 0 ... 20000 µS/cm, 0 ... 100 °C	12922-00
1	Cobra SMARTsense - C02, ... 0 ... 100000 ppm	12932-00
1	Cobra SMARTsense - Oxygen, 0 ... 20 mg/l	12933-00
1	Halogen lamp with reflector, 12 V / 20 W	05780-00
1	Mount for halogen lamp with reflector	05781-00
2	Thermos flask 500 ml	64841-00
2	Rubber stopper 34/41, 2 holes 7 mm	39261-02
1	Support base, variable	02001-00
4	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00
3	Boss head	02043-00
2	Universal clamp	37715-00
1	Test tube,200x30 mm,DURAN, PN29	36294-00
1	Rubber stopper 26/32, 1 hole 7 mm	39258-01
1	Test tube,200x30 mm,side arm,PN29	36331-00
1	Rubber stopper 26/32, 1 hole 1,5 mm	39258-09
1	Erlenmeyer flask, narrow neck, PN29	36424-00
1	Beaker, 400 ml, high-form	46028-00
1	Glass tube, straight, l=80 mm, 10pcs.	36701-65
1	Rubber tubing, i.d. 6 mm	39282-00
1	Pipettor,bulb,3 valves, 10ml max.	47127-01
1	Graduated pipette 10 ml	36600-00
1	Graduated cylinder, 50 ml, plastic	36628-01
1	Portable Balance, OHAUS YA302	49213-00
1	Plastilina	167707
3	Erlenmeyer flask 100 ml, narrow neck, PN 19	36418-00
1	Spatula, double blade, 150 mm	33460-00

Basic set Cobra4 Biochemistry and plant physiology (15260-88)

1	USB charger for Cobra4 Mobile-Link 2 and Wireless/USB-Link	07932-99
1	Cobra4 Wireless/USB-Link incl. USB cable	12601-10
1	Cobra4 Sensor-Unit pH, BNC connector	12631-00
1	Cobra4 Sensor-Unit Conductivity+	12632-00
1	Cobra4 Sensor-Unit Weather	12670-00
1	Holder for Cobra4 with support rod	12680-00
2	Immersion probe NiCr-Ni, steel, -50...400 °C	13615-03
1	Conductivity temperature probe Pt1000	13701-01
1	Test tube,200x30 mm,DURAN, PN29	36294-00
1	Test tube,200x30 mm,side arm,PN29	36331-00
2	Universal clamp	37715-00
1	Universal clamp with joint	37716-00
1	Rubber stopper 26/32, 1 hole 7 mm	39258-01
1	Rubber stopper 26/32, 1 hole 1,5 mm	39258-09
2	Rubber stopper,d=41/34mm, 2 holes	39261-02
1	pH-electrode, plastic body, gel, BNC	46265-15
1	Dialysis tubing 24A,diam.44mm, 1m	64208-00
2	Dialysis clips, 2	64209-00
2	Thermos flask	64841-00
1	Demo advanced Biologie Handbuch Cobra4Biochemie & Pflanzenphysiologie	01331-01
1	Demo advanced Biology Manual Cobra4 Biochemistry & plant physiology	01331-02
2	Support base, variable	02001-00
1	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00
3	Support rod, stainless steel, 500 mm	02032-00
2	Boss head	02043-00
1	Hot/cold air blower, 1800 W	04030-93
1	Ceramic lamp socket E27, with reflector, switch and security	06751-01
1	Filament lamp, 220V/120W, with reflector	06759-93
1	Cobra4 Sensor-Unit Thermodynamics, pressure abs. 2 bar and 2x temperature NiCr-Ni	12638-01

Student set Environment and outdoors digital for 4 work groups (12626-88D)

1	pH-electrode, plastic body, gel, BNC	46265-15
1	Buffer solution tablets pH4, 100	30281-10
1	Buffer solution tablets pH10, 100	30283-10
1	Standard solution 1413µS/cm(25°C), 460ml	47070-02
1	Protection sleeve for electrode with a diameter of 12 mm	37651-15
1	Labels for microscopic slides, 120/pkg	64703-00
1	Bottle, square, HDPE, 100ml	47417-00
1	Beaker, 250 ml, low form, plastic	36013-01
1	Wash bottle, plastic, 500 ml	33931-00
1	Foam insert for Environmental Experimentation case	12622-25
1	Case with insert	331694
1	Carton 500 X 150 X 130 MM	155955
1	Cobra SMARTsense - Humidity, 0 ... 100 %	12931-00
1	Cobra SMARTsense - pH, 0 ... 14	12921-00
1	Cobra SMARTsense - Conductivity, 0 ... 20000 µS/cm, 0 ... 100 °C	12922-00
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00
1	Cobra SMARTsense - Light, 1 ... 128 kLX	12906-00

Student set Soil examination (30836-88)

6	Dish, plastic, 150x150x65 mm	33928-00
6	Brush, fine	64702-00
6	Nature viewer 5x, lens d=42mm	64600-00
1	Snap-cap vials,d=30mm,h=100m-m,10p	33623-03
6	Rubber stopper,d=27/21mm, 2 holes	39257-02
2	Glass tube, straight, l=80 mm, 10/pkg.	36701-65
6	PVC tubing, i.d. 7 mm	03985-00
6	Wire gauze square 150MMX150mm	33284-00
1	Soil density probe, l=58 cm	64244-00
6	Garden trowel, steel	40484-02
6	Beaker, 250 ml, low form, plastic	36013-01
6	Funnel, cut of sloped	329473
6	Dropping bottle,plastic,50ml	33920-00
6	Measuring scoop, PP, white, 10 ml	47457-00
1	Plastic sack, flat, DIN A5, 100pc	46444-01
1	Bottle, square, LDPE, 500ml, GL32	47396-00
1	Bottle, square, LDPE, 500ml, GL65	47400-00
1	Graduated cylinder 100 ml, PP transparent	36629-01
1	Measuring tape, l = 2 m	09936-00
1	Spring balance,transparent, 100 N	03065-07
1	Portable Balance, OHAUS YA501	49214-00
1	pH test sticks 2.0-9.0,100 sticks	30301-06
1	TESS Applied Sciences manual Bodenuntersuchungen	30836-01
1	Petri dishes, plastic, d=94mm, 20/pkg	64709-03
1	TESS Applied Sciences manual examination of soil	30836-02
1	Nitrate, nitrite, tester, 100 pcs	30346-07
1	Case with lid	172043
1	Foam insert for soil examination set	30836-25
1	Circular filter,d 150 mm,100 pcs	32977-06

Examination of soil consumables for 10 groups (30836-10)

1	Hydrochloric acid,10%,tech.gr.,1l	30933-25
1	Calcium chloride 6-hyrdr. 250 g	48020-25
1	Hydrochloric acid,10%,tech.gr.,1l	31821-70

Student set Biological water analysis (30834-88)

1	TESS Biology manual	30834-01
1	Foam insert for Case	167912
6	Sieve, narrow mesh, 160mm dia	65854-00
1	Fishing net f.aquatic insects	64576-30
6	Dish, plastic, 150x150x65 mm	33928-00
6	Tweezers,curved,pointed, 100 mm	64608-00
4	Brush, fine	64702-00
2	Painters brush, hard	40979-00
12	Weighing dish, PS, 85 x 85 x 7 mm	167918
6	Nature viewer 3x, lens d=22 mm	64599-00
6	Nature viewer 5x, lens d=42mm	64600-00
1	Snap-cap vials,d=24mm,h=52mm,10p.	33621-03
1	Snap-cap vials,d=30mm,h=100m-m,10p	33623-03
1	Petri dishes, plast.,d94mm,20 off	64709-04
2	Ruler, plastic, 200 mm	09937-01
1	Sticker for 30834-88	329472
1	Carrying case, universal, PHYWE	168280
1	Dropping pipette with bulb, 10pcs	47131-01
1	Vernier calliper, plastic	03011-00

Student set Electrophysiology digital (15674-88D)

1	Cobra SMARTsense - EKG, 0 ... 4,5 mV	12934-00
1	Cobra SMARTsense - Spirometer, ± 10 l/s	12936-00
1	Cobra SMARTsense - Heart Rate, 30 ... 200 bpm	12935-00
1	Cobra SMARTsense - Temperature, - 40 ... 120 °C	12903-00
1	Blood pressure measuring unit	64234-00

Student set Molecular biology, (15310-88)

1	Microliterpipette 2-20 µl	47141-10
1	Microliterpipette 20-200 µl	47141-11
1	Pipette tips, 2-200 µl, racked	47148-11
1	Electrophoresis chamber, horizontal	173187
1	Spatula, steel, l=185mm	46952-00
1	Spoon, nickel-plated, 180 mm	33392-00
1	Protecting glasses, clear glass	39316-00
1	Staining dish, UV permeable, PETG	35023-20
1	TESS box, plastics, high, 305 x 425 x 150 mm	15200-00
1	Lid for TESS box, plastic	15205-00
1	Carton 430 x 310 x 160mm	171673
1	Foam insert for 15310-88	172151
1	Sticker for 15310-88	172152
1	Storage information for 15310-88	172153

Biology Set Molecular Biology, necessary accessories for 5 groups (13448-88)

1	Hotplate magnetic stirrer with connection for electronic contact thermometer, 3 ltr., 230 V	35760-93
1	Erlenmeyer flask, narrow neck, 500 ml	36121-00
1	Graduated cylinder, high ,PP, 500 ml	46288-01
1	Magnetic stirring bar, 50 mm, cylindrical	46299-03
1	Precision Balance, Sartorius ENTRIS822-1S, 820 g / 0,01 g	49295-99
1	Electrophoresis power supply 100V/200V	65966-93

Demo PHYWE

DEMO beginner Applied Sciences set Light, Air, Earth (13244-88)

1	Light box, halogen 12 V/20 W with 2.1 mm socket for small	09801-01
1	Bottom with stem for light box	09802-10
1	Power supply 12V / 2A	11262-99
1	Slide mount for optical bench	09822-00
1	Diaphragm with hole, d=20mm	09816-01
1	Model earth/moon	09825-00
1	Support base, variable	02001-00
2	Support rod, stainless steel, l = 600 mm, d = 10 mm	02037-00
1	Magnifier w.handle, 6x, d=30mm	87004-06
1	Screen, white, 150x150 mm	09826-00
1	Cardboards 200x300 mm, black, 10 pieces	06306-01
1	Erlenmeyer flask, narrow neck, 500 ml, PN 29	36421-00
1	Glass beaker DURAN®, low form, 400 ml	36014-00
1	Glass beaker DURAN®, low form, 250 ml	36013-00
1	Funnel, glass, top dia. 80 mm	34459-00
1	Glass tube,right-angled, 10 pcs.	36701-52
1	Rubber stopper 26/32, 1 hole 7 mm	39258-01
1	Rubber stopper 26/32, 2 holes 7 mm	39258-02
1	PVC tubing, i.d. 7 mm	03985-00
2	Porcelain dish 140ml, d 100mm	32518-00
1	Pipette with rubber bulb, long	64821-00
1	Crucible tongs,w.bow,stainl.steel	46964-00
1	Scissors, straight,180 mm	64798-00
1	Protective desk plate 40 x 40 cm	39180-10
1	Protecting glasses, clear glass	39316-00
1	Litmus paper, blue, 1 box	30678-01
1	PVC-plates,pack.5 pcs.	31751-02
1	Garden trowel, steel	40484-02
1	Measuring tape, l = 2 m	09936-00
2	Storage tray, 413 x 240 x 100 mm	47325-02
2	Partition for storage tray, 230 x 95 mm	47326-02

DEMO beginner Applied Sciences set Water (13234-88)

3	Evapor. dish,boro3.3,spout,15ml	46250-00
1	Crucible tongs, 200 mm, stainless steel	33600-00
1	Graduated pipette, 5 ml : 0,1	36599-00
1	Pipettor,bulb,3 valves, 10ml max.	47127-01
1	Dropping pipette with bulb, 10pcs	47131-01
1	Retort stand, h = 750 mm	37694-00
1	Butane burner with cartridge,	32180-00
2	Right angle boss-head clamp	37697-00
2	Universal clamp	37715-00
1	Glass tube, d 38/35mm,l 300mm	64940-00
1	Glass wool 100 g	48154-10
1	Funnel, glass, top dia. 80 mm	34459-00
3	Beaker, 100 ml, low-form	46053-00
2	Beaker, 400 ml, low-form	46055-00
1	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
1	Spoon, special steel	33398-00
1	Distilling bridge GL18/8	35902-15
1	Flask,round,1-neck,250ml,GL25/13	35812-15
1	Erlenmeyer, wide neck, 100 ml	46151-00
1	Rubber stopper 26/32, 1 hole 7 mm	39258-01
1	Glass tube, straight, l=80 mm, 10/pkg.	36701-65
1	Ring with boss head, i. d. = 10 cm	37701-01
1	Wire gauze with ceramic, 160 x 160 mm	33287-01
1	Lab thermometer,-10..+100 °C	38056-00
1	Battery box	06030-21
1	Lamp holder E10, on base plate	06170-00
1	On/off switch	06034-01
1	Filament lamps 1.5V/0.15A,E10,10 pieces	06150-03
1	Flat battery, 4.5 V	07496-01
2	Iron electrode, d 8mm	45204-00
1	Holder for two electrodes	45284-01
4	Connecting cord, 32 A, 500 mm, black	07361-05
1	AQUADUR-Test sticks Water hardne.	47020-01
1	Storage tray, 413 x 120 x 100 mm	47325-01
2	Storage tray, 413 x 240 x 100 mm	47325-02
4	Partition for storage tray, 230 x 95 mm	47326-02
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331585

DEMO beginner Applied Sciences set Heat, 230 V (13234-88)

1	Heating + cooking hotplate,230V	04025-93
1	Stainless Steel pot 3,2 l	05934-00
1	Beaker, 600 ml, high-form	46029-00
1	Test tube, d = 30 mm, l = 200 mm, white	36294-05
1	Test tube, d 30mm, l 200mm, black	36294-06
1	Test tube rack, wood, for 6 tubes d= 30 mm	40569-10
2	Lab thermometer,-10..+100 °C	38056-00
2	Rubber stopper 26/32, 1 hole 7 mm	39258-01
1	Glass tube holder with tape measure clamp	05961-00
1	Graduated vessel, 1 l, with handle	36640-00
2	Heat sensitive paper	04260-00
1	Aluminium rod,U-shaped	05910-00
1	Copper rod, U-shaped	05910-01
1	Glass rod,U-shaped	05911-00
1	Filament lamp, 220V/120W, with reflector	06759-93
1	Ceramic lamp socket E27, with reflector, switch and security plug	06751-01
1	Universal clamp	37715-00
1	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00
1	Convection of liquids tube, small	04510-01
1	Retort stand, h = 750 mm	37694-00
2	Right angle boss-head clamp	37697-00
1	Circular filter,d 70 mm,100 pcs	32977-02
1	Storage tray, 413 x 120 x 100 mm	47325-01
1	Storage tray, 413 x 240 x 100 mm	47325-02
1	Partition 115x95 mm	47326-01
2	Partition for storage tray, 230 x 95 mm	47326-02
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331585

Demo Physics board with stand (02150-00)

DEMO advanced Physics Set Mechanics 1 (15510-88)

1	Clamp on fixing magnet	02151-01
1	Rod on fixing magnet	02151-02
1	Hook on fixing magnet	02151-03
1	Inclined plane f.demonstr.board	02152-00
1	Scale for demonstration board	02153-00
1	Pointers f. Demonst.Board, 4 pcs	02154-01
1	Optical disk, magnet held	08270-09
2	Torsion dynamometer	03069-03
1	Helical spring, 3 N/m	02220-00
2	Weight holder for slotted weights, 10 ghts	02204-00
4	Slotted weight, black, 10 g	02205-01
4	Slotted weight, silver bronze, 10 g	02205-02
2	Slotted weight, black, 50 g	02206-01
2	Slotted weight, silver bronze, 50 g	02206-02
1	Pulley,movable,dia.65mm,w.hook	02262-00
1	Rod for pulley	02263-00
1	Holding pin	03949-00
1	Fish line, l. 100m	02090-00
1	Helical spring, 20 N/m	02222-00
1	Pulley,movable,dia.40mm,w.hook	03970-00
1	Block and tackle, with 4 pulleys	02265-00
1	Center-of-gravity plate	02300-01

2	Balance pan, plastic	03951-00
1	Lever	03960-00
1	Pointer for demonstration lever	03963-00
1	Roller for inclined plane	11301-01
1	Rubber bands, 50 pieces	03920-00
1	Support plate on fixing magnet	02155-00
1	Sinker, aluminum	03903-01
1	Beaker, 600 ml, high-form	46029-00
1	Marker, black	46402-01
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331657
1	Case with lid	172043
1	Foam insert for 15510-88	172021
1	Storage informatino for 15510-88	172022
1	Sticker for 15510-88, top	172023
1	Sticker for 15510-88, sidewise	172082

DEMO advanced Mechanics 1 necessary acessories (15510-01)

1	Glycerol, 250 ml	30084-25
1	Denaturated alcohol (spirit for burning), 1000 ml	31150-70
1	Set of precision weights,1g-50g	44017-00
1	Stop watch, interruption type	03076-01
1	Copper wire, d = 0.2 mm, l = 100 m	06106-00

DEMO advanced Physics Mechanics 2 (15511-88)

1	Scale for demonstration board	02153-00
1	Leaf spring	02228-00
1	Friction block	02240-01
1	Gear wheel, 20 teeth	02350-13
1	Gear wheel, 40 teeth	02351-03
2	Axle on fixing magnet	02151-04
1	Wheel and axle	02360-00
1	Weight, 150 g, for 11060.00	11060-01
1	Clamping holder, 0-13 mm, fixing magnet	02151-07
1	Marker points for demonstration board, 24 pcs	02154-02
2	Syringe holder on fixing magnet	02156-00
1	Overflow vessel on fixing magnet	02158-00
1	Rollercoaster track, fix.magnet	02159-00
1	Immersion probe	02632-00
1	Hollow and solid cylinder	02637-00
2	Glass tube, l = 375 mm	322308
2	Glass tube holder with tape measure clamp	05961-00
1	Support rod,stainl.steel, 100mm	02030-00
2	Silicone tubing, ID 6 mm	47530-00
1	Funnel, plastic, dia.50mm	36890-00
1	Beaker, 100 ml, low form, plastic	36011-01
2	Hose clamp for 5-12 mm diameter	40997-00
2	Gas syringe, 100 ml	02614-00
2	Plunger plate for gas syringes	02618-00
1	Commercial weight, 500 g	44096-50
2	Commercial weight, 200 g	44096-20
1	Storage tray, 413 x 120 x 100 mm	47325-01
1	Rubber caps, pack of 20	02615-03
1	Box, PP (71x54x15mm)	172055
1	Box, PP (98x73x20mm)	172059
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331657
1	Case with lid	172043
1	Foam insert for 15511-88	172024
1	Storage information for 15511-88	172025
1	Sticker for 15511-88, top	172026
1	Sticker for 15511-88, sideways	172083

DEMO advanced Physics Set Linear Motion (Dynamics) (15514-88)

4	Slotted weight, black, 10 g	02205-01
4	Slotted weight, silver bronze, 10 g	02205-02
3	Slotted weight, black, 50 g	02206-01
3	Slotted weight, silver bronze, 50 g	02206-02
1	Weight holder, silver bronze, 1 g	02407-00
1	Silk thread, l = 200 m	02412-00
20	Slotted weight, blank, 1 g	03916-00
1	Plastilina, 1 Stck.	167707
1	Pulley,movable,dia.40mm,w.hook	03970-00
4	Connecting cord, 32 A, 1000 mm, red	07363-01
5	Connecting cord, 32 A, 1000 mm, yellow	07363-02
5	Connecting cord, 32 A, 1000 mm, blue	07363-04
1	Measuring tape, l = 2 m	09936-00
2	Tube with plug	11202-05
2	Needle with plug	11202-06
1	Fork with plug	11202-08
1	Rubber bands for fork with plug, 10 pcs	11202-09
1	Plate with plug	11202-10
1	Magnet w.plug f.starter system	11202-14
4	Light barrier, compact	11207-23
1	Demonstration track, aluminium, 1.5 m	11305-00
1	Pulley for demonstration track	11305-10
1	Holder for pulley	11305-11
2	End holder for demonstration track	11305-12
2	Cart, low friction sapphire bearings	11306-00
2	Weight for low friction cart, 400 g	11306-10
4	Holder for light barrier	11307-00
2	Shutter plate for low friction cart, width: 100 mm	11308-00
1	Starter system for demonstration track	11309-00
1	Friction accessory for low friction cart	11310-00
1	Equiforce launcher	11311-00
1	Timer 4-4	13604-99
1	Support clamp for small case	02043-10
1	Portable Balance, OHAUS CS2000E	48911-00
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331657
2	Box, PP (98x73x20mm)	172059
1	Box, PP (71x54x15mm)	172055
1	Case with lid	172043
1	Foam insert for 15514-88	172299
1	Storage information for 15514-88	173020
1	Sticker for 15514-88, top	173021
1	Sticker for 15514-88, sideways	173022

DEMO advanced Mechanics 2 necessary acessories (15511-01)

1	Ruler, l = 50 cm	09851-04
1	Microspoon, steel	33393-00
1	Patent Blue V (sodium salt), 25 g	48376-04
1	Spirit level	02124-00

DEMO advanced Physics Set Heat (15530-88)

1	Rod on fixing magnet	02151-02
2	Clamp.holder d=28-36mm fix.magn.	02151-06
2	Clamping holder, 0-13 mm, fixing magnet	02151-07
1	Scale for demonstration board	02153-00
1	Pointers f. Demonst.Board, 4 pcs	02154-01
1	Marker points for demonstration board, 24 pcs	02154-02
1	Support plate on fixing magnet	02155-00
1	Holder for Cobra4, magn.	02161-10
1	Burner-holder on fixing magnet	02162-00
1	Wire gauze holder on fix. magnet	02163-00
1	Clamp on holder	02164-00
1	Wire gauze with ceramic, 160 x 160 mm	33287-01
1	Brass tube	04234-11
1	Iron tube	04234-12
1	Aluminium tube	04234-13
1	Collar for linear expansion	04231-55
1	Rotating shaft with pointer	04236-01
1	Thermometer, non-graduated	04256-00
2	Metal bodies, set of 3	04406-00
1	Convection of liquids tube	04510-00
2	Beaker, aluminum, polished	05903-00
1	Aluminium rod,U-shaped	05910-00
1	Copper rod, U-shaped	05910-01
1	Brass rod, U-shaped	05910-02
1	Glass rod,U-shaped	05911-00
1	Test tube, d 30mm, l 200mm, black	36294-06
1	Test tube, d = 30 mm, l = 200 mm, white	36294-05
1	Beaker, 100 ml, low form, plastic	36011-01
1	Beaker, 250 ml, low-form	46054-00
1	Beaker, 400 ml, low-form	46055-00
2	Erlenmeyer flask 100 ml, wide-neck SB 29	36428-00
2	Glass tube L= 80mm	322298
1	Glass tube L =200 mm	322307
2	Glass tube, l = 375 mm	322308
1	Graduated cylinder 100 ml, PP transparent	36629-01
1	Graduated cylinder250 ml, PP transparent	36630-01
1	Pipette with rubber bulb	64701-00
1	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
1	Rubber stopper 26/32, 1 hole 7 mm	39258-01
2	Rubber stopper 26/32, 2 holes 7 mm + 2,5 mm	39258-13
1	Funnel, plastic, dia.50mm	36890-00
2	Silicone tubing, ID 6 mm	47530-00
2	Heat sensitive paper	04260-00
2	Felt sheet, 100 x 100 mm	04404-20
1	Fishing line, l. 20m	02089-00
1	Marker, black	46402-01
1	Microspoon, steel	33393-00
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331657
1	Foam insert for 15530-88	172027
1	Storage information for 15530-88	172028
1	Case with lid	172043
1	Sticker for 15530-88, top	172029
1	Sticker for 15530-88, sideways	172084
1	Box, PP (71x54x15mm)	172055

DEMO advanced Heat necessary accessories (15530-02)

1	Cobra4 Mobile-Link 2 incl. accessories: battery, USB cable, charger and SD memory card	12620-10
1	Cobra4 Sensor-Unit 2 x Temperature, NiCr-Ni	12641-00
2	Immersion probe NiCr-Ni, steel, -50...400 °C	13615-03
1	Glycerol, 250 ml	30084-25
1	Denaturated alcohol (spirit for burning), 1000 ml	31150-70
1	Butane burner with cartridge,	32180-00
1	Boiling beads, 200 g	36937-20
1	Patent Blue V (sodium salt), 25 g	48376-04
1	Support rod, stainless steel, 500 mm	02032-00
1	Water boiler cordless, 1.7 l, 230 V	04027-93
2	Ceramic lamp socket E27, with reflector, switch and security	06751-01
1	Filament lamp, 220V/120W, with reflector	06759-93
	Large-scale display, digital	07157-93

DEMO advanced Applied Sciences Basic Set Renewable Energy basics and thermal energy (15580-88)

1	Connector, straight, module DB	09401-01
4	Connector, angled, module DB	09401-02
2	Connector, T-shaped, module DB	09401-03
2	Connector interrupted, module DB	09401-04
2	Junction, module DB	09401-10
1	Socket for incandescent lamp E10 ,module DB	09404-00
1	Switch on/off, module DB	09402-01
1	Switch, change-over, module DB	09402-02
1	Motor with indicating disc, 5 V, module DB	09469-00
1	Solar battery, 4 cells, with cable, connectors, and magnetpads	06752-21
1	Clamping holder with 2 clamping possibilit, 0-13 mm,fixing magnet	02151-08
1	Scale for demonstration board	02153-00
1	Clamp on holder	02164-00
1	Solar ray collector, magnetic	02165-00
1	Funnel, plastic,cylindrical,300ml	36889-00
1	Thermogenerator, Peltie element	04374-00
1	Heat insulating sheet, felt, 100 mm x 135 mm	04375-00
2	Felt sheet, 100 x 100 mm	04404-20
1	Lid for student calorimeter	04404-01
1	Heating coil with sockets	04450-00
1	Apparatus carrier w. fix. magnet	45525-00
2	Beaker, 250 ml, low-form	46054-00
2	Beaker, 400 ml, low-form	46055-00
1	Agitator rod	04404-10
1	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03
1	Silicone tubing, ID 6 mm	47530-00
1	Pinchcock, width 15 mm	43631-15
1	Filament lamps 1.5V/0.15A,E10,10 pieces	06150-03
1	Connector, angled with socket, module DB	09401-12
1	Motor 12 V, module DB	09475-01
1	Weight holder for slotted weights, 10 ghts	02204-00
4	Slotted weight, black, 10 g	02205-01
1	Slotted weight, black, 50 g	02206-01
1	Fishing line, l. 20m	02089-00
1	Connecting cord, 32 A, 500 mm, yellow	07361-02
2	Connecting cord, 32 A, 500 mm, blue	07361-04
2	Connecting cord, 32 A, 500 mm, red	07361-01
1	Connecting cord, 32 A, 250 mm, yellow	07360-02
2	Connecting cord, 32 A, 250 mm, blue	07360-04
2	Connecting cord, 32 A, 250 mm, red	07360-01
1	Box, PP (98x73x20mm)	172059
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331657
1	Case with lid	172043
1	Foam insert for 15580-88	172012
1	Storage information for 15580-88	172013
1	Sticker for 15580-88, top	172014
1	Sticker for 15580-88, sideways	172090

Cobra4 extension set for renewable energy: electric parameters, temperature (15608-88)

1	USB charger for Cobra4 Mobile-Link 2 and Wireless/USB-Link	07932-99
2	Cobra4 Wireless/USB-Link incl. USB cable	12601-10
1	Cobra4 Sensor-Unit 2 x Temperature, NiCr-Ni	12641-00
1	Cobra4 Sensor-Unit Energy: Current, voltage, work, power	12656-00
2	Immersion probe NiCr-Ni, steel, -50...400 °C	13615-03
2	Holder for Cobra4, magn.	02161-10
1	Software Cobra4 - multi-user licence	14550-61

DEMO advanced Renewable Energy Basic Set , necessary accessories (15580-01)

1	Water, distilled 5 l	31246-81
1	Support rod, stainless steel, 750 mm	02033-00
1	Ceramic lamp socket E27, with reflector, switch and security	06751-01
1	Filament lamp, 220V/120W, with reflector	06759-93
1	Connecting cord, 32 A, 750 mm, red	07362-01
1	Connecting cord, 32 A, 750 mm, blue	07362-04
1	PHYWE power supply, universal DC: 0...18 V, 0...5 A / AC: 2/4/6/8/10/12/15 V, 5 A	13504-93

DEMO advanced Applied Sciences Renewable Energy Solar cells, Wind energy, Hydropower (15581-88)

1	Connector, straight, module DB	09401-01
1	Connector interrupted, module DB	09401-04
1	Light emitt. diode,red,module DB	09454-00
2	Solar cell (2.5x5)cm,module DB	09470-00
1	Solar battery, 4 cells, with cable, connectors, and magnetpads	06752-21
1	Battery holder module (AA type), SB	05606-00
2	Blower, 12V	05750-00
2	Generator with metrical thread axis and nut	05751-01
2	Rotor, 2 pieces	05752-01
1	Clamping holder with 2 clamping possibilit, 0-13 mm,fixing magnet	02151-08
1	Sliding mount for optical bench	02151-09
2	Support rod, stainless steel, 500 mm	02032-00
1	Ni-MH accus, size AA, 1.3 Ah / 1.2V, 1 pair	07922-03
1	Cardboard, black, 200 x 300 mm	171968
1	Filament lamps 4V/0.04A, E10, 10	06154-03
1	Filament lamps 3.5V/0.2A,E10, 10	06152-03
1	Resistance decade, module DB	09420-00
1	Capacitor (gold cap), 1F, DB	09450-10
1	Double sockets,1 pair,red a.black	07264-00
1	Boss head	02043-00
1	Concentrated solar power unit, 180 mm	02168-00
2	clamp, d = 16 mm, with mounting rod	05764-00
1	Water pump/ water turbine/ generator	05753-00
1	Dish, plastic, 150x150x65 mm	33928-00
1	Pelton wheel, model	02521-00
1	Driving belt	03981-00
2	Rubber tubing, i.d. 8 mm	39283-00
1.5	Silicone tubing, ID 10 mm	47524-00
1	Hose clamp for d = 10-17 mm	40998-00
1	Syringe 20ml	167705
1	Connecting cord, 32 A, 750 mm, red	07362-01
1	Connecting cord, 32 A, 750 mm, blue	07362-04
2	Box, PP (98x73x20mm)	172059
50	snap-fastener, flexible	170863
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331657
1	Case with lid	172043
1	Foam insert for 15581-88	172015
1	Storage information for 15581-88	172016
1	Sticker for 15581-88, top	172017
1	Sticker for 15581-88, sideways	172091

DEMO advanced Applied Sciences Renewable Energy, Fuel Cells 15582-88)

1	Connector, straight, module DB	09401-01
1	Solar battery, 4 cells, with cable, connectors, and magnetpads	06752-21
2	Blower, 12V	05750-00
2	Generator with metrical thread axis and nut	05751-01
2	Rotor, 2 pieces	05752-01
1	Clamping holder with 2 clamping possibilit, 0-13 mm,fixing magnet	02151-08
1	Clamp on holder	02164-00
1	Double PEM electrolyser, DB	09488-00
1	Double PEM fuel cell for hydrogen/ oxygen operation and hydrogen/ air operation, DB	09486-00
2	Gas storage with magnetic pad, incl. tube and plugs	09489-00
2	Building Block with magnetic pad, DB	09490-00
2	Metal angle for building block with magnetic pad	09491-00
1	Connector, angled with socket, module DB	09401-12
1	Resistance decade, module DB	09420-00
1	Connecting cord, 32 A, 750 mm, red	07362-01
1	Double sockets,1 pair,red a.black	07264-00
1	Connecting cord, 32 A, 750 mm, blue	07362-04
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331657
1	Case with lid	172043
1	Foam insert for 15582-88	172018
1	Storage information for 15582-88	172019
1	Sticker for 15582-88, top	172020
1	Sticker for 15582-88, sideways	172092

DEMO advanced Set Fuel Cells, necessary accessories (15582-01)

1	Lab protecting glasses with UV filter	39315-00

DEMO advanced Physics Electricity/Electronics Building Block System 1 (15569-88)

6	Connector, straight, module DB	09401-01
6	Connector, angled, module DB	09401-02
4	Connector, T-shaped, module DB	09401-03
4	Connector interrupted, module DB	09401-04
2	Junction, module DB	09401-10
2	Connect.straight w.socket,mod. DB	09401-11
2	Connector, angled with socket, module DB	09401-12
2	Switch on/off, module DB	09402-01
2	Switch, change-over, module DB	09402-02
3	Socket for incandescent lamp E10 ,module DB	09404-00
1	Resistor 1 Ohm,module DB	09411-10
1	Resitor 10 Ohm,module DB	09412-10
1	Resistor 50 Ohm,module DB	09412-50
2	Resistor 100 Ohm,module DB	09413-10
1	Resistor 10 kOhm,module DB	09415-10
1	Resistor 47 kOhm,module DB	09415-47
1	Potentiometer 250 Ohm, module DB	09423-25
1	NTC-resistor,module DB	09430-00
1	PTC-resistor, module DB	09431-00
1	Support plate w. holder,module DB	09471-00
1	Human model f.electric. safety,DB	09480-00
1	Bell gong on 4-mm-plug	05673-02
2	Battery holder module (C type), SB	05605-00
1	Clamp on fixing magnet	02151-01
1	Motor, 2 V DC	11031-00
1	Disc for 11031-00	11031-01
1	Conductors/non-conductors, l = 150 mm	06107-50
1	Bimetal strip	05913-00
1	Scale for demonstration board	02153-00
3	Alligator clip	167700
1	Connecting plug, 2 pcs.	07278-05
1	Electr.symbols f.demo-board,12pcs	02154-03
1	Glass tank, 100x50x120 mm	06620-10
2	Plate electrode holder	06618-00
2	Copper electrode, 76 mm x 40 mm	45212-00
1	Zinc electrode, 76 mm x 40 mm	45214-00
2	Lead electrode, 76 mm x 40 mm	45215-00
1	Iron electrode, 76 x 40 mm	45216-00
1	Filament lamps 1.5V/0.15A,E10,10 pieces	06150-03
1	Filament lamps 4V/0.04A, E10, 10	06154-03
1	Filament lamp 6 V/3 W, E10, 10 pcs.	35673-03
1	Filament lamps 12V/0.1A, E10, 10 pieces	07505-03
1	Connecting cord, 100 mm, red	07359-01
1	Connecting cord, 32 A, 100 mm, blue	07359-04
2	Connecting cord, 32 A, 500 mm, blue	07361-04
2	Connecting cord, 32 A, 500 mm, red	07361-01
2	Connecting cord, 32 A, 250 mm, blue	07360-04
2	Connecting cord, 32 A, 250 mm, red	07360-01
1	Box, PP (71x54x15mm)	172055
5	Box, PP (98x73x20mm)	172059
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331657
1	Case with lid	172043
1	Foam insert for 15570-88	172003
1	Storage information for 15569-88	173176
1	Sticker for 15569-88	173180
1	Sticker for 15569-88, sideways	173181

DEMO advanced Electricity 1 necessary accessories (15570-01)

1	30 MHz digital storage oscilloscope with colour display,2 x BNC cables l = 75 cm incl.	11462-99
1	PHYWE Digital Function Generator, USB	13654-99
1	Loudspeaker,8 Ohm/5 kOhm	13765-00
1	Universal clamp	37715-00
1	Support rod, stainless steel, 500 mm	02032-00
1	Boss head	02043-00
1	Ceramic lamp socket E27, with reflector, switch and security	06751-01
1	Filament lamp, 220V/120W, with reflector	06759-93
2	Adapter, BNC-plug/socket 4 mm	07542-26

DEMO advanced Physics Electricity/Electronics Building Block System 2, Electromagnetism and Induction (15570-88)

2	Junction, module DB	09401-10
1	Wire crossing, insulated, module DB	09401-05
1	Universal holder,module DB	09403-00
2	Coil 400 turns, module DB	09472-01
1	Coil 1600 turns, module DB	09472-02
1	Contact spring w. armature,mod.DB	09473-00
1	Contact element,module DB	09473-01
1	Relay 6 V, module DB	09474-00
1	Motor 12 V, module DB	09475-01
1	Holder for U-magnet, module DB	09476-00
1	Magnet holder,d=18mm	09476-10
1	Pole shoes,1 pair (18x4x70)mm	09476-11
1	Coil f.galvanomtr.model,module DB	09477-00
1	Scale f.galvonomtr.model,mod. DB	09477-01
1	Clamp on holder	02164-00
1	Holder f.electr.motor,magn.board	07849-00
1	Motor model f. magnet board	07850-20
1	Magn.rotor f.generator model	07850-22
1	U-core	07832-00
1	Yoke	07833-00
1	Tightening screw	07834-00
1	Circular trough	07835-00
1	Magnet, bar-shaped, d = 18 mm, l = 70mm	06318-00
1	Neon lamp 110 V AC, E10	07506-90
1	Insulating support, l = 235 mm	07924-00
1	Conductor swing	06412-00
1	Pulley,movable,dia.40mm,w.hook	03970-00
1	Rod for pulley	02263-00
1	Weight holder for slotted weights, 10 ghts	02204-00
2	Slotted weight, black, 10 g	02205-01
2	Slotted weight, silver bronze, 10 g	02205-02
1	Slotted weight, black, 50 g	02206-01
1	Fishing line, l. 20m	02089-00
1	Magn.rotor f.electr.motor model	07850-21
1	Box, PP (71x54x15mm)	172055
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331657
1	Case with lid	172043
1	Foam insert for 15571-88	172006
1	Storage information for 15571-88	172007
1	Sticker for 15571-88, top	172008
1	Sticker for 15571-88, sideways	172088

DEMO advanced Electromagnetism and induction 2, necessary accessories (15571-01))

1	PHYWE power supply, variable DC: 12 V, 5 A / AC: 15 V, 5 A	13540-93
1	Demonstration multimeter ADM3, analogue and digital	13840-00

DEMO advanced Physics Electricity/Electronics Building Block System 3 (15572-88)

2	Junction, module DB	09401-10
1	Wire crossing, insulated, module DB	09401-05
1	Wire crossing,connected,module DB	09401-06
1	Resistor 500 Ohm,module DB	09413-50
1	Resistor 1 kOhm,module DB	09414-10
1	Potentiometer 10 kOhm,module DB	09425-10
1	Capacitor 10 nF,module DB	09442-10
1	Capacitor 47 nF,module DB	09442-47
1	Capacitor(ELKO)0.047 mF,module DB	09445-47
1	Capacitor(ELKO),0.1 mF,module DB	09446-10
1	Capacitor(ELKO),0.47 mF,module DB	09446-47
1	Silicon diode 1N4007,module DB	09451-00
1	Z-diode ZF 4.7,module DB	09452-00
1	Photodiode,module DB	09453-00
1	Light emitt. diode,red,module DB	09454-00
1	Bridge rectifier,module DB	09455-00
1	Bridge rectifier w. LED,module DB	09455-01
2	Transistor BC337,module DB	09456-00
1	Transistor BC327,module DB	09457-00
1	Phototransistor, module DB	09458-00
1	Transmitter f. opt. fiber,mod. DB	09461-00
1	Optical fiber, 2m	09461-02
2	Solar cell (2.5x5)cm,module DB	09470-00
1	Coil 400 turns, module DB	09472-01
1	Coil 1600 turns, module DB	09472-02
1	Clamp on holder	02164-00
1	U-core	07832-00
1	Yoke	07833-00
1	Tightening screw	07834-00
1	Magnet, bar-shaped, d = 18 mm, l = 70mm	06318-00
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331657
1	Case with lid	172043
1	Foam insert for 15572-88	172009
1	Storage information for 15572-88	172010
1	Sticker for 15527-88, top	172011
1	Sticker for 15572-88, sideways	172089

DEMO advanced Electronics 3 necessary accessories (15572-01)

1	30 MHz digital storage oscilloscope with colour display,2 x BNC cables l = 75 cm incl.	11462-99
1	PHYWE Digital Function Generator, USB	13654-99
1	Loudspeaker,8 Ohm/5 kOhm	13765-00
1	Universal clamp	37715-00
1	Support rod, stainless steel, 500 mm	02032-00
1	Boss head	02043-00
1	Ceramic lamp socket E27, with reflector, switch and security	06751-01
1	Filament lamp, 220V/120W, with reflector	06759-93
2	Adapter, BNC-plug/socket 4 mm	07542-26

DEMO advanced Physics Set Optics (15550-88)

1	Optical block, semicircular, magnet held	08270-01
2	Opt. block,planoconvex, magn.held	08270-02
1	Opt. block,planoconcave,magn.held	08270-03
1	Opt. block,trapeze, magnet held	08270-05
1	Opt. block,triangular,magnet held	08270-06
1	Model earth/moon, magnet held	08270-07
1	Cuvette, magnet held, 230x75 mm	08270-08
1	Optical disk, magnet held	08270-09
2	Diaphragm w. holder, magnet held	08270-10
1	Light guide model, magnet held	08270-11
1	Concave/convex mirror,magnet held	08270-12
2	Plane mirror, magnet held	08270-13
1	Magnetic bottom for light box	09804-10
1	Light box accessories for colour mixing	09806-00
1	Colour filter set, additive (red, blue, green)	09807-00
1	Colour filter set, subtractive (yellow, magenta, cyan)	09808-00
1	Scale for demonstration board	02153-00
1	Absorption plates for beta rays	09024-00
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331657
1	Case with lid	172043
1	Foam insert for 15590-88	172000
1	Storage information for 15590-88	172001
1	Sticker for 15590-88, top	172002
1	Sticker for 15590-88, sideways	172086

DEMO advanced Optics necessary accessories (15550-01)

1	PHYWE power supply, universal DC: 0...18 V, 0...5 A / AC: 2/4/6/8/10/12/15 V, 5 A	13504-93

DEMO advanced Physics set Radioactivity (15590-88)

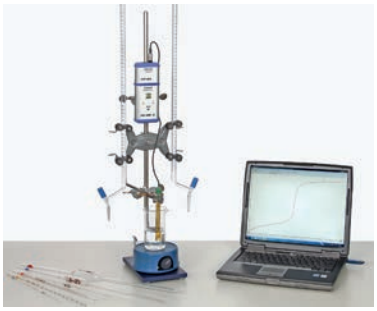
1	Support rod,stainl.steel, 100mm	02030-00
1	Support clamp for small case	02043-10
1	Scale for demonstration board	02153-00
1	Support plate on fixing magnet	02155-00
1	Clamp on holder	02164-00
1	Steel pellets, d = 2 mm, 120 g	03990-00
1	Optical disk, magnet held	08270-09
1	Columbite, natural mineral	08464-01
1	Absorption material f.student exp	09014-03
1	Counter tube holder on fixating magnet	09201-00
1	Source holder on fixing magnet	09202-00
1	Plate holder on fixing magnet	09203-00
1	Specimen tube with holder	09203-01
1	Defl.magnets f. plate holder,2pcs	09203-02
1	Plate holder on fix. magnet	09204-00
2	Petri dish, d 40 mm	64704-00
1	Geiger-Mueller counter tube, type B, BNC cable 50 cm	09005-00
1	Absorption plates for beta rays	09024-00
1	Software interTESS DVD, complete version with all experiment Physics, Chemistry, Biology, Spplied Sciences	331657
1	Case with lid	172043
1	Foam insert for 15590-88	172000
1	Storage information for 15590-88	172001
1	Sticker for 15590-88, top	172002
1	Sticker for 15590-88, sideways	172086

DEMO advanced Radioactivity necessary accessories (15590-01)

1	Geiger-Müller-Counter	13606-99
1	PHYWE high voltage supply unit with digital display, 10 kV	13673-93
1	Potassium chloride 250 g	30098-25
3	Barrel base PHYWE	02006-55
1	Vernier calliper stainless steel 0-160 mm, 1/20	03010-00
1	Insulating stem	06021-00
1	Copper wire, d = 0.5 mm, l = 50 m	06106-03
1	Conductor ball, d 40mm	06237-00
1	Danger sign - high-voltage -	06543-00
1	High-value resistor, 50 megOhms	07159-00
1	Connecting cord, 32 A, 250 mm, red	07360-01
1	Connecting cord, 32 A, 250 mm, blue	07360-04
2	Connecting cord, 32 A, 500 mm, red	07361-01
1	Connecting cord, 30 kV, 1000 mm	07367-00
2	Insulating support, l = 235 mm	07924-00
1	Isotope generator Cs-137, 370 kBq	09047-60
1	Radioactive sources, set	09047-40
3	Barrel base expert	02004-55

XRE 4.0 X-ray expert set for schools (09117-88)

1	XR 4.0 expert unit, X-ray unit, 35 kV	09057-99
1	XR 4.0 X-ray Plug-in Cu tube	09057-51
1	XR 4.0 X-ray goniometer	09057-10
2	Slide mount for optical bench expert, h = 30 mm	08286-01
1	XR 4.0 X-ray fluorescent screen	09057-26
1	XR 4.0 Software measure X-ray	14414-61
1	Slide mount for optical bench expert	08286-00
1	XR 4.0 X-ray optical bench	09057-18
1	Table with stem	09824-01
1	XR 4.0 TESS expert Physik Handbuch Experimentemit RÃ¶ntgenstrahlung (XT)	01200-01
1	TESS expert Physics Handbook X-ray Experiments for XR 4.0 expert unit	01200-02
1	Data cable USB, plug type A/B, 1.8 m	14608-00
1	Geiger-Mueller counter tube, type B, BNC cable 50 cm	09005-00
1	XR 4.0 X-ray LiF crystal, mounted	09056-05
1	XR 4.0 potassium bromide (KBr) crystal	09056-01
1	XR 4.0 X-ray Absorption set for X-rays	09056-02
1	XR 4.0 X-ray Diaphragm tube d = 1 mm	09057-01
1	XR 4.0 X-ray Diaphragm tube d = 2 mm	09057-02
1	XR 4.0 X-ray Diaphragm tube d = 5 mm	09057-03
1	XR 4.0 Drawer Content Overview, laminated	171396
1	XR 4.0 Drawer Content Overview, laminated	331553
1	Quick Start Guide X-ray expert unit (English)	00259-01
1	Flyer X-ray expert unit (Engl.)	00298-02



Demo advanced Basic Set pH Titration Cobra4 (12627-88)

2	USB charger for Cobra4 Mobile-Link 2 and Wireless/USB-Link	07932-99
2	Cobra4 Wireless/USB-Link incl. USB cable	12601-10
1	Cobra4 Sensor-Unit Chemistry	12630-00
1	Cobra4 Sensor-Unit Drop Counter	12636-00
2	Holder for Cobra4 with support rod	12680-00
1	Immersion probe NiCr-Ni, teflon, 300 °C	13615-05
1	Storage flask for pH electrodes,filled with 250 ml 3.0 M KCl solution	18481-20
1	pH-electrode, glass, refillable, BNC	46268-10
1	Software Cobra4 - multi-user licence	14550-61

Standard Labware for Set pH-Titration Cobra4 (12627-01)

1	Electrode holder, slewable	18461-88
1	Spoon, special steel	33398-00
1	Wash bottle, plastic, 500 ml	33931-00
1	Funnel, glass, top dia. 55 mm	34457-00
1	Funnel, glass, top dia. 80 mm	34459-00
1	Burette, lateral stopcock, Schellbach, 25 ml	36506-01
2	Burette, lateral stopcock, Schellbach, 50 ml, graduations 0, 1 ml	36513-01
1	Volumetric flask 100 ml, IGJ12/21	36548-00
7	Volumetric flask 250 ml, IGJ14/23	36550-00
1	Volumetric flask 500 ml, IGJ19/26	36551-00
4	Volumetric flask 1000ml, IGJ24/29	36552-00
1	Volumetric pipette, 1 ml	36575-00
1	Volumetric pipette, 2 ml	36576-00
1	Volumetric pipette, 10 ml	36578-00
1	Volumetric pipette, 25 ml	36580-00
1	Volumetric pipette, 50 ml	36581-00
1	Pipette dish	36589-00
1	Pasteur pipettes, 250 pcs	36590-00
1	Pipettor	36592-00
1	Graduated pipette, 1 ml	36595-00
1	Graduated pipette 10 ml	36600-00
1	Funnel, d.40 mm, f.burettes	36888-00
3	Right angle boss-head clamp	37697-00
1	Universal clamp	37715-00
1	Burette clamp, roller mount., 2 pl.	37720-00
1	Rubber caps, 10 pcs	39275-03
1	Lab protecting glasses with UV filter	39315-00
1	Beaker, 50 ml, high-form	46025-00
1	Beaker, 100 ml, high-form	46026-00
1	Beaker, 250 ml, low-form	46054-00
1	Magnetic stirring bar 15 mm, cylindrical	46299-01
1	Magnetic stirring bar 30 mm, cylindrical	46299-02
1	Precision Balance, Sartorius ENTRIS623-1S, 620 g / 0.001 g	49294-99
1	Magnetic stirrer with heater MR Hei-Standard	35751-93
16	Beaker, 150 ml, high-form	46032-00

Chemical set for Basic Set pH Titration Cobra4 (12627-10)

1	USB charger for Cobra4 Mobile-Link 2 and Wireless/USB-Link	07932-99
1	Cobra4 Wireless/USB-Link incl. USB cable	12601-10
1	Cobra4 Sensor-Unit Chemistry	12630-00
1	Cobra4 Sensor-Unit Drop Counter	12636-00
1	Holder for Cobra4 with support rod	12680-00
1	Immersion probe NiCr-Ni, teflon, 300 °C	13615-05
1	Storage flask for pH electrodes,filled with 250 ml 3.0 M KCl solution	18481-20
1	pH-electrode, glass, refillable, BNC	46268-10
1	Software Cobra4 - multi-user licence	14550-61

Basic set Cobra4 Biochemistry and plant physiology (15620-88)

1	USB charger for Cobra4 Mobile-Link 2 and Wireless/USB-Link	07932-99
1	Cobra4 Wireless/USB-Link incl. USB cable	12601-10
1	Cobra4 Sensor-Unit pH, BNC connector	12631-00
1	Cobra4 Sensor-Unit Conductivity+	12632-00
1	Cobra4 Sensor-Unit Weather	12670-00
1	Holder for Cobra4 with support rod	12680-00
2	Immersion probe NiCr-Ni, steel, -50...400 °C	13615-03
1	Conductivity temperature probe Pt1000	13701-01
1	Test tube,200x30 mm,DURAN, PN29	36294-00
1	Test tube,200x30 mm,side arm,PN29	36331-00
2	Universal clamp	37715-00
1	Universal clamp with joint	37716-00
1	Rubber stopper 26/32, 1 hole 7 mm	39258-01
1	Rubber stopper 26/32, 1 hole 1,5 mm	39258-09
2	Rubber stopper,d=41/34mm, 2 holes	39261-02
1	pH-electrode, plastic body, gel, BNC	46265-15
1	Dialysis tubing 24A,diam.44mm, 1m	64208-00
2	Dialysis clips, 2	64209-00
2	Thermos flask	64841-00
1	Demo advanced Biologie Handbuch Cobra4Biochemie & Pflanzenphysiologie	01331-01
1	Demo advanced Biology Manual Cobra4 Biochemistry & plant physiology	01331-02
2	Support base, variable	02001-00
1	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00
3	Support rod, stainless steel, 500 mm	02032-00

Chemicals set Biochemistry & plant physiology (65980-10)

1	Glycerol 99% 100 ml	30084-10
1	Urea, 250 g	30086-25
1	Sodium hydrogen carbonate 250 g	30151-25
1	Water, distilled 5 l	31246-81
1	Hydrogen peroxide, 30%, 250 ml	31710-25
1	Urease soln.in 50% glycerol,10ml	31924-03
1	Buffer solution, pH 4.01, 1000	46270-12
1	Buffer solution, pH 10.01,1000 ml	46272-12
1	Caustic soda solution, 1.0 m, 1000 ml	48329-70
1	Patent Blue V (sodium salt), 25 g	48376-04
1	Hydrochloric acid, 1.0 mol/l, 1000 ml	48454-70
1	Tartrazine 25 g	48498-04

Cobra4 Set Neurobiology with one nerve cell (65964-11)

1	Cobra4 Xpert-Link	12625-99
1	Cobra4 Xpert-Link set of cables	12625-10
1	Neuro-simulator	65963-00
1	Neuro-simulator, power supply	65963-93

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General notes on safety

Notes on safety

The regulations for dealing with electrical devices, lasers, radioactive materials and hazardous materials are not uniform worldwide. Before any experimentation, it is essential that you become familiar with the national and local laws, directives and ordinances regarding the handling of these appliances and materials, as well as their storage and transport.

You can refer as an example to our notes on safety, which correspond to the high German and EU standards. The laws in the respective country are binding, however.

1.) Experiments using electrical energy

The utilisation of the electrically operated devices (mains power supply) that are offered herein is only allowed in science rooms of educational institutions, schools, universities, and laboratories, but NOT in residential areas.

Experiments at school usually use non-hazardous extra-low voltages (< 25 V~/< 60 V-). The following safety notes provide information about the existing legal regulations. In addition, they include rules of conduct for the responsible teacher for the execution of experiments with hazardous voltage levels.

When performing experiments with electrical energy, it must be absolutely sure that the persons involved in the experiment cannot come into contact with hazardous voltage. The professional (teacher) who supervises/conducts the experiment is responsible for this.

In the "Safety requirements for electrical equipment for measurement, control, and laboratory use" (DIN EN 61010-1, VDE 0411 part 1) of the European Union, non-hazardous voltage is defined as voltage < 33 V~ or < 70 V- or, in the case of higher voltage, with a limited current of 0.5 mA~ and 2 mA- maximum.

Other restrictions for schools providing general education have been decreed by the standing conference of the minister of education and cultural affairs of Federal Republic of Germany in the "Directives concerning safety during lessons" (GUV-SI 8070) with reference to the standard VDE 0105 part 12 ("Operation of power installations - Particular requirements for experiments with electrical energy in lecture rooms"). In these directives, the voltage limits for students up to the German class level 10 (age approximately 16 years) have been fixed at 25 V~ and 60 V- maximum.

Professionals (usually teachers) and students of class levels higher than level 10 may work with hazardous voltages in exceptional cases, if the teaching objective cannot be reached with non-hazardous voltage. In this case, the teacher must be present during the experiment.

The following rules and regulations should be observed:

1. **Electrical safety**
   (DIN EN 61010-1, VDE 0105 part 12, GUV-SI-8070)

Prior to the first experiments of students, trainees, or apprentices with electrical energy in a laboratory or classroom, the students, trainees, and apprentices must be informed in detail about the hazards of the electrical current and about the applicable safety instructions.

Prior to using the electrical devices, they must be checked for signs of damage! Do not use the device if it is damaged!

The operating instructions of the equipment that is used for the experiment must be followed!

Do not use hazardous voltages (> 25 V~ and > 60 V-) in student experiments!

The professional must re-check the experiment set-up (circuit) prior to the start of the experiment and inform the user of any potential hazards!

Modifications of the experiment set-up (set-up, conversion, and take-down) must only be performed when the set-up is completely disconnected from the power supply and when all poles of the supply voltage are switched off!

If measurements or adjustments are unavoidable during an experiment with hazardous voltage, work only with one hand and hold the other behind the back or put it in a pocket!

Ensure that there is a sufficient number of emergency OFF switches in the laboratory.

Use only 4-mm safety cables that are protected against accidental contact (e.g. PHYWE ref. no. 07336-01) when performing experiments with hazardous voltages!

After the completion of the experiment, it should be taken into consideration that component parts, such as capacitors, may supply hazardous voltage even some time after the equipment has been switched off!

Experiments with set-up transformers require special safety measures. Even if the primary side of the transformer is supplied with extra-low voltage (< 25 V~), very high hazardous voltages may be generated on the secondary side by the transformation, e.g. if the coils get mixed up!

If demonstration experiments are performed with hazardous voltages, the teacher or lecturer must ensure a sufficient safety distance from the students. In addition, these kinds of experiments must be marked with the danger sign "High voltage!" (PHYWE ref. no. 06543-00)!

Experiments that are directly supplied with mains power must not be performed unless a residual current circuit breaker (< 30 mA), e.g. a safety plug/socket assembly (PHYWE ref. no. 17051-93) or a variable isolating transformer (PHYWE ref. no. 13535-93), has been installed before the set-up. Do not plug the 4-mm connecting cables directly into the earthing contact socket outlet (SCHUKO socket)!

If power supply units (e.g. power supply unit for students, PHYWE ref. no. 13505-93) are used that do not produce hazardous voltages (extra-low voltages < 25 V~ and < 60 V-), simple, unprotected 4-mm connecting cables and other non-insulated components may also be used for student experiments.

2. EMC (electromagnetic compatibility) (Technical recommendation concerning the application of the EMC Act on electrical teaching equipment, Reg TP 322 TE01)

Experiment set-ups for the demonstration of physical processes must only be used in science rooms at schools, universities, and other educational institutions!

The teacher (expert) who sets up and performs the experiments is responsible for the compliance with the requirements for the EMC Act on the electromagnetic compatibility of equipment! The experiment set-ups do not require a CE mark or declaration of conformity, but the teacher as an expert must take all the necessary measures in order to avoid interferences in the environment!

Possible EMC measures:

- Ensure shielding and equipotential bonding!
- Keep a sufficiently large distance from sensitive equipment!
- Use short connecting cables (in order to reduce RF emission)!
- Floor coverings that my lead to static charges should be avoided and the body should be discharged prior to touching any sensitive experiment equipment!
- RF emitters, e.g. mobile phones, should be not be used in close vicinity of the experiment set-up!
- Critical experiment set-up and devices (e.g. Van de Graaf generator, Ruhkorff induction coil, transmitter), which can cause interferences even at a distance of several 100 metres should be switched on as briefly as possible.

2.) Experiments using lasers

In general, the "Directives concerning safety during lessons" (GUV-SI 8070) are applied at schools. In accordance with these directives, the following points must be observed when working with lasers:

1. Only lasers of class 1, 1 M, 2, and 2 M1 in accordance with DIN EN 60 825 may be used at schools.
2. Lasers of class 1 M, 2, and 2 M must be kept under lock and key.
3. Prior to setting up and performing experiments with lasers of class 1 M, 2, and 2 M, the students who observe or are involved in the experiment must be informed as to the risk to the eyes that is caused by the laser light. These lasers must only be used under the supervision of the teacher.
4. The area in which experiments with lasers of class 1 M, 2, and 2 M are performed must be marked with laser warning signs during the operation of the laser. This laser area of experiment set-ups must be secured against accidental access by some form of delimitation.
5. The set-up and performance of experiments with lasers of class 1 M, 2, and 2 M must ensure that looking into the direct laser beam or into the reflected beam is avoided, e.g. with the aid of some kind of screening. If lasers of class 1 M and 2 M are used, the beam cross-section must not be reduced, i.e. these lasers must not be used

in combination with converging components (e.g. magnifying glasses).

6. The use of laser devices of class 3 B or 4 in other educational institutions (universities etc.) must be reported to the responsible accident insurer and to the responsible occupational safety and health authority prior to the first start-up of the lasers.

For the use of laser systems of class 3 B or 4, a competent person must be appointed the laser safety officer in writing.

Additional information concerning the use of lasers can be found in the documents of the German Social Accident Insurance "GUV-V B – Laser radiation" and "GUV-I 832 – Use of laser systems". These documents are mainly based on the EU standard "DIN EN 60825-1 – Safety of laser products".

3.) Handling of radioactive products

In Germany, the handling of radioactive substances is controlled by the German Radiation Protection Ordinance (Strahlenschutzverordnung, StrlSchV). The legal bases of this ordinance are articles 25 to 27 combined with appendix V of the ordinance dated 20 July 2001, last amended by article 2 of the law of 02/08/2008. Substances within the exemption limits (see Appendix V of the German Radiation Protection Ordinance (StrlSchV) for the exemption limits) can be supplied to schools without any conditions. If the exemption limits are exceeded, the school will need a special handling permit issued by the responsible supervisory authority prior to purchasing the substances.

If several substances within the exemption limits are owned and/or purchased, the sum formula that is stated in the German Radiation Protection Ordinance must be observed.

Radioactive substances must be protected against unauthorised persons, which is why they must be stored in a theft-proof manner. In addition, the handling regulations of the German Radiation Protection Ordinance must be observed. Substances that have become unusable must be handed over directly to the responsible collection centre or to a disposal company.

4.) Safety instruction for handling hazardous materials

Before any experimentation with hazardous materials, it is essential that you become familiar with the national and local directives and ordinances concerning the handling of hazardous materials, their storage and transport. The basic principle is that all hazardous materials must be dealt with cautiously and carefully. It is of course required that, in case of experiments, neither the students nor the teachers be exposed to any unnecessary dangers to health. The instructions of the safety data sheets for the individual materials, in the most current version in each case, are to be considered, as well as the accident-prevention specifications and the respective workplace-related operating instructions. The waste disposal of used hazardous materials must be implemented according to recognized methods. The local specifications for the proper removal of chemical residues are to be considered in this case.

General Terms and Conditions (GTC)

of PHYWE Systeme GmbH & Co. KG

§ 1 Application of Conditions

1. These General Terms and Conditions (hereinafter referred to as GTC) shall apply for all goods, services and offers of PHYWE Systeme GmbH & Co.KG (hereinafter referred to as PHYWE) for its customers (hereinafter referred to as Customer). They shall apply equally for all future business between the contract parties without requiring a repeated reference. General Terms and Conditions of the Customer shall apply only if expressly approved by PHYWE in writing.
2. All deviating agreements between PHYWE and the Customer shall be set down in writing; a waiver of the written form does not have any effect on the agreement's validity. In the event of such an agreement these GTC shall be of lesser importance and shall supplement the agreement.
3. PHYWE reserves all rights to PHYWE operational and offer documents. If no order is placed, all documents shall be returned immediately of the Customer's own accord. All information in them and from other transactions shall be treated as strictly confidential.
4. All offers, samples and test products as well as their technical data and descriptions in the respective product information and promotional materials on the PHYWE website are for information only and are not binding. They do not represent a warranty of quality or application.
5. Insofar as PHYWE considers it necessary for the completion of its performances, PHYWE is authorized to exchange job-related data with assistants or trading partners. If the Customer does not desire such an information exchange, the Customer may object to it in writing at any time.

§ 2 Offer and Contract Conclusion

PHYWE's offers are not binding. PHYWE reserves an acceptance period of two weeks from receipt at PHYWE regarding the Customer's binding orders. Verbal statements of acceptance (by phone) and all Customer orders shall be confirmed by PHYWE in writing or by telex; a waiver of the confirmation does not affect the effectiveness of verbal statements of acceptance and orders (by telephone).

§ 3 Prices

1. The prices given in the PHYWE price list or the PHYWE order confirmation, exclusive of the relevant applicable value-added tax in the respective country, shall be binding. Additional goods and services are charged separately.
2. The prices are "ex work PHYWE" and include PHYWE standard packaging. Special packaging or other requests from the Customer, such as packaging in certain lots, are charged separately. Deviating provisions may be agreed between PHYWE and the Customer or by PHYWE for a region or a country in writing from time to time.

§ 4 Delivery and Performance Terms

1. Delivery dates or terms that may be agreed upon, both binding and unbinding, shall be set down in writing. Non-binding delivery terms may be exceeded by up to 8 weeks by PHYWE; only after expiration of this term we shall fall into arrears by reminder of the Customer. Delivery terms shall start as of contract conclusion and acceptance of payment details by PHYWE. In the event that changes to the contract are agreed upon, it is subsequently required to agree on a new delivery date at the same time. Claims for damages or recourse of the Customer towards PHYWE shall be excluded in any case.
2. In the event of delivery and performance delays due to force majeure, natural disasters as well as due to labour disputes, traffic or operation disturbances, lack of material through no fault of their own and similar reasons on PHYWE and its suppliers' part, the Customer is not entitled to withdraw from the contract or to assert claims towards PHYWE. The Customer is entitled to withdraw from the contract if the aforementioned reasons cause an extension of the delivery date by more than four months. PHYWE is entitled equally to withdraw from the contract. Claims for damages or recourse of the Customer towards PHYWE shall be excluded in any case.
3. PHYWE is entitled to make partial deliveries and partial performances at any time unless the deliveries and performances are to be made fully and completely in accordance with the contractual arrangements.
4. PHYWE's compliance with delivery and performance obligations requires the Customer's timely and proper compliance with its obligations.
5. If the Customer falls into arrears, PHYWE is entitled to demand reimbursement of the additional expenses it had to make for the unsuccessful offer and storage and maintenance of the owed object; with commencement of default of acceptance the risk of incidental deterioration and accidental loss is transferred to the Customer.

§ 5 Export Business

PHYWE is entitled to withdraw from the contract regarding delivery of such products (partial withdrawal) that require approval of the federal ministry for economics and export control, the Federal Institute for Medicaments and Medical Products or a similar governmental institution for their export from Germany or their import in their country of destination pursuant to legal provisions in the event that the approval is not issued or probably may not be obtained until the agreed delivery date. PHYWE shall immediately advise the Customer of this and possibly reimburse a compensation for the part of the performance affected by the withdrawal.

§ 6 Shipping and Transfer of Risk

1. Place of performance is Göttingen. The delivery condition is "ex works PHYWE". Other agreements must be made in writing.
2. The Customer may request PHYWE to ship the goods. It shall bear the costs and risk for it. In the case of a forwarding order the risk is transferred to the Customer as soon as the shipment had been handed over to the person executing the transport. If PHYWE is able to ship the goods at the time determined by contract and the shipment is delayed at the Customer's request the risk is transferred to the Customer at notice of readiness for shipment.
3. At the Customer's request shipments shall be insured in its name and on its account.

§ 7 Claims for Defects/Guarantee

1. PHYWE is working pursuant to the guarantee claims typical in Germany and the EU. If a PHYWE product shows any other defect already present at delivery, the Purchaser shall advise it immediately and provide evidence. In such an event PHYWE shall repair the defect or deliver a product free of defects (supplementary performance) pursuant to legal provisions. PHYWE shall bear the expenses required for the purposes of supplementary performance, including but not limited to transport, labour and material cost. Additional expenses caused by the sold product being brought to a place other as the domicile or the branch office of the Customer shall not be borne by PHYWE.
2. Insignificant or commercial deviations of the delivered goods in size, shape and colour being in the material's nature do not establish claims for defects by the Customer. Article 377 German Commercial Code applies.
3. PHYWE reserves the right to changes to the PHYWE products required for technical or other reasons not affecting usability and not reducing the service's value and for technical improvements. They do not establish claims for defects, abatement or withdrawal from the transaction by the Customer.
4. If PHYWE's operation or maintenance instructions are not adhered to, changes to the products are made, parts are exchanged or consumables not complying with the original specifications are used, the Customer may not assert claims for defects if the Customer does not refute a substantiated claim to the effect that it was only one of those circumstances that had caused the defect.
5. The Customer must immediately inform customer service management/PHYWE's technical hotline of visible defects in writing, however, the latest within one week after receiving and/or accepting the

delivered goods. Defects that can not be discovered within this period even with careful examination shall be communicated and proven to PHYWE in writing immediately upon discovery.

6. Claims for defects for regular wear and tear are excluded.
7. Only the immediate Customer is entitled to claims for defects towards PHYWE and may not transfer them to third parties.
8. Claims for defects fall under the statute of limitations after 12 months as of delivery of the goods under contracts with the Customer. Retaining payments by the Customer is only admissible if the proportion of the occurred defect is appropriate.

§ 8 Repairs

If the Customer is not entitled to claims for defects pursuant to § 7 or if the statutory period of limitation pursuant to § 7.8 is expired and PHYWE and the Customer agree on a repair of the products § 7.8 applies equally to the limitation of a defect of the repair.

§ 9 Reservation of Title

1. PHYWE reserves title to the goods until fulfilment of all claims from the business relation for whatever legal reason including the claims arising in the future or conditional claims. If the realisable value of existing securities (goods subject to reservation of title pursuant no. 3 below and transferred accounts receivable pursuant no. 5 below) exceeds the secured claims by more than 10 % in total PHYWE is obliged insofar to release securities at the seller's discretion at the Customer's request.
2. Joint ownership rights arising from combination or mixing are deemed goods subject to reservation of title. PHYWE has an appropriate right to the reservation of title on these goods as well.
3. The Customer is entitled to process and sell the goods subject to reservation of title in the course of normal business unless it falls into arrears. Pledging or protective conveyance is inadmissible. By way of security the customer shall immediately transfer to PHYWE all claims (including any outstanding balance claims from the current accounts) arising from the resale or another legal reason (insurance, inadmissible action) in connection with the goods subject to reservation of title to their full extent. PHYWE shall give it the revocable authorization to collect the claims transferred to PHYWE for its account in its own name. This authorization for collection may only be withdrawn if the Customer does not properly fulfil its payment obligations.
4. In the event that the Customer behaves contrary to the contract – including but not limited to falling into arrears – PHYWE is entitled to take back the goods subject to reservation of title after expiration of an appropriate additional respite or demand the transfer of the Customer's claims for return towards third parties as the case may be. PHYWE taking back the goods subject to reservation of title does not constitute a withdrawal from the contract unless PHYWE has expressly stated such withdrawal.

§ 10 Payment

1. All payments exceeding the credit limit of the Customer with PHYWE confirmed by PHYWE in writing shall be made for payment in advance or confirmed with an irrevocable letter of credit from a large European bank accepted by PHYWE or an equivalent bank guarantee.
2. Within or above credit limit invoices shall be payable without deducting a cash discount or other discounts with PHYWE receiving the payment within 20 days as of contract conclusion and receipt of the invoice or an equivalent payment listing by the Customer.
3. In the event of orders with a purchase price surpassing € 25,000.00 the Customer shall make an advance payment of 40% of the purchase price for PHYWE products and 60% of the purchase price for third party products. The advance payment is due on contract conclusion and receipt of an invoice or equivalent payment listing.
4. A payment is only deemed made when PHYWE has the amount at its disposal. In case of cheques the payment is only deemed made when the cheque has been cashed.
5. The Customer shall fall into arrears 3 days after maturity of the claim by PHYWE and receipt of an invoice or delivery without it requiring a written reminder. If the Customer falls into arrears PHYWE is entitled to demand interest of 8% above the relevant basic interest rate of the European Central Bank at the respective point in time. PHYWE may submit evidence of a greater damage
6. If PHYWE becomes aware of circumstances calling the Customer's financial standing into question, including but not limited to not cashing its cheque or stopping its payments, or if PHYWE becomes aware of other circumstances calling the Customer's financial standing in question, PHYWE is entitled to call the complete outstanding debts even if it had accepted cheques.
7. The Customer is only entitled to set off its debts if the counterclaims have been established as final and absolute or are undisputed. The same shall apply for the right of retention pursuant to article 273 German Civil Code, the commercial right of retention pursuant to article 369 German Civil Code and the right of refusal of services pursuant to article 320 German Civil Code.

§ 11 Copyright Infringements

1. PHYWE shall exempt the Customer and its customers from claims arising from infringements of copyrights, trade marks or patents unless the design of a delivery object had been made by the Customer. PHYWE's exemption obligations shall be limited to the amount of the predictable damage. An additional requirement for exemption is that in case of a legal dispute (article 72 German Code of Civil Procedure) the Customer informs PHYWE of the dispute and that the alleged legal infringement may be ascribed to the construction of PHYWE's delivery items without combination or use with other products.
2. Optionally PHYWE has the right to free itself from the obligations assumed in clause 1 by either

a) obtaining the required licences regarding the alleged infringed patents, or

b) providing the Customer with a changed delivery item or part of it that rectifies the infringement reproach concerning the delivery item by exchanging it for the infringing delivery items or their parts unless the changed delivery item (or parts of it) falls behind the original performance regarding the usability and/or its value.

§ 12 Liability

1. PHYWE shall be liable for breaches of contractual and non-contractual obligations, including but not limited to impossibility, delay and unlawful acts, only in cases of malicious intent and gross negligence – of its executive employees as well – limited to damages foreseeable at contract conclusion.
2. Claims for damages of material defects shall fall under the statute of limitation after 12 months as of delivery of the goods – with exception of personal injury or wilful or grossly negligent breaches of duty. The limitation of legal regress claims remains unaffected. The relevant legal provisions apply for claims for damages on account of other legal reasons.

§ 13 Applicable law, jurisdiction, partial invalidity

1. In addition to these provisions German law with exemption of the provisions of the UN Convention on Contracts for the International Sale of Goods dated 11/04/1980 (CISG) applies.
2. Place of jurisdiction is Göttingen
3. If a provision in these General Terms and Conditions or a provision under other agreements is or becomes ineffective the validity of all other provisions or agreements shall remain unaffected.

General Terms and Conditions of PHYWE Systeme GmbH & Co. KG, last updated on 01/08/2010

After announcement of new General Terms and Conditions all previous General Terms and Conditions loose their validity.

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1. Language
2. Education level = School (age 11-16 and age 16-19), University
3. Media e. g. product videos
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