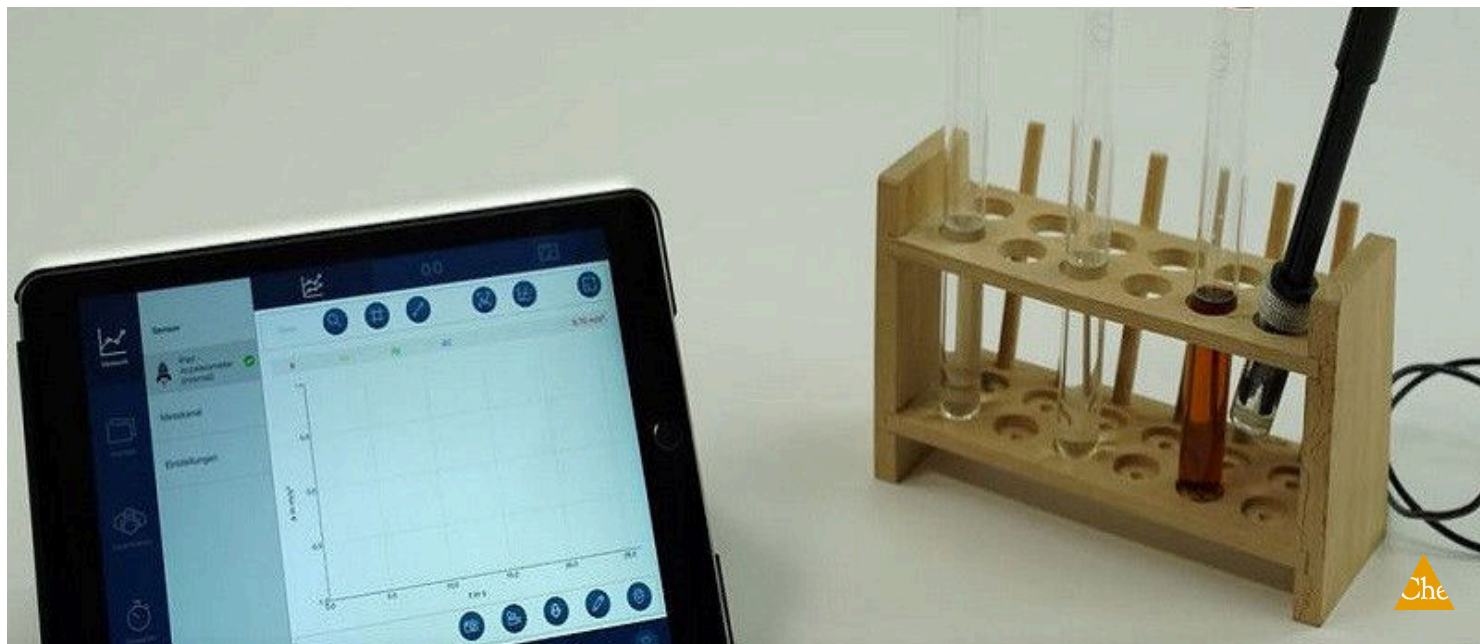


# pH-value of everyday substances



Chemistry

Inorganic chemistry

Acids, bases, salts

Chemistry

Industrial Chemistry

Exhaust gas cleaning, environmental protection



Difficulty level

easy



Group size

-



Preparation time

-



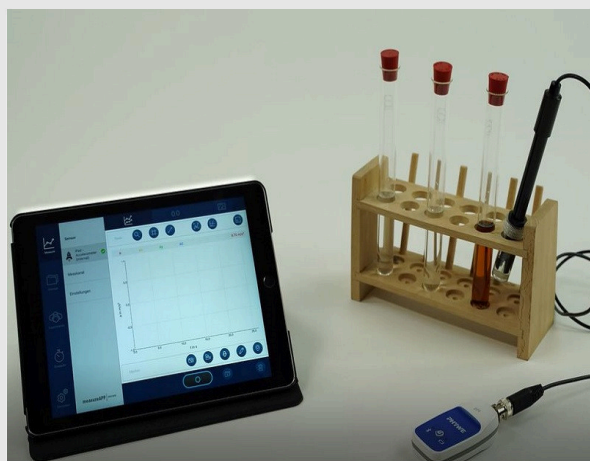
Execution time

-

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## Teacher information

### Application

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Experiment set-up

Many substances that surround us in everyday life have a certain pH value and thus react acidic, neutral or alkaline. Many pH values of household chemicals (cleaning agents, food) can already be estimated by their components. For example, many household cleaners contain alkaline solutions. They are added there because of their decomposing and thus cleaning effect against organic pollutants.

Other everyday substances such as milk or fruit juice are more difficult to assess whether they are acids or alkalis. Therefore the measurement of the pH value is an important task, not only for food. This experiment investigates how the acidic or basic property of a chemical can be easily determined.

## Other teacher information (1/2)

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### Prior knowledge



- The students are familiar with the terms acids and bases or alkalis.
- "Acid" or "basic" is a typical property of any aqueous solution.
- This property can also be determined for typical household chemicals (cleaning agents, food).

### Principle



In any aqueous solution, the pH value can be determined with a suitable measuring instrument and "mediates" the property of the examined substance:

- $\text{pH} < 7$ : substance reacts acidic
- $\text{pH} = 7$ : substance reacts neutrally
- $\text{pH} > 7$ : substance reacts basic

## Other teacher information (2/2)

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### Learning objective



- The students learn about measuring methods for determining the pH value
- Classification of substances on the basis of the pH value in acids or bases

### Tasks



- In this experiment, everyday substances with you get into contact daily are to be examined for their pH value.
- The question of when a chemical is acidic or basic and how these properties can be determined is clarified.

## Safety Instructions

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- The general instructions for safe experimentation in science lessons apply to this experiment.
- Acids and alkalis (such as in cleaning agents) can cause burns.
- Wearing protective goggles is recommended.

## Student Information

## Motivation



Hazard pictogram for corrosive substances

In everyday life we encounter many acidic or basic substances which are "corrosive" due to their chemical properties. For this reason, these substances are usually provided with a warning label (see figure on the left). But how can we determine (without a warning label) whether a substance is an acid or base/alkali?

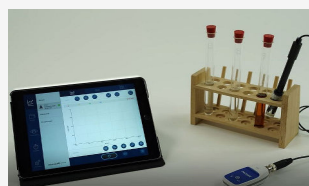
The proton concentration is a measure of how basic or acidic a solution is. Since this concentration can fluctuate over several orders of magnitude, the pH value is defined as the negative decadic logarithm of the proton concentration.

Use the "Cobra SMARTsense" for pH determination system and the PHYWE measureAPP.

## Tasks

- Determines the pH value of household chemicals such as milk, soap or lemonade.
- Before you start the experiment, consider whether typical household chemicals are "acidic" or "alkaline". Answer the questions on the right.
- Write down your experimental observations and answer the questions in the report.

### Property of typical household chemicals?



Vinegar in water has an acidic property

correct

wrong

## Equipment

Position	Material	Item No.	Quantity
1	<a href="#">Cobra SMARTsense - pH, 0 ... 14 (Bluetooth)</a>	12921-00	1
2	<a href="#">Beaker, 50 ml, plastic (PP)</a>	36080-00	2
3	<a href="#">Test tube rack f. 6 tubes, wood</a>	37685-10	1
4	<a href="#">Test tube, 180x20 mm, PN19</a>	36293-00	6

## Additional Equipment

Position	Art. No.	Designation
1		mobile device (Smartphone / Tablet)
2	14581-61	measureApp
3		Detergents
4		Food (milk, lemonade, vinegar, baking powder ..)

## Set-up (1/3)

The Cobra SMARTsense pH Sensor and measureApp are required to measure the pH value. Check that "Bluetooth" is activated on your device (tablet, smartphone) (the app can be downloaded free of charge from the Appstore - QR codes below). Now open measureApp on your device.



measureApp for  
Android operating  
systems

(Google Play Store)



measureApp for iOS  
operating systems

(App Store)

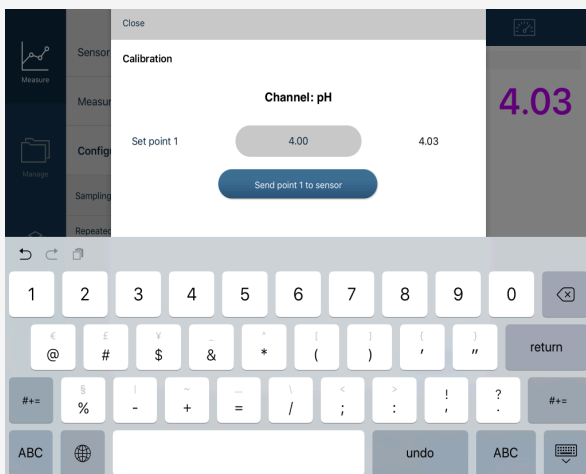
## Set-up (2/3)



measureApp

- Turn on the Cobra SMARTsense pH sensor by pressing and holding the power button.
- Connect the sensor in the measureAPP under the point "Measure" to the device as shown in the figure on the left.
- The Cobra SMARTsense pH sensor is now displayed in the app.

## Set-up (3/3)

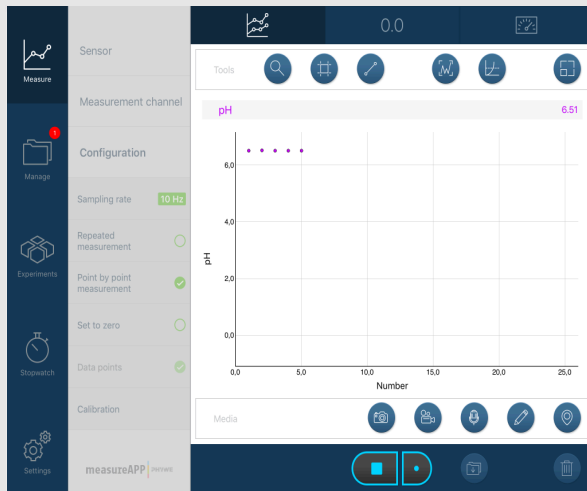


Calibration

- The pH sensor must be calibrated before starting the experiment.
- To do this, the sensor is placed under "Measure" > "Configuration" > "Calibration" in two buffer solutions with pH 4 and pH 10, 25 ml each (see picture on the left).
- For this purpose, the storage container must be unscrewed at the tip. For calibration and measurement, it is important to leave the sensor in the liquid until the measured value does not change significantly. Between the calibration steps the sensor must be rinsed carefully with clear water.



## Procedure

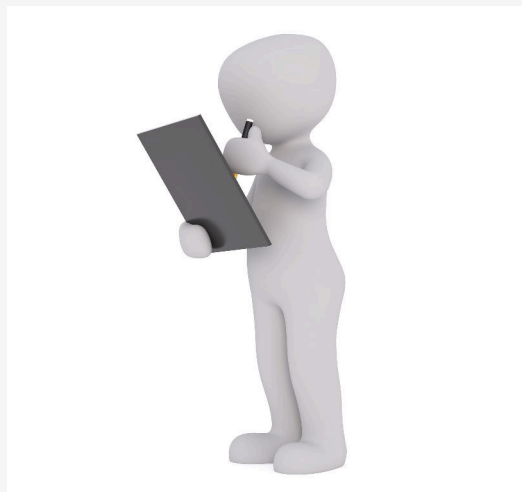
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Measurement

- Now prepare the chemicals to be measured in various suitable containers and fill in enough liquid so that the measuring head of the pH sensor can be completely immersed.
- Now select under "Configuration" the option "point by point measurement" to measure the individual pH values one after the other and start the measurement in measureAPP by pressing . For each new substance the measured pH value can be added to the measurement series by pressing the button next to, as shown in left picture.
- After each measurement the sensor must be rinsed with clear water. After all pH values have been measured, the measurement series is stored and exported to "Manage".

## Report

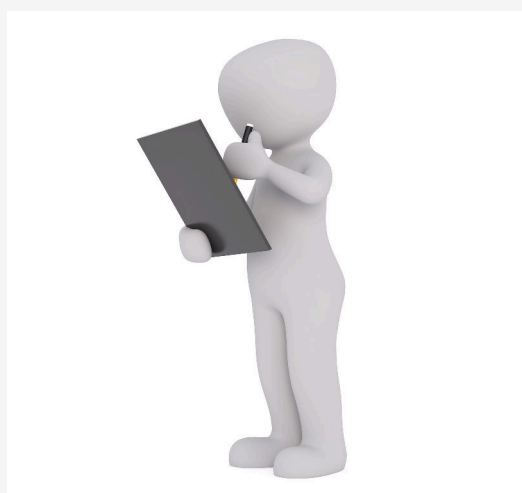
## Results - Experimental observations



### Write down your observations

Why is it necessary to rinse the pH sensor with water between measurements?

## Results - Table 1



### Enter the pH value in the table!

Substance	pH value (measured)	acidic or alkaline?
Milk		
Vinegar		
Soap		

## Task 1



Warning notice "Corrosive effect"

Fill in the blanks

The pH value is a measure for the proton concentration of a solution. If the pH value is  than 7, you have an acidic solution.

If the pH value is 7, you have a  solution.

For  solutions the pH-value is higher than 7, so the pH-value is a criterion how acidic or basic a solution is.

Check

## Task 2

Vinegar

Assign the substances the property "acidic" or "basic".

blood, pH = 7.4 →

milk, pH = 6 →

Saline solution, pH = 8.5 →

Check

## Task 3

How does the pH value of a solution change?

The pH value is a measure of how basic or acidic a solution is. In  
[ ] water, hydronium and hydroxide ions form in  
[ ] proportions by the transfer of a proton.

If you now add an acid = [ ] or a base = [ ],  
this ratio changes. The more hydronium ions there are, the more  
[ ] the solution is.

pure

equal

proton acceptors

acidic

proton donors

 Check

Slide	Score/Total
Slide 8: Answer the questions	0/4
Slide 18: Experimental observation	0/3
Slide 19: Multiple tasks	0/7
Slide 20: Temperature of our body	0/5

Total Score  ★ 0/19 Show solutions Retry Export text