Properties of material - combustibility, melting point

Chemistry > General Chemistry > Chemical & physical material properties

Difficulty level	Group size	Preparation time	Execution time
easy	1	10 minutes	10 minutes

Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

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Teacher information

Application

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molten iron

In this experiment the students investigate the melting temperature and the firing range of different materials. These characteristic physical properties enable them to systematically differentiate between the materials. The melting temperature marks a change in the state of aggregation from solid to liquid. The different measurement results which certainly occur when determining the melting temperature should be used to discuss possible sources of error, whereby the different accuracy of the thermometers or possible impurities of the substances cause the main error. On this occasion, the necessity of several measurement series, averaging etc. can also be discussed.

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Other teacher information (1/2)

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Prior knowledge

- The melting temperature is the substance-dependent temperature at which a substance under constant pressure changes from the solid state of aggregation to the liquid state of aggregation by the addition of heat. The particle movement in the material increases in this process.
- Burns are exothermic oxidation reactions that take place with atmospheric oxygen. The flammability of a substance depends on three factors: The substance itself, the oxygen content and the ignition temperature.

Scientific principle

The students examine five different materials for their melting temperature and flammability as physical material properties.

Other teacher information (2/2)

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Learning objective

- Substances can be recognized and described by characteristic properties.
- These properties include flammability and melting temperature

Tasks

Examination of the emitted substances for flammability and melting temperature.

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Safety instructions

- The burning of sulphur produces gases that are harmful to health. Work only with small quantities and if possible under the fume cupboard! Ventilate the room well!
- Before melting the stearic acid, inform the students that it is flammable. Only heat the lower part of the test tube!
- Put on protective goggles!
- The general instructions for safe experimentation in science teaching apply to this experiment.

Student Information

Robert-Bosch-Breite 10
37079 Göttingen
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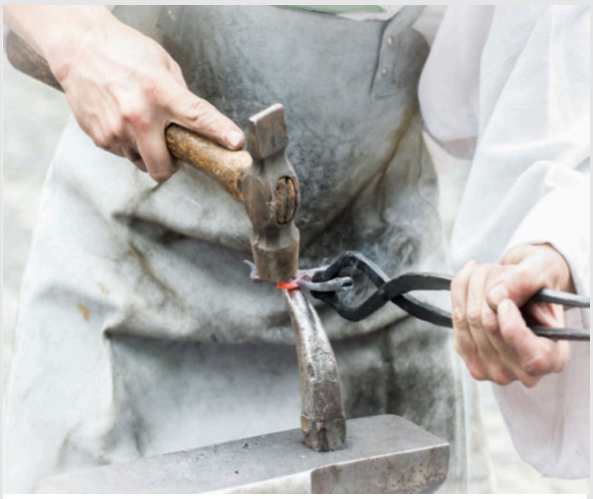
info@phywe.de
www.phywe.de

Motivation



Metal working by a blacksmith

Every day we come in our environmentin contact with a wide range of different materials and substances. On the basis of our perception of certain characteristics we can distinguish the different materialsFor example, we know from our everyday experience that wax melts at lower temperatures than iron. This knowledge enables us to order materials systematically and use them in a targeted manner. Melting temperature and flammability, for example, are important properties of heavy metals, which must be taken into account when processing metals into tools or car body parts, for example. In this experiment, five different substances are to be examined for their flammability and melting temperature properties.

Tasks

Experiment set-up

How can substances be distinguished?

- Examine the substances emitted for flammability and melting temperature.
- Before the preliminary test, prepare a table with one column each for the substances, one for the flammability and one for the measured melting temperatures.

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37079 Göttingen
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Fax: 0551 604 - 107
info@phywe.de
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Equipment

Position	Material	Item No.	Quantity
1	Iron powder, techn. 500 g	30067-50	1
2	Sodium chloride 250 g	30155-25	1
3	Sulphur, pieces, 500 g	30277-50	1
4	Quartz sand, coarse, 1000 g	CHE-881318041	1
5	Test tube, 180x18 mm,100pcs	37658-10	1
6	Test tube rack f. 6 tubes, wood	37685-10	1
7	Test tube brush w. wool tip,d20mm	38762-00	1
8	Protecting glasses, clear glass	39316-00	1
9	Rubber gloves, size M (8), one pair	39323-00	1
10	Spatula, powder, steel, l=150mm	47560-00	1
11	Stearic acid 250 g	30228-25	1
12	Support base, variable	02001-00	1
13	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
14	Boss head	02043-00	1
15	Porcelain dish, 75ml, d = 80 mm	32516-00	1
16	Combustion spoon, l=300 mm	33346-00	1
17	Universal clamp	37715-01	1
18	Lab thermometer,-10..+150C	38058-00	1
19	Butane burner with cartridge, 220 g	32180-00	1
20	Wire gauze with ceramic, 160 x 160 mm	33287-01	2

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Set-up

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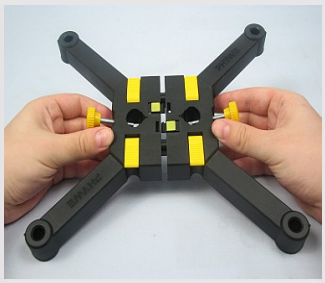
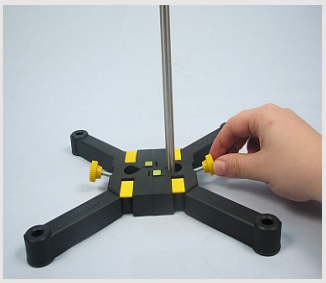
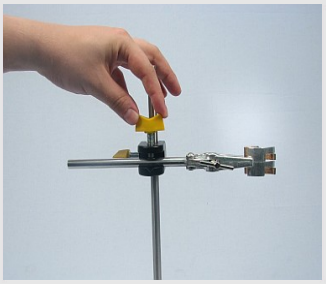
- Assemble the tripod from the tripod base and the tripod rod. See the two illustrations above.



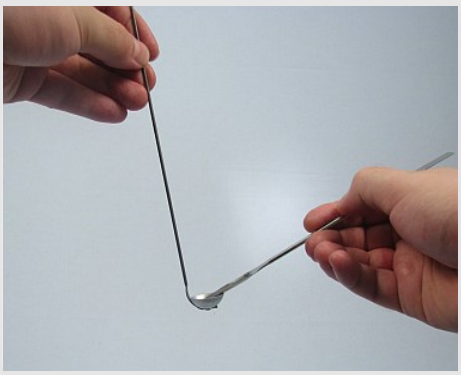


- Attach the double socket to the stand rod and fix the universal clamp to it, see the two illustrations below.



Procedure (1/3)

- Fill the combustion spoon with a small spatula tip of iron powder.
- Hold the combustion spoon in the non-luminous flame and check for flammability for approx. 1 min.



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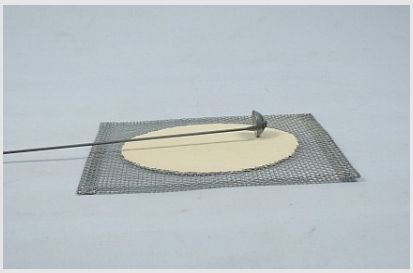
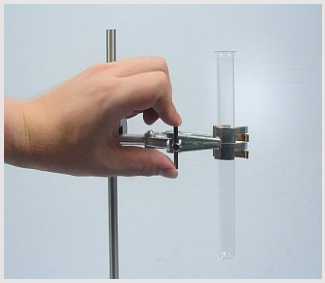
Procedure (2/3)

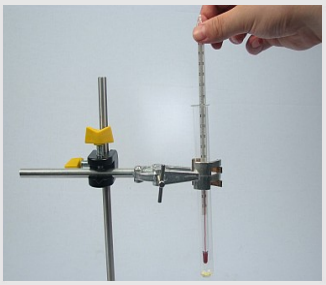
- Place the evaporating dish on a wire net and ignite the burner (non-luminous flame).
- Carefully pour the contents of the combustion spoon into the evaporation dish, anneal the combustion spoon until residues are burnt and allow the combustion spoon to cool on the second wire mesh.
- Do the same with the other substances and enter the results in a table.



Procedure (3/3)

- Clamp a test tube to the tripod and fill a small piece of sulphur into it.
- Carefully heat the test tube until most of the sulfur has melted.
- Remove the burner.
- Now immerse the thermometer in the melt, read the temperature and enter it in a table.
- Repeat the test with the thermometer cleaned by the teacher, also with stearic acid.





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Report

Task 1+2

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- Enter your results in your already prepared table.
- Answer the following questions using your chart.

What changes in the states of aggregation do you observe during heating?

From liquid to gas or from _____ to _____.

Check

What changes in the states of aggregation do you observe when cooling down ?

From gaseous to liquid or from _____ to _____.

Check

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Task 3

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Arrange the terms in the text gaps.

The change in the state of aggregation we observe when substances are heated is called _____. This requires _____ to be expended. The change in state of aggregation when substances cool down is called _____. No _____ has to be expended.

energy | melting | energy | solidification

Check

Task 4

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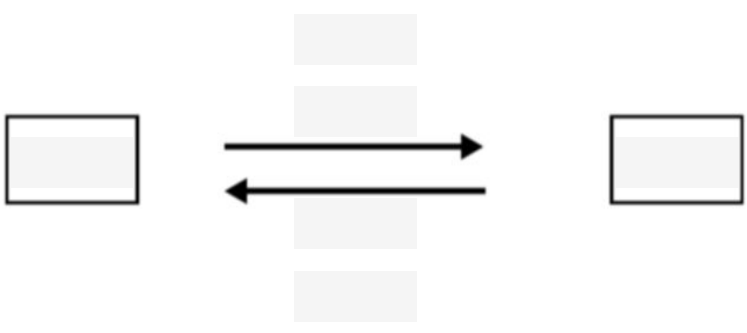
Melting Crucible

Complete the graphic



Check

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Slide	Score/Total
Slide 15: Multiple tasks	0/4
Slide 16: Gap text for the change of aggregate state	0/4
Slide 17: Complete the graphic	0/6

Total amount 0/14

Solutions Repeat

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