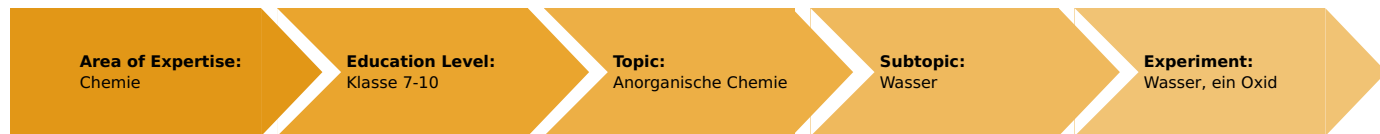


Water, an oxide (Item No.: P7155400)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

water, material property, oxide

Task and equipment

Information for teachers

Learning objectives

- When substances containing hydrogen are burned, water is formed.
- Thus, water is an oxide and accordingly a compound.

Notes on set-up and preparation

Preparation

Instead of ice water, cooled water (from the refrigerator) can be used. If water at room temperature is used, the condensation effect is very slightly.

The use of a filter (water-jet) pump is not mandatory. One can also draw in the combustion gas with a pipettor or a Peleus ball or even completely disperse with low pressure. However, if this is done, only extremely small quantities of condensed water are produced, but they can still be detected with dehydrated copper sulphate.

Remarks on the students' experiments

To avoid the time-consuming disassembly of the experimental apparatus, the combustion products can also be drawn in through a cold trap. However, in this case the test tube must be replaced; and, in addition, condensation on cold surfaces cannot be demonstrated.



Hazard and Precautionary statements

Methylated spirit:

H225: Highly flammable liquid and vapour.

P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

Hazards

- Raw alcohol (methylated spirit) is highly flammable. Extinguish all open flames!
- Wear protective glasses!
- Lubricate all rubber-glass connections with glycerol. Do not use force!

Remarks on the method

Based on the fact that water has been shown to be an oxide, a repetition of the terms reduction and reducing agent is possible - in particular in Exercise 4. This is the first time that this term has been used for a liquid. This repetition requires the student to rethink these concepts, since in their conceptual world these terms (oxide, reducing agent, etc.) are quickly identified with solids.

The procedure: identification as compound - analysis - synthesis corresponds to strict natural scientific method and should also be thus conveyed to the students.

Water, an oxide (Item No.: P7155400)

Task and equipment

Task

Is water an element or a compound?

Determine the processes by which water is produced.



Equipment



Position No.	Material	Order No.	Quantity
1	Rubber tubing, i.d. 6 mm	39282-00	1
1	Rubber tubing,vacuum,i.d.6mm	39286-00	1
2	Boss head	02043-00	2
3	Universal clamp	37715-00	2
4	Protecting glasses, clear glass	39316-00	1
5	Support base, variable	02001-00	1
6	Test tube brush w. wool tip,d25mm	38762-00	1
7	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
8	Graduated cylinder, 10 ml, plastic	36636-00	1
9	Water jet pump, plastic	02728-00	1
10	Crucible tongs,200mm,stainl.steel	33600-00	1
11	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	1
12	Test tube rack f. 6 tubes, wood	37685-10	1
13	Porcelain dish, 75ml, d = 80 mm	32516-00	1
14	Funnel, glass, top dia. 80 mm	34459-00	1
15	Test tube,180x20 mm,side arm,PN19	36330-00	1
16	Glass beaker DURAN®, tall, 250 ml	36004-00	1
17	Glass tubes,right-angled, 10	36701-59	(1)
	Butane burner f.cartridge 270+470	47536-00	1
	Butane cartridge CV 300 Plus, 240 g	47538-01	1
	Wood splints, package of 100	39126-10	(1)
	Glycerol, 250 ml	30084-25	1
	Denaturated alcohol (spirit for burning), 1000 ml	31150-70	1
Additional material			
	Ice water		

Set-up and procedure

Set-up

Hazards

- Raw alcohol (methylated spirit) is highly flammable. Extinguish all open flames!
- Wear protective glasses!
- Lubricate all rubber-glass connections with glycerol. Do not use force!



Set-up

Set up the support stand with two bossheads and universal clamps according to Fig. 1 - Fig. 4. Place the universal clamps at right angles to each other (Fig. 5 + Fig. 6).

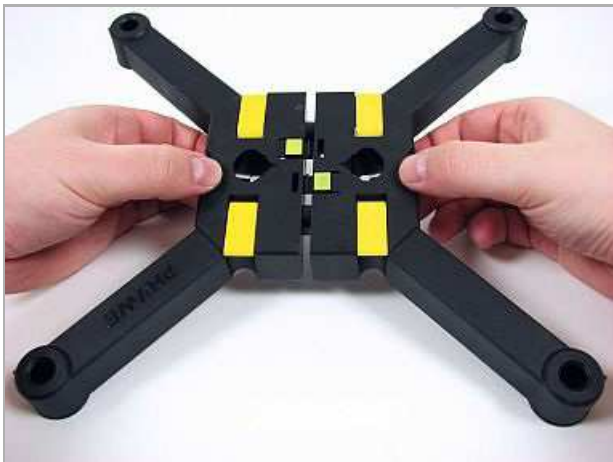


Fig. 1



Fig. 2

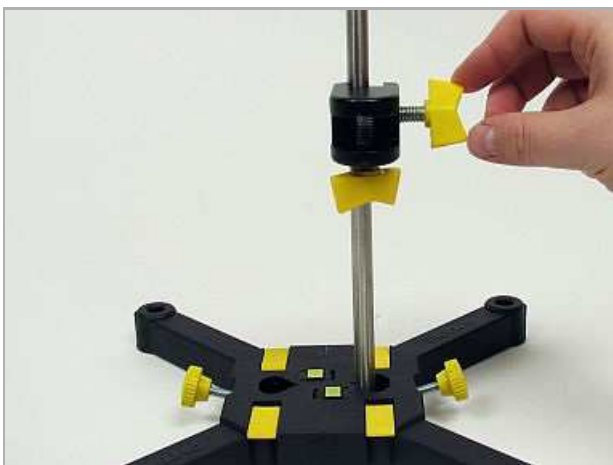


Fig. 3



Fig. 4



Fig. 5

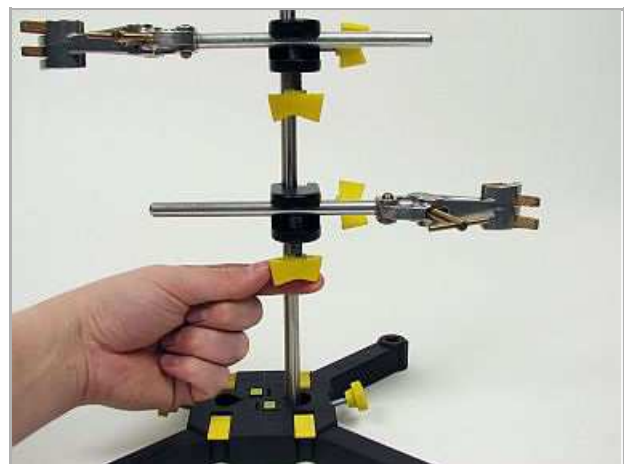


Fig. 6

Add a drop of glycerol to the end of the right-angled glass tube (Fig. 7) and twist its long leg cautiously into the stopper's hole (Do not use force!) (Fig. 8).

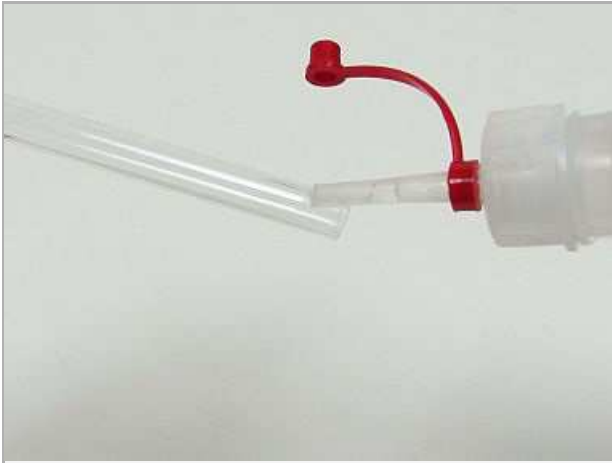


Fig. 7

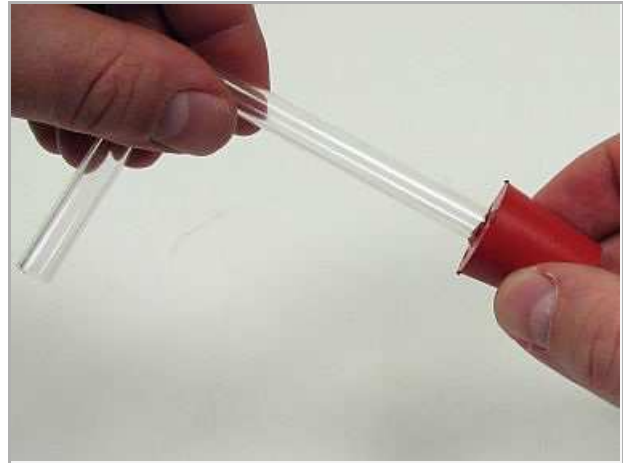


Fig. 8

Clamp the test tube into the lower universal clamp (Fig. 9). Seal the test tube with the stopper (Fig. 10) and twist the right-angled tube into the stopper until it nearly touches the bottom of the test tube. Clamp the funnel into the other universal clamp (Fig. 11). Connect the funnel and the open end of the right-angled tube with a long piece of tubing such that a continuously closed apparatus is formed (Fig. 12).

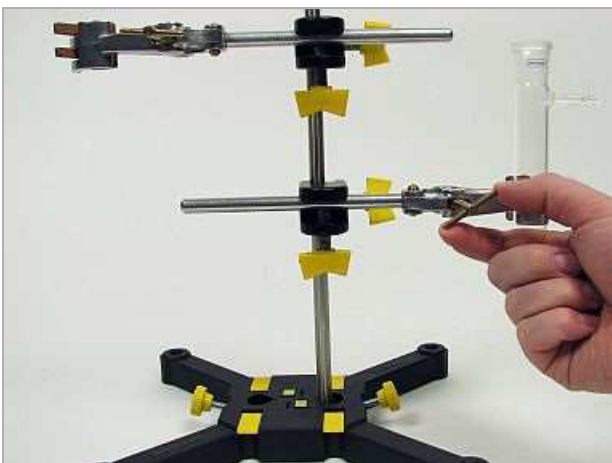


Fig. 9

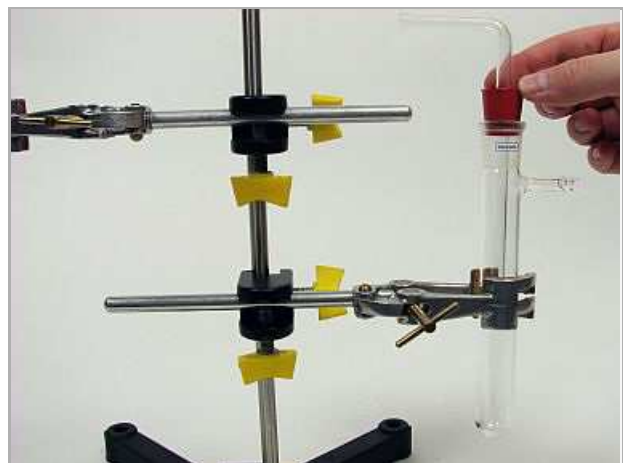


Fig. 10

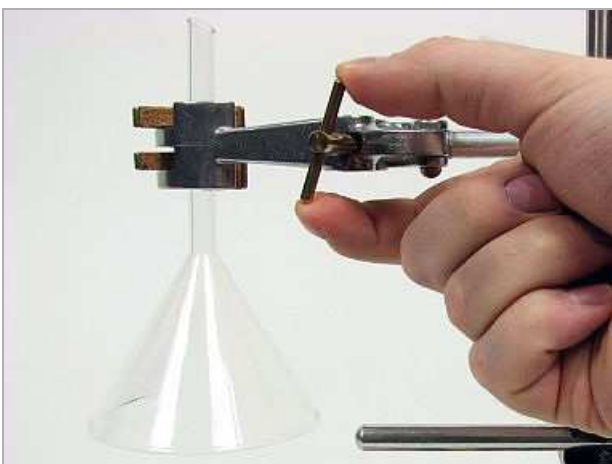


Fig. 11



Fig. 12

Lower the apparatus so that the test tube is immersed for one-third of its length in the beaker below it, which contains ice water (Fig. 13).



Fig. 13

Procedure

Procedure

Connect the water jet pump to the side arm of the test tube with vacuum tubing (Fig. 14) and adjust the water flow such that a slight vacuum is generated.

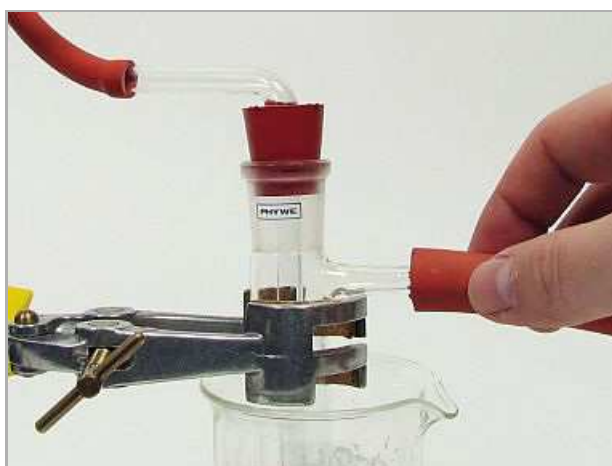


Fig. 14

Hold the burner, which has been adjusted to have its smallest flame, under the funnel and allow its combustion products to flow through the apparatus for approximately 5 min (Fig. 15).



Fig. 15

Pour out the ice water and dry the beaker. Extinguish the burner's flame.

Fill the porcelain dish with approximately 3 ml of methylated spirit (Fig. 16), remove the dispensing bottle and the graduated cylinder from the experimental area. Light a wooden splint, extinguish all other flames, and ignite the methylated spirit with the wooden splint (Fig. 17). Hold the bottom of the beaker, which is dry and still cool, above the methylated spirit flame with the crucible tongs (Fig. 18).



Fig. 16



Fig. 17



Fig. 18

Report: Water, an oxide

Result - Observations

Note your observations.

a) Bunsen burner flame:

b) Methylated spirit flame:

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Evaluation - Question 1

Draw conclusions from your observations.

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Evaluation - Question 2

According to your experimental results, which class of substances does water belong to? Answer the question in the experiment's title using your conclusions.

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Evaluation - Question 3

How can it be proved that the resulting liquid is really water?

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Evaluation - Question 4

How could the other component(s) of water be determined?

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Evaluation - Question 5

On cold days fog forms at the exhaust pipe of a car on starting. Explain this observation.

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