Synthesis of water (Item No.: P7155600)

Curricular Relevance

Area of Expertise: Chemie
Education Level: Klasse 7-10
Topic: Anorganische Chemie
Subtopic: Wasser
Experiment: Wassersynthese

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Easy	10 Minutes	10 Minutes	2 Students

Additional Requirements:

Experiment Variations:

Keywords:

water, synthesis of water

Task and equipment

Information for teachers

Learning objectives

- Water (hydrogen oxide) is produced when hydrogen is burned.
- To test the result of analysis, a synthesis should be conducted as a countercheck.

Notes on set-up and procedure

Preparation
To save time, hydrogen from a steel cylinder can also be used.
Place the ice for the cold trap in the students' working area before class begins.

Remarks on the students' experiments
If there are not enough water-jet pumps or water pressure is too low, the experiment can be modified by burning the hydrogen flame directly into the opening of a flask clamped upside down above it and cooled by flowing water.

Hazard and Precautionary statements

Calcium, granular:

H261:	In contact with water releases flammable gases.
P402 + P404:	Store in a dry place. Store in a closed container.

Copper sulphate:

H302:	Harmful if swallowed.
H315:	Causes skin irritation.
H319:	Causes serious eye irritation.
H410:	Very toxic to aquatic life with long lasting effects.
P273:	Avoid release to the environment.
P305 + P351 + P338:	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P302 + P352:	IF ON SKIN: Wash with plenty of soap and water.

Hazards

- Lubricate rubber-glass connections with glycerol. Do not use force!
- Explosive mixtures are formed during the experiment. Wear protective glasses!

Remarks on the method

In connection with the experiments on the analysis of water, the term synthesis should be elucidated or consolidated at this time. The above-mentioned methodological considerations on the reliability of analysis and synthesis are a part of this.

Waste disposal

- Precipitate the copper sulphate as basic or sulphide and dispose it of as heavy metal waste.
- Allow the calcium to react completely by adding water and pour the residue into the collection container for acids and alkalis.

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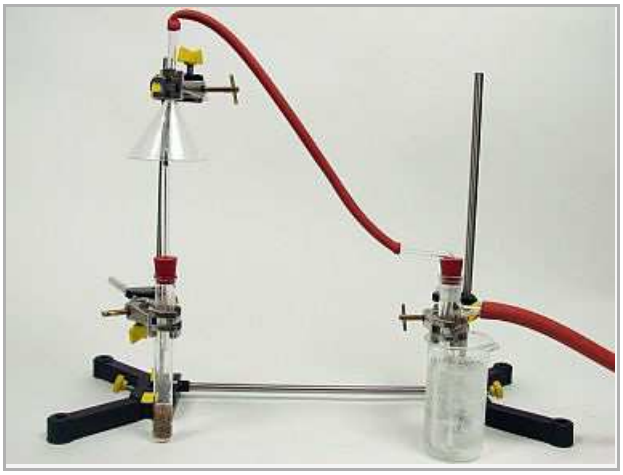
Task and equipment

Task

Which substance is produced on burning hydrogen?

Burn hydrogen and investigate its combustion product.



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	3
3	Universal clamp	37715-00	3
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	3
8	Wash bottle, 250 ml, plastic	33930-00	1
8	Spatula, powder, steel, l=150mm	47560-00	1
9	Water jet pump, plastic	02728-00	1
10	Test tube rack f. 6 tubes, wood	37685-10	1
10	Test tube, 18x188 mm, 10 pcs	37658-03	(2)
11	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	2
12	Funnel, glass, top dia. 80 mm	34459-00	1
13	Test tube,180x20 mm,side arm,PN19	36330-00	1
14	Test tube,180x20 mm,DURAN, PN19	36293-00	1
15	Glass beaker DURAN®, tall, 250 ml	36004-00	1
16	Glass tubes,straight with tip, 10	36701-62	(1)
17	Glass tubes,right-angled, 10	36701-59	(1)
	Butane burner f.cartridge 270+470	47536-00	1
	Butane catridge CV 300 Plus, 240 g	47538-01	1
	Wood splints, package of 100	39126-10	(1)
	Calcium, granular 50 g	30049-05	1
	Glycerol, 250 ml	30084-25	1
	Copper-II sulphate,cryst. 250 g	30126-25	1
	Standard sand,coarse 2500 g	31826-79	1
	Iron wool 200 g	31999-20	1
Additional material			
	Distilled water		
	Ice		

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Set-up and procedure

Set-up

Hazards

- Lubricate rubber-glass connections with glycerol. Do not use force!
- Explosive mixtures are formed during the experiment. Wear protective glasses!




Set-up

Set up the support stand according to Fig. 1 - Fig. 5.

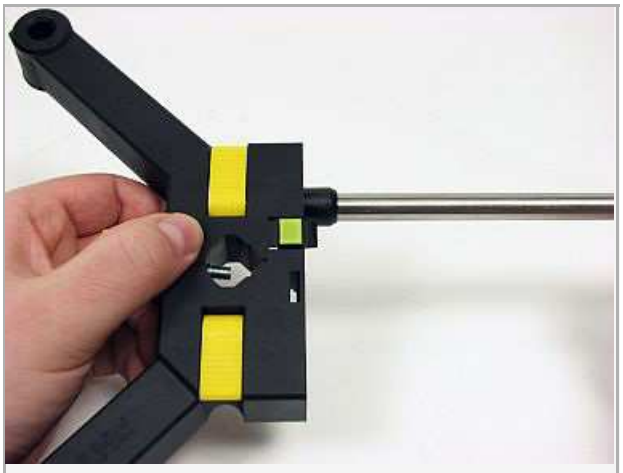

Fig. 1

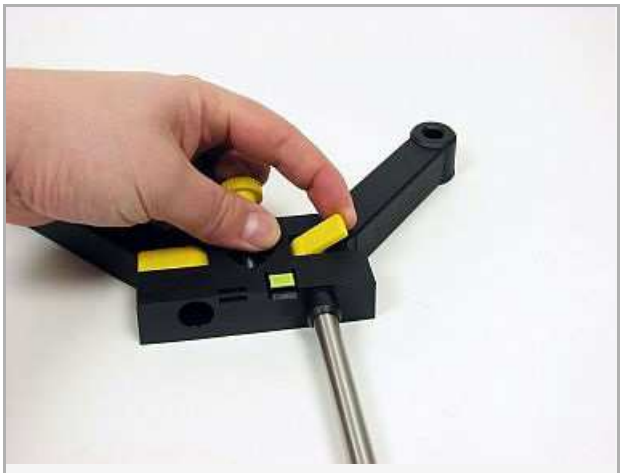

Fig. 2

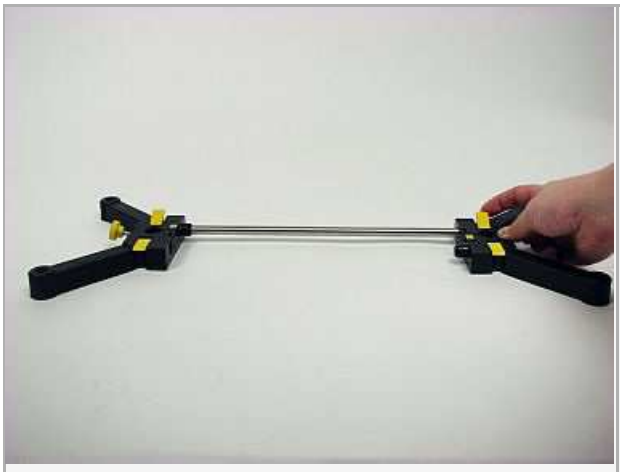

Fig. 3

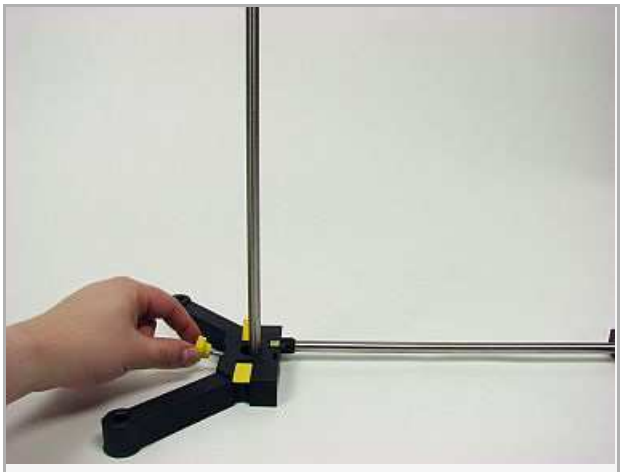

Fig. 4

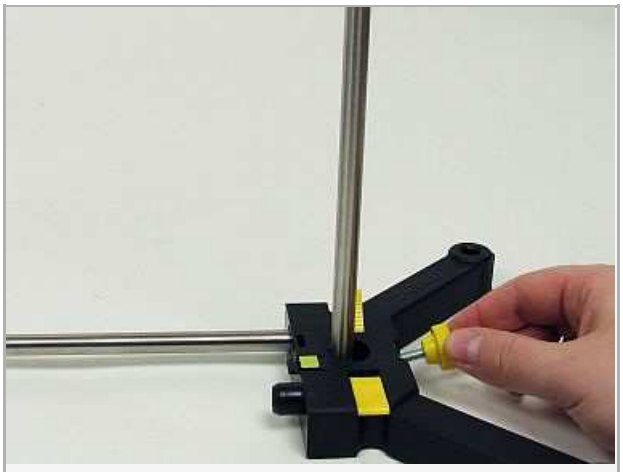

Fig. 5

Attach a universal clamp to the right support rod (Fig. 6 + Fig. 7) and clamp the test tube with side arm into it (Fig. 8).

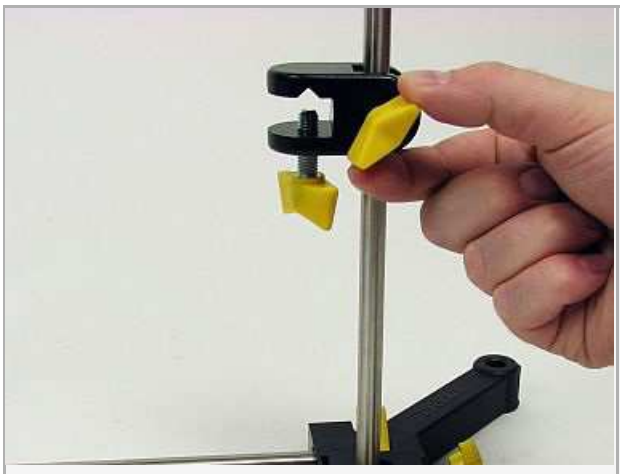

Fig. 6

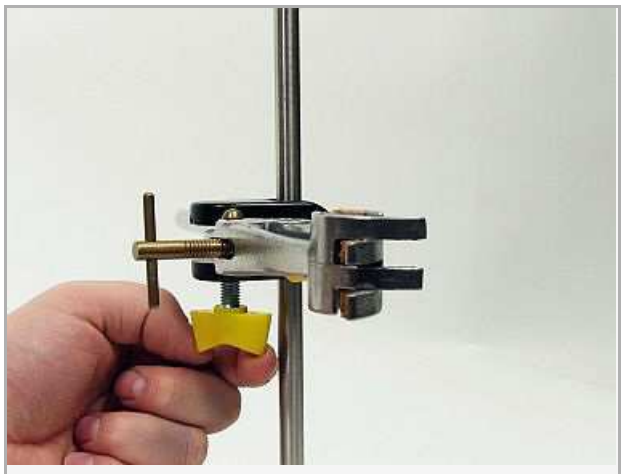

Fig. 7

Fig. 8

Twist the right-angled glass tube (lubricate with glycerol (Fig. 9)) into the stopper (Fig. 10), and seal the test tube with it (Fig. 11). Then move the long leg of the right-angled tube downwards until it nearly reaches the bottom of the test tube.

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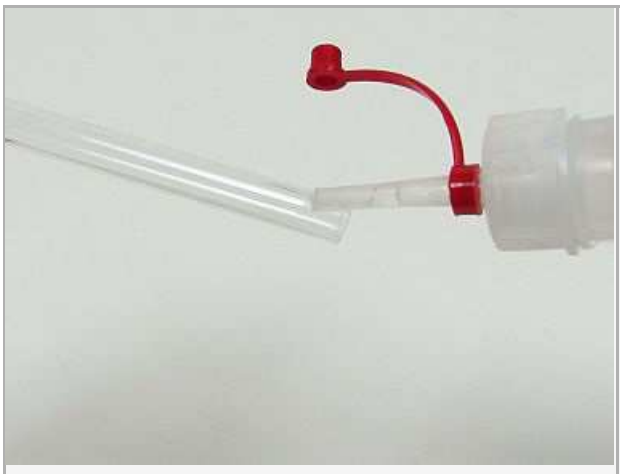

Fig. 9

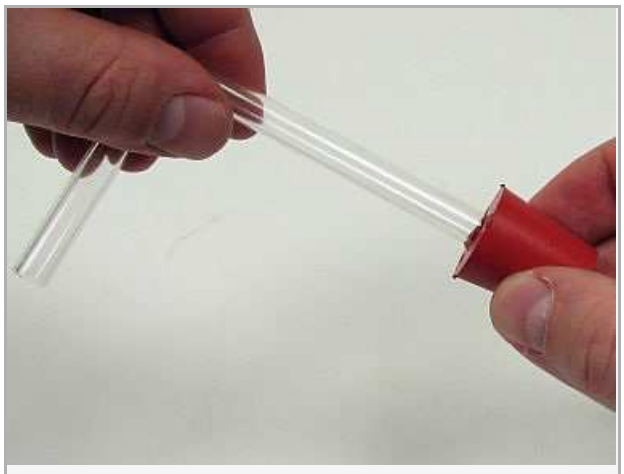

Fig. 10

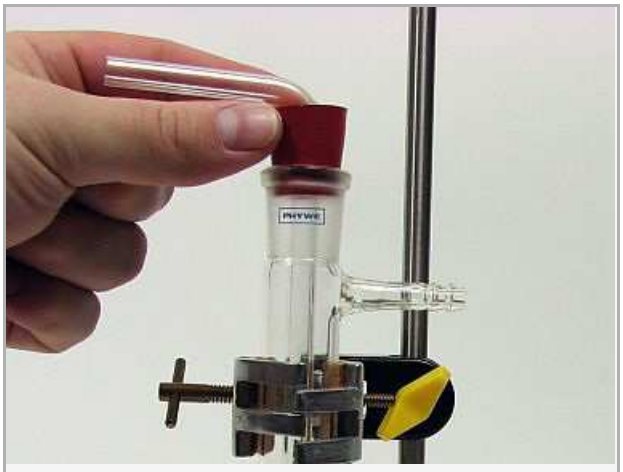

Fig. 11

Connect the water-jet pump via a piece of vacuum tubing to the side arm of the test tube (Fig. 12). Immerse this test test into a glass beaker filled with ice water (Fig. 13).

Fig. 12

Fig. 13

Connect the funnel with its discharge tube upwards to the left support rod such that a test tube can be attached under it (Fig. 14 - Fig. 16). Connect the discharge tube of the funnel to the right-angled glass tube with a piece of tubing so that a continuous apparatus is formed (Fig. 17 + Fig. 18).

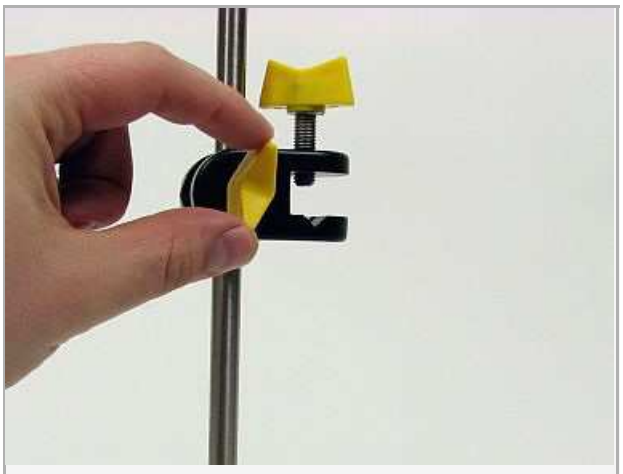

Fig. 14

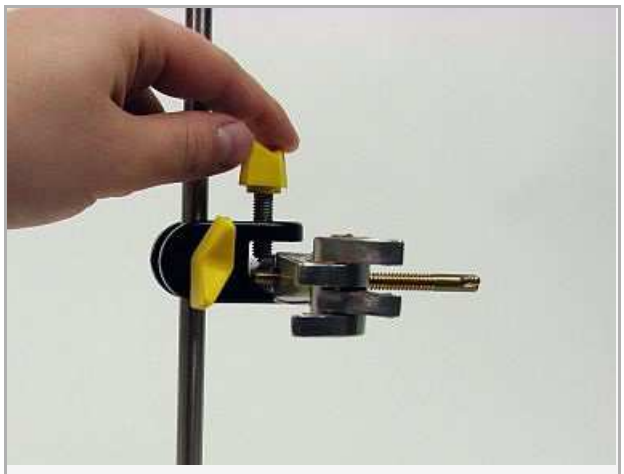

Fig. 15

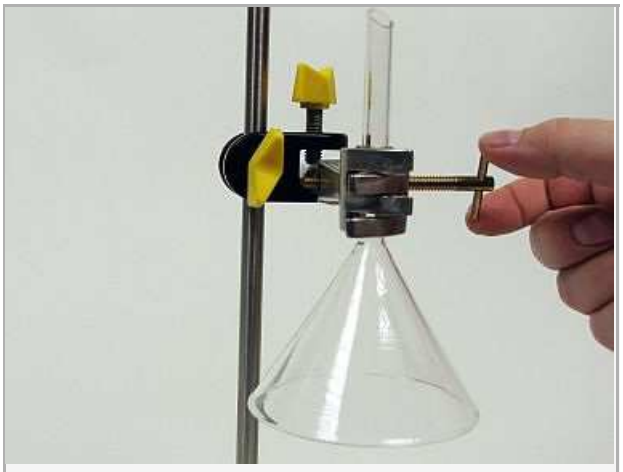

Fig. 16

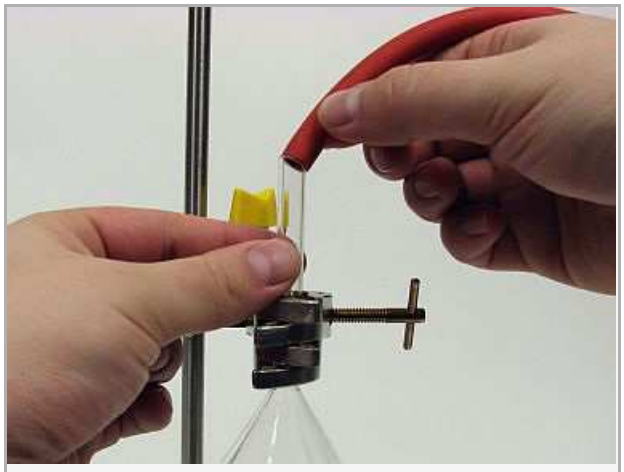

Fig. 17

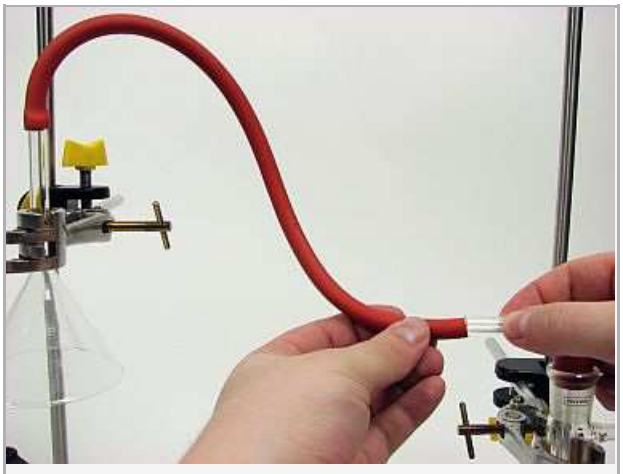

Fig. 18

Attach a universal clamp below the funnel (Fig. 19 + Fig. 20). Insert a bit of iron wool into the glass tube with tip and turn the tube (lubricate with glycerol) into the stopper. Put a spatulaful of calcium into the Duran test tube. Pour approximately 3 cm of sand onto it (Fig. 21). Moisten the sand thoroughly with water such that a small amount of water remains above the sand (Fig. 22). Seal the test tube with the stopper (Fig. 23) and attach it to the support stand below the funnel (Fig. 24).

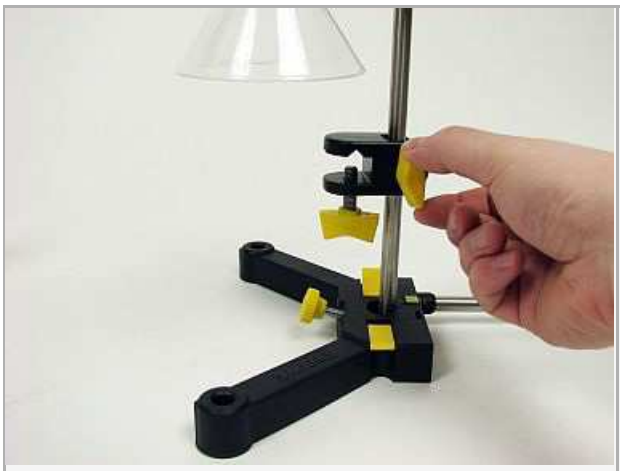
Fig. 19


Fig. 20


Fig. 21


Fig. 22


Fig. 23

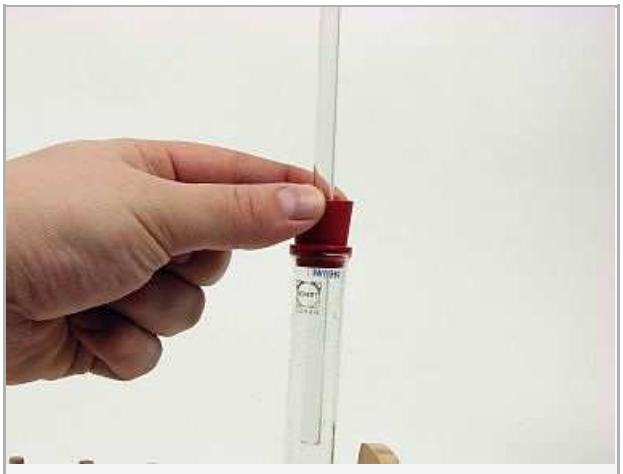
Fig. 24

Procedure

Procedure

Turn on the water-jet pump; check the apparatus for air-tightness.

After the reaction has begun, light the emerging gas with a wooden splint (perform a hydrogen-oxygen test beforehand!). Extinguish the burner flame and remove the burner.

Shut off the water-jet pump after the reaction has stopped. Remove the test tube with the reaction mixture. Put a spatula-tip full of copper sulphate into a test tube. Dehydrate it by heating and put it into the liquid in the test tube with side arm (Fig. 25).

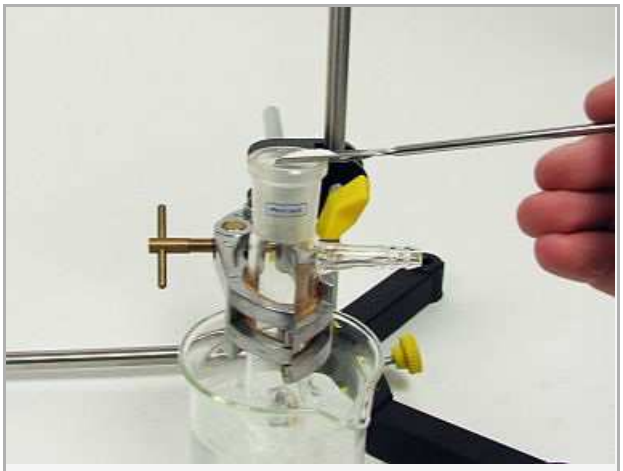

Fig. 25

Waste disposal

- Allow the calcium to react completely by adding water and pour the residue into the collection container for acids and alkalis.
- Dispose of the copper sulphate as heavy metal waste.

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Report: Synthesis of water

Result - Observations

Note your observations.

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Evaluation - Question 1

Draw conclusions from your observations. Summarise the process in a word equation.

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Evaluation - Question 2

Can it be proven with this experiment that water only consists of hydrogen and oxygen?

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Evaluation - Question 3

Explain the terms analysis and synthesis.

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Evaluation - Question 4

Decide whether it is practical to obtain water by the method described above.

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