Properties of oxygen (Item No.: P7153500)

Curricular Relevance

Area of Expertise: Chemie
Education Level: Klasse 7-10
Topic: Anorganische Chemie
Subtopic: Nichtmetalle, Gase und Halbmetalle
Experiment: Eigenschaften von Sauerstoff

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

Additional Requirements:

Experiment Variations:

Keywords:

air, oxygen, non-metals

Task and equipment

Information for teachers

Learning objectives

- Oxygen is a component of many compounds; pure oxygen can be released from oxygen-rich compounds.
- Oxygen has characteristic properties, with whose help it can be identified.

Notes on set-up and procedure

Preparation
The 30% hydrogen peroxide solution in the list of chemicals can be converted into a concentration appropriate for this experiment by diluting it 1: 10.

Remarks on the students' experiments
Ensure that the glass equipment is not forced into the stopper, insert it by turning it after dripping water into the stopper. The entire apparatus must be well sealed.

Hazard and Precautionary statements

Hydrogen peroxide:

H302:	Harmful if swallowed.
H318:	Causes serious eye damage.
P280:	Wear protective gloves/protective clothing/eye protection/face protection.
P305 + P351 + P338:	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P313:	Get medical advice/attention.

Manganese dioxide:

H272:	May intensify fire; oxidiser.
H302 + H332:	Harmful if swallowed or if inhaled.

Hazards

- Mangenese compounds are hazardous to health. Do not swallow them!
- Hydrogen peroxide is caustic. Put on your protective glasses!
- Lubricate rubber-glass connections with water! Do not use force to insert the glass tubes!

Note

In the experiment oxygen is obtained from hydrogen peroxide via the catalytic action of manganese dioxide.
$2\ H_2O_2 \rightarrow 2\ H_2O + O_2$
The substance quantities given in the experimental set-up are not mandatory. If the production of oxygen diminishes, shake the Erlenmeyer flask gently or if necessary, allow some additional hydrogen peroxide to drip into the flask.

Remarks on the method

The test for oxygen already been treated in the preliminary experiments, the smouldering splint test, is used here and consolidated in the second part of the experiment. In a lecture, which can also lead to the completion of the "Substance description form" (see Question 2 in the report), the students should be informed of the importance of oxygen, especially for the processes of life (respiration, metabolism). Its industrial preparation by decomposing oxygen-rich compounds, but even more importantly the liquefaction of air, can be discussed here, but also in the framework of the "Technical Chemistry" unit of instruction.

Waste disposal

Filter the flask's contents. Pour the filtrate into the container for acids and alkalis. Add the residue to the heavy metal wastes. Remove the residual manganese dioxide clinging to the flask with acidified sodium thiosulphate solution and dispose of it in the same manner as the filtrate.

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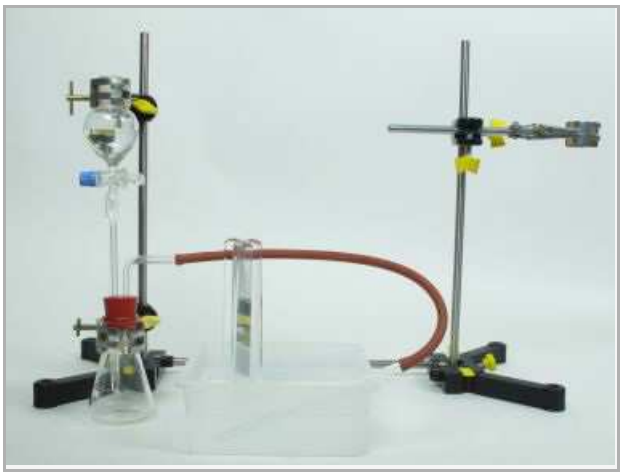
Task and equipment

Task

What properties does oxygen have? Where can it be found outside the atmosphere?

Prepare oxygen from a compound and investigate its propeties.



Equipment

Position No.	Material	Order No.	Quantity
1	Rubber tubing, i.d. 6 mm	39282-00	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	Grad.cylinder,high,PP,50ml	46287-01	1
9	Dish, plastic, 150x150x65 mm	33928-00	1
9	Spatula, powder, steel, l=150mm	47560-00	1
10	Test tube rack f. 6 tubes, wood	37685-10	1
10	Test tube, 18x188 mm, 10 pcs	37658-03	(3)
10	Test tube holder, up to d 22mm	38823-00	1
11	Erlenmeyer flask 100 ml, wide-neck SB 29	36428-00	1
12	Rubber stopper 26/32, 2 holes 7 mm	39258-02	1
13	Dropping funnel with drip nozzle, 50ml	36912-00	1
14	Glass tube,right-angled, 10 pcs.	36701-52	(1)
15	Glass tubes,straight, 200 mm, 10	36701-66	(1)
	Wood splints, package of 100	39126-10	(1)
	Manganese-IV oxide,powder 500 g	30138-50	1
	Hydrogen peroxide,30%,tech.gr.,1l	31942-70	1

Set-up and procedure

Set-up

Hazards

- Manganese compounds are hazardous to health. Do not swallow them!
- Hydrogen peroxide is caustic. Put on your protective glasses!
- Lubricate rubber-glass connections with water! Do not use force on inserting the glass tubes!




Set-up

Set up the support stand according to Fig. 1 - Fig. 6.

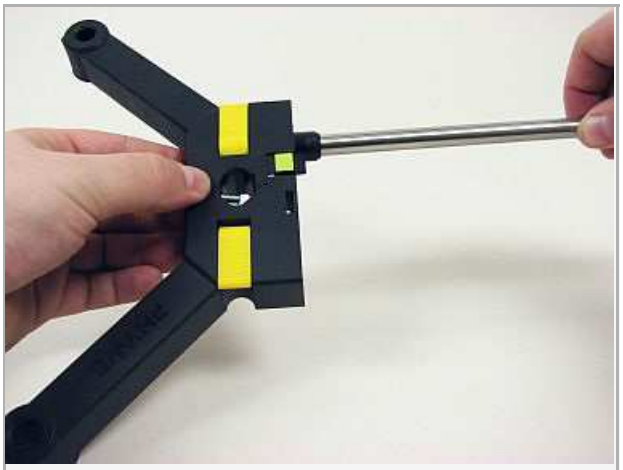


Fig. 1

Fig. 2

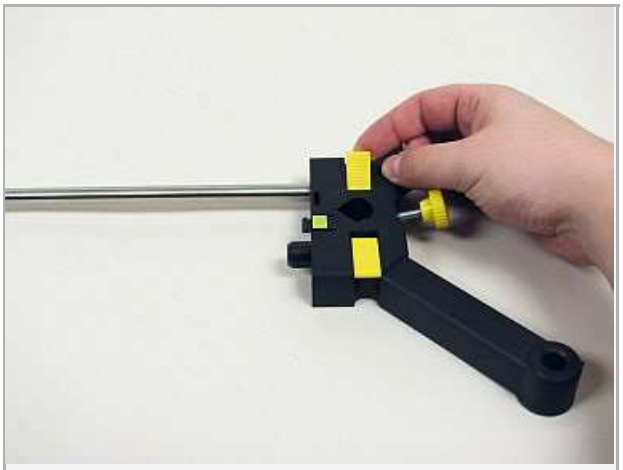


Fig. 3

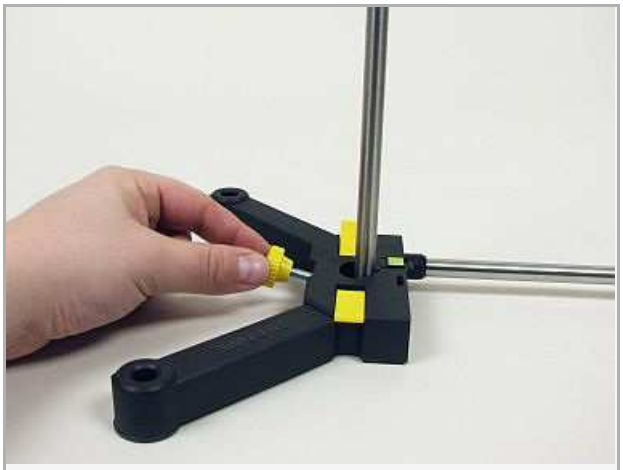


Fig. 4

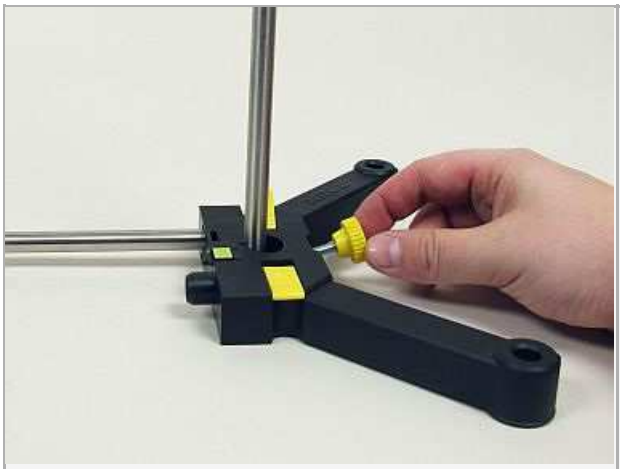


Fig. 5

Fig. 6

Clamp the Erlenmeyer flask in such a manner that it stands securely on the working surface (Fig. 7 - Fig. 9).

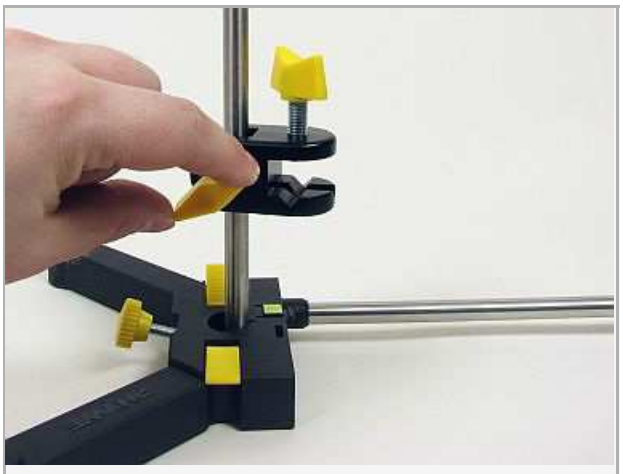


Fig. 7

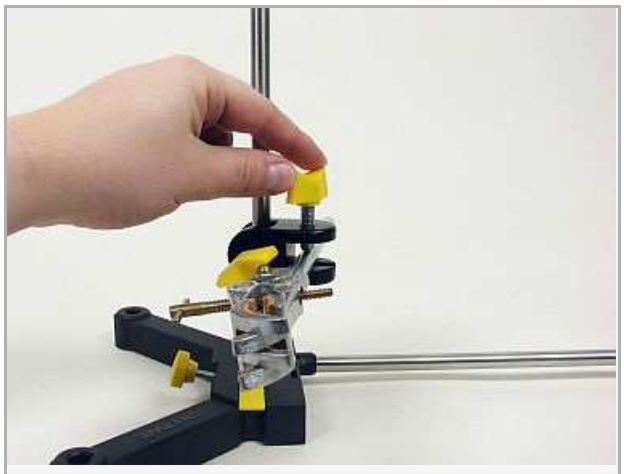


Fig. 8

Fig. 9

Attach one universal clamp to the first vertical rod (Fig. 10 + Fig. 11) and a second one to the second vertical rod (Fig. 12 + Fig. 13).

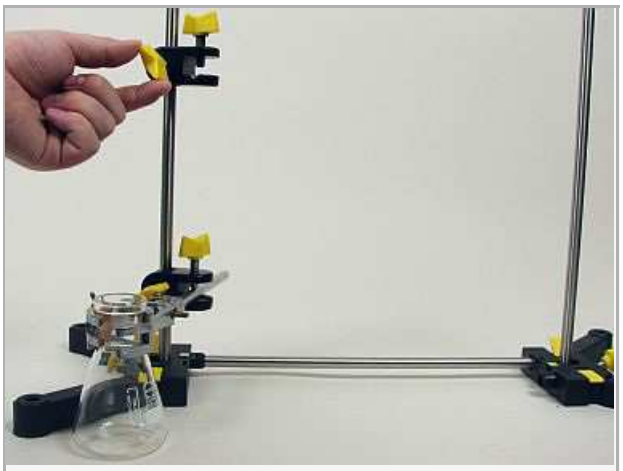


Fig. 10

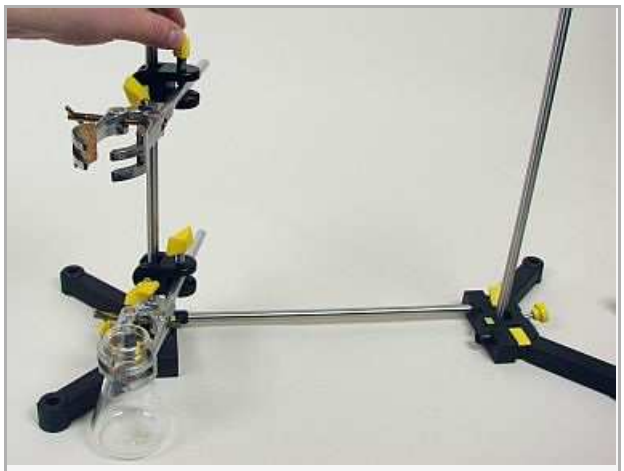


Fig. 11

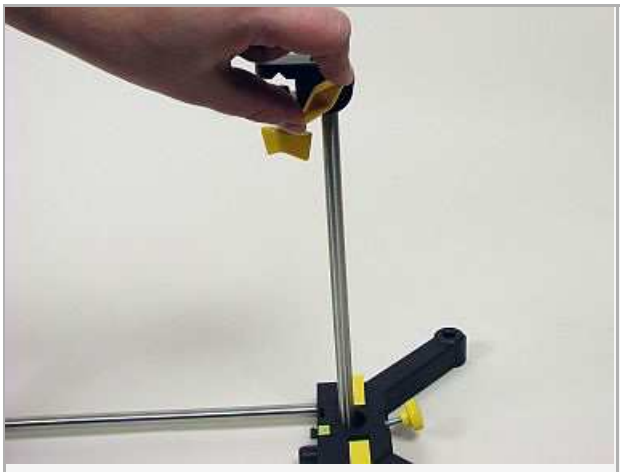


Fig. 12

Fig. 13

Insert the right-angled glass tube into the stopper by turning it (lubricate it with water) (Fig. 14). Subsequently insert the separatory funnel into the second hole such that a part of its outlet tube extends beyond the stopper (Fig. 15).

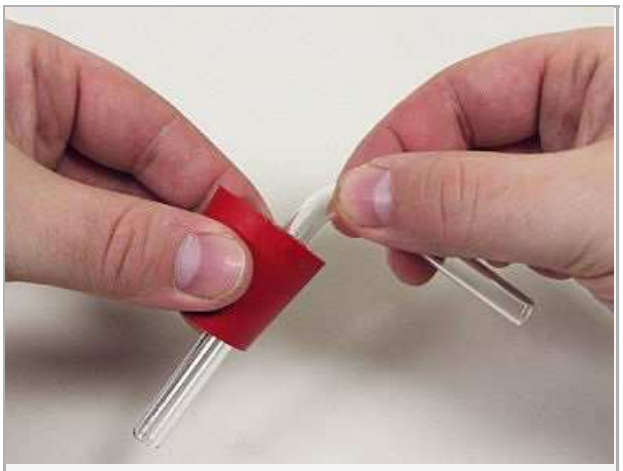


Fig. 14

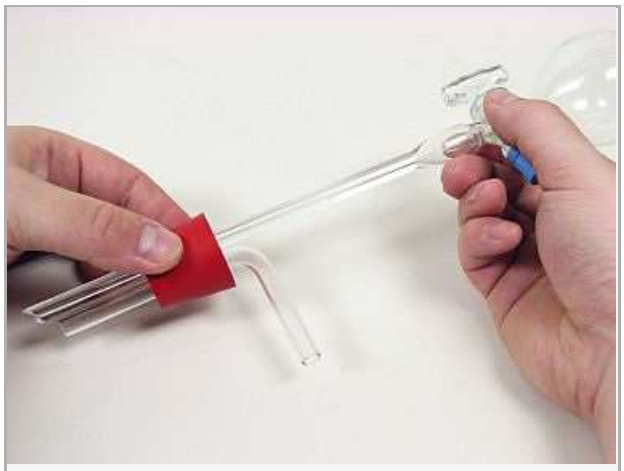


Fig. 15

Connect the right-angled glass tube with the "gas supply tube" (glass tube with tip) via a piece of tubing (Fig. 16 + Fig. 17).

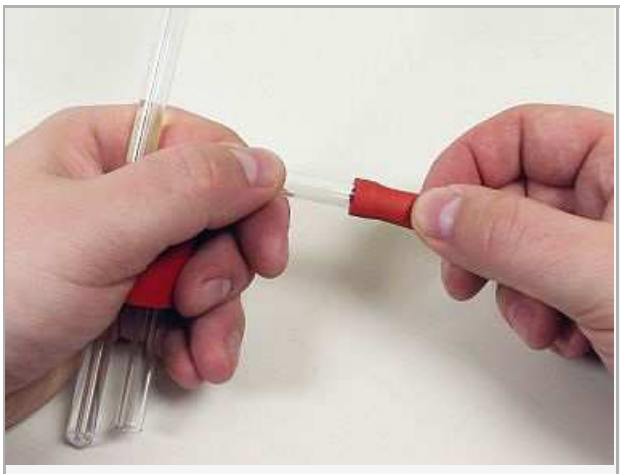


Fig. 16

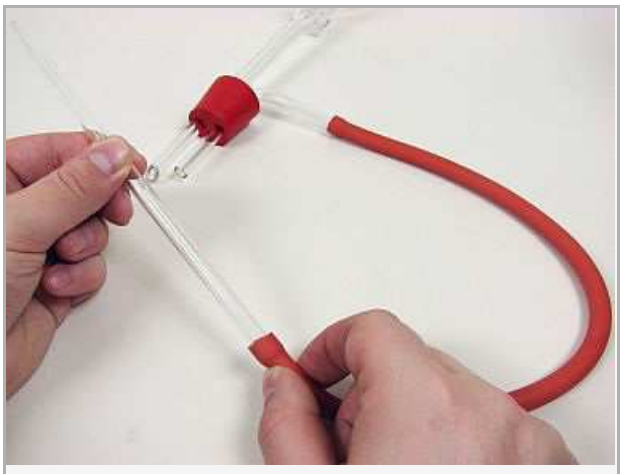


Fig. 17

Put a spatulaful of manganese dioxide into the Erlenmeyer flask (Fig. 18), and seal it with the stopper (Fig. 19). Press the stopper in tightly. Then secure the separatory funnel with the universal clamp (Fig. 20).


Fig. 18

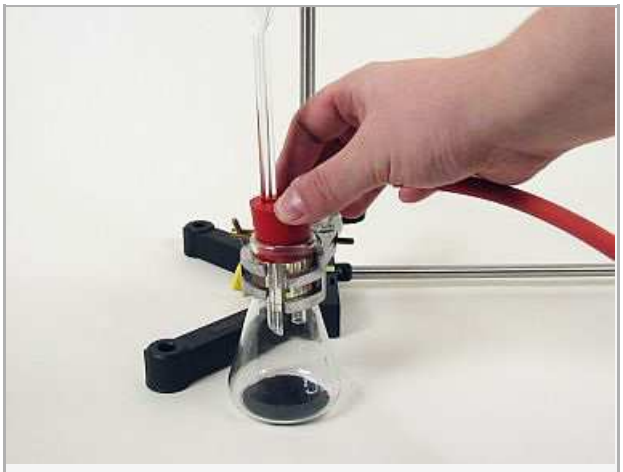


Fig. 19

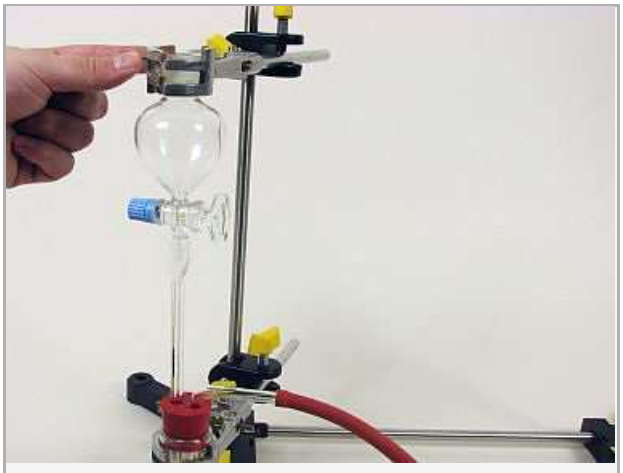


Fig. 20

Fill the plastic dish approximately half-full with water (Fig. 21). Lay the test tubes in the dish so that they are completely filled with water (Fig. 22).

Fig. 21

Fig. 22

Procedure

Procedure

Close the stopcock of the separatory funnel (Fig. 23). Measure out 40 ml of hydrogen peroxide in the graduated cylinder and pour it cautiously into the separatory funnel (Fig. 24).

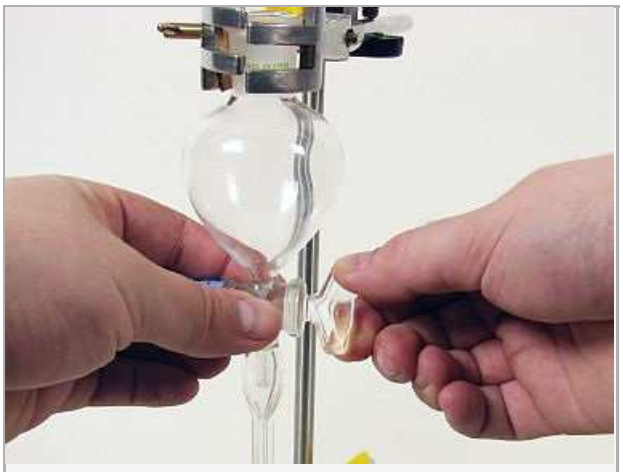


Fig. 23

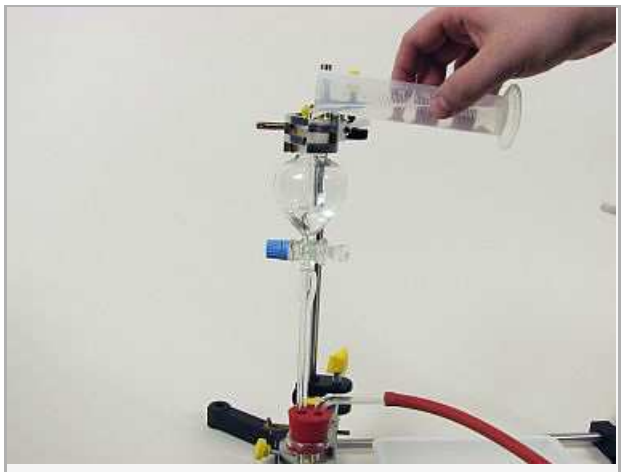


Fig. 24

Open the stopcock so that the hydrogen peroxide drips slowly onto the manganese dioxide (Fig. 25). Lay the "gas supply tube" into the plastic dish and allow the gas to escape for approximately 30 seconds (Fig. 26).

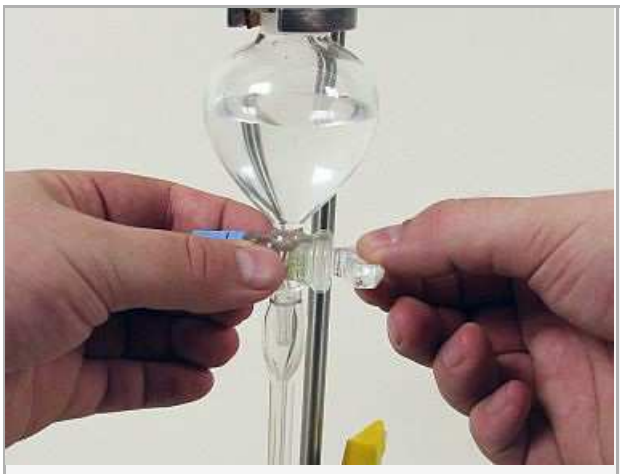


Fig. 25

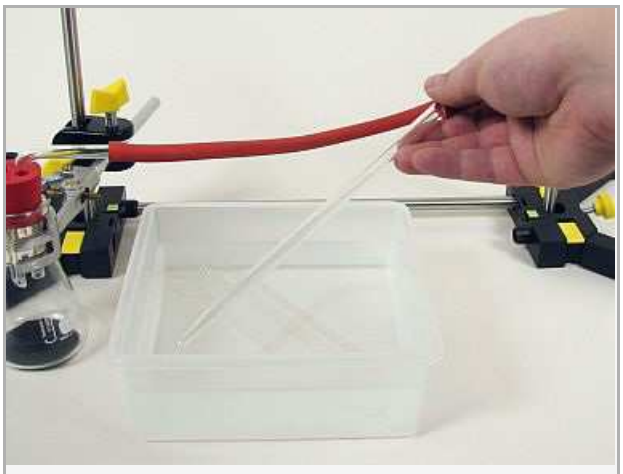


Fig. 26

Seal the test tubes successively with your thumb and place them upside down in the plastic dish such that no water runs out (Fig. 27).

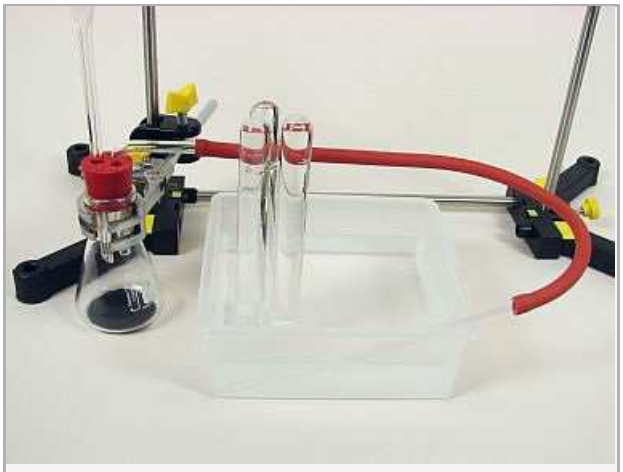


Fig. 27

Fill them (pneumatically) with the gas being generated (Fig. 28).


Fig. 28

In the first test tube conduct the smouldering splint test (Fig. 29). Clamp the second gas-filled test tube with the opening upwards onto the support stand (Fig. 30). After approximately 30 seconds, conduct the smouldering splint test. Finally clamp the third gas-filled tet tube with the opening downwards onto the support stand (Fig. 31). After approximately 30 seconds, conduct the smouldering splint test on them also.

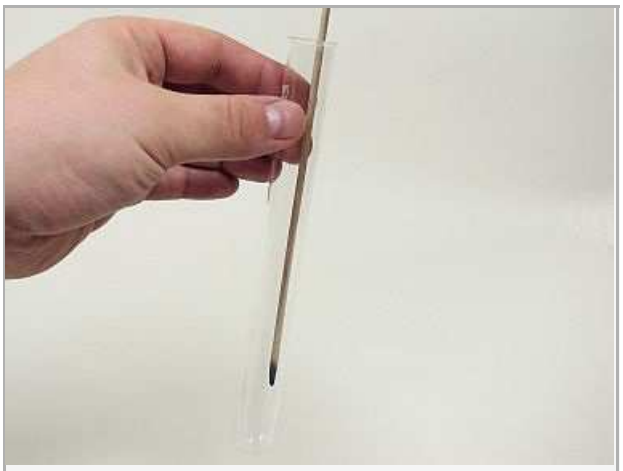


Fig. 29

Fig. 30

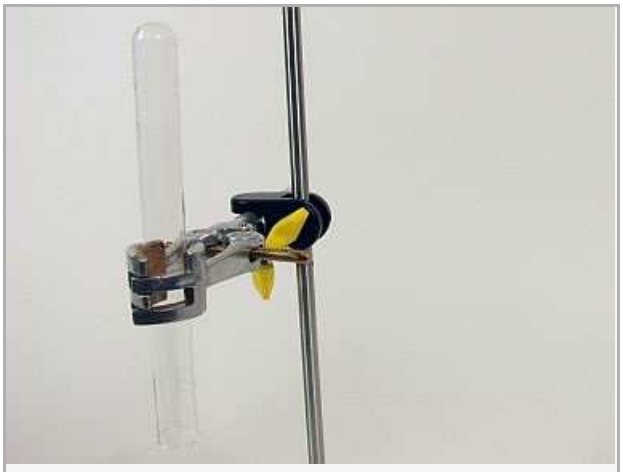


Fig. 31

Waste disposal

Leave the entire contents of the Erlenmeyer flask on the table for disposal.

Report: Properties of oxygen

Result - Observations

Note your observations.

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Evaluation - Question 1

From which substance can oxygen have been released? Name a substance familiar to you that can also give off oxygen.

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Evaluation - Question 2

Make conclusions from your observations.

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Evaluation - Substance description form

Record the observed properties in the general "Substance description form". Fill in the missing information with the help of your textbook.

Name of the substance:	
Chemical symbol:	
Colour:	
State of aggregation:	
Melting point:	
Boiling point:	
Other properties:	
Occurence:	
Use:	

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