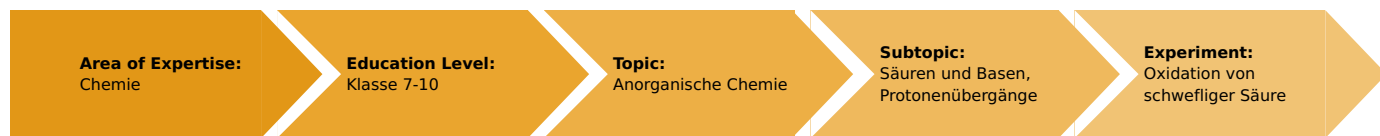


Oxidation of sulphurous acid (Item No.: P7158100)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

sulphurous acid, reaction behaviour, oxidation

Task and equipment

Information for teachers

Learning objectives

- Sulphurous acid can be oxidised and transformed into sulphuric acid. Sulphuric acid can thus be described as the reaction product of sulphur trioxide and water.
- Because of the oxidizability of sulphur dioxide, sulphuric acid is part of the "acid rain".

Notes on set-up and procedure

Preparations

Prepare a 3% H_2O_2 solution (put 10 ml of the 30% solution into 90 ml of water), a 5% sulphuric acid (3 ml of concentrated H_2SO_4 and 100 ml of water), a 5% hydrochloric acid (13 ml of concentrated HCl and 100 ml of water) and a 10% barium chloride solution (10 g of BaCl_2 and 90 ml of water).

Remarks on the students' experiments

Make sure that the apparatus is sealed tightly so that all of the oxygen passes through the sulphurous acid, if possible. Do not use glycerine in order to make the rubber-glass joints slippery since it might react uncontrollably with H_2O_2 .



Hazard and Precautionary statements

Sulphuric acid:

- H314: Causes severe skin burns and eye damage.
 H290: May be corrosive to metals.
 P280: Wear protective gloves/protective clothing/eye protection/face protection.
 P301 + P330 + P331: IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
 P309: IF exposed or if you feel unwell:
 P310: Immediately call a POISON CENTER or doctor/physician.
 P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Sulphurous acid:

- H332: Harmful if inhaled.
 H315: Causes skin irritation.
 H319: Causes serious eye irritation.
 H335: May cause respiratory irritation.
 P261: Avoid breathing vapours.
 P280: Wear eye protection.
 P305 + P351 + P338: IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Hydrochloric acid:

- H314: Causes severe skin burns and eye damage.
 H335: May cause respiratory irritation.
 H290: May be corrosive to metals.
 P280: Wear protective gloves and eye/face protection.
 P301 + P330 + P331: IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
 P309 + P310: IF exposed or if you feel unwell: Immediately call a POISON CENTER or doctor/physician.
 P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Barium chloride:

- H332: Harmful if inhaled.
 H301: Toxic if swallowed.
 P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.

Manganese(IV) oxide:

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

Hydrogen peroxide:

- H272: May intensify fire; oxidiser.
 H302: Harmful if swallowed.
 H318: Causes serious eye damage.
 P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
 P221: Take any precaution to avoid mixing with combustibles, heavy-metal compounds, acids and alkalis.
 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.

Hazards

- Acids and hydrogen peroxide are highly corrosive. Splashes on skin must be washed out immediately with a lot of water! Put on protective glasses!
- Manganese and barium compounds are hazardous to health when they are swallowed!
- Use water to make the rubber-glass joints slippery!

Notes

Barium chloride serves as an indicator for sulphate anions. With sulphite-anions, too, it forms a white barium sulphite precipitate which, however, is split up again into barium chloride and sulphurous acid (SO₂ and H₂O) by means of the hydrochloric acid. The

barium sulphate precipitate, on the other hand, is not affected by diluted hydrochloric acid.

Remarks on the method

This experiment refers to the already known preparation of oxygen from H_2O_2 . If this has not been treated yet, the formation of oxygen must be explained to the students either in the form of a lecture or by means of a test with a glowing wood splint. Discuss the special hazards, e.g. for the respiratory tracts (smog), due to the formation of "sulphuric-acid aerosols".

Waste disposal

Precipitate the barium ions which are still dissolved by adding some sulphuric acid. Filter out the barium sulphate and treat it as heavy-metal waste. Put the filtrate into the collecting tank for acids and alkalis.

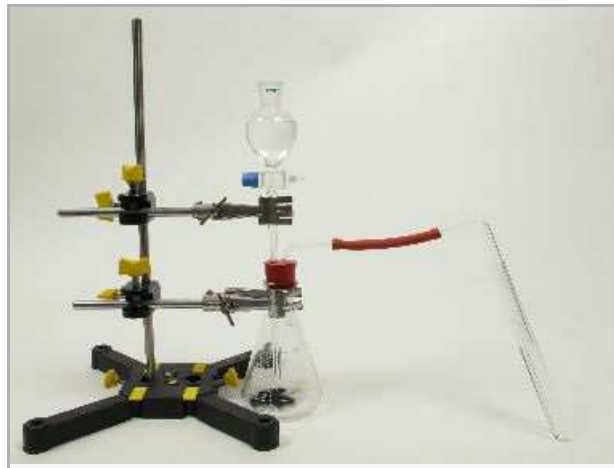
Oxidation of sulphurous acid (Item No.: P7158100)

Task and equipment

Task

What is the difference between sulphurous acid and sulphuric acid?

Prepare sulphuric acid from sulphurous acid and study the different properties of the two acids.



Equipment



Position No.	Material	Order No.	Quantity
1	Protecting glasses, clear glass	39316-00	1
2	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10	1
3	Dropping funnel with drip nozzle, 50ml	36912-00	1
4	Glass tubes, right-angled, 10	36701-59	(1)
5	Glass tube, right-angled, 10 pcs.	36701-52	(1)
6	Spatula, powder, steel, l=150mm	47560-00	1
7	Erlenmeyer flask, narrow neck, PN 29	36424-00	1
8	Rubber stopper 26/32, 2 holes 7 mm	39258-02	1
9	Pipette with rubber bulb	64701-00	2
10	Grad. cylinder, high, PP, 50ml	46287-01	1
11	Rubber tubing, i.d. 6 mm	39282-00	1
12	Test tube, 18x188 mm, 10 pcs	37658-03	(3)
13	Support base, variable	02001-00	1
14	Boss head	02043-00	2
15	Universal clamp	37715-00	2
16	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
	Barium chloride 250 g	30033-25	1
	Manganese-IV oxide, powder 500 g	30138-50	1
	Hydrochloric acid 37 %, 1000 ml	30214-70	1
	Sulphuric acid, 95-98% 500 ml	30219-50	1
	Water, distilled 5 l	31246-81	1
	Sulphurous acid, 5-6%, g.r. 1000 ml	31832-70	1
	Hydrogen peroxide, 30%, tech. gr., 1l	31942-70	1

Set-up and procedure

Set-up

Hazards

- Acids and hydrogen peroxide are highly corrosive. Splashes on the skin must be washed out immediately with a lot of water! Put on protective glasses!
- Manganese and barium compounds are hazardous to health when they are swallowed!
- Use water to make the rubber-glass joints slippery!



Set-up

Set up the support system according to Fig. 1 - Fig 4.



Fig. 1

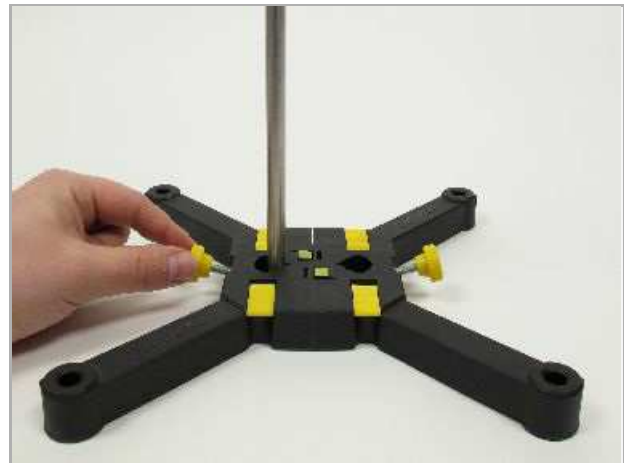


Fig. 2



Fig. 3



Fig. 4

Attach the Erlenmeyer flask in such a way that it rests solidly on the working surface (Fig. 5). Fill it with a spatulaful of manganese dioxide (Fig. 6).



Fig. 5



Fig. 6

Carefully slip the dropping funnel through one of the holes of the rubber stopper (Fig. 7) and the small right-angled glass tube (Make it slippery by means of water.) through the other hole (Fig. 8). Fix one end of a rubber tubing (length approximately 10 cm) to this glass tube (Fig. 9) and seal the Erlenmeyer flask by means of the rubber stopper (Fig. 10). Connect the other end of the rubber tubing to the short leg of the long right-angled glass tube (Fig. 11).



Fig. 7



Fig. 8



Fig. 9

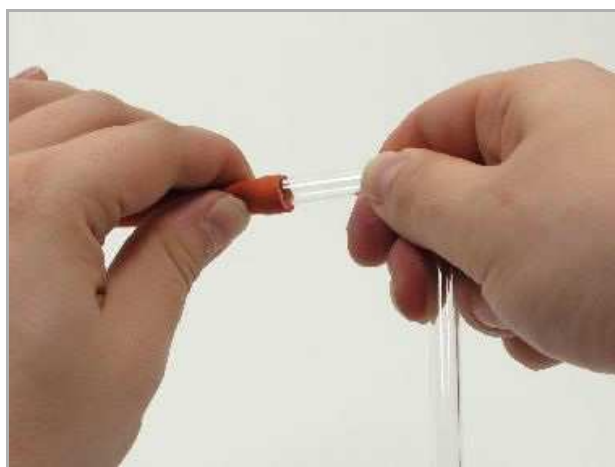


Fig. 10

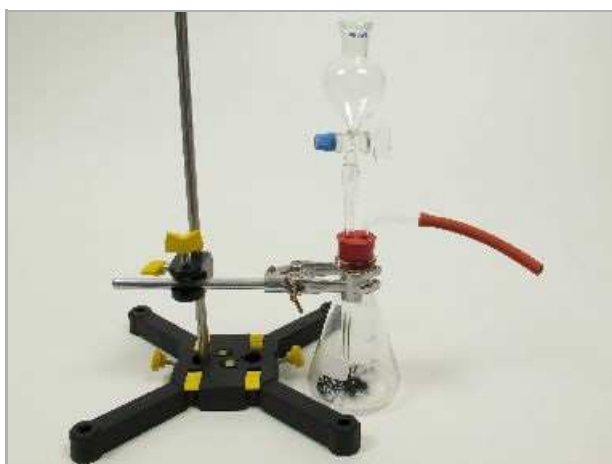


Fig. 11

Fix the separatory funnel to the support stand (Fig. 12 - Fig. 14).

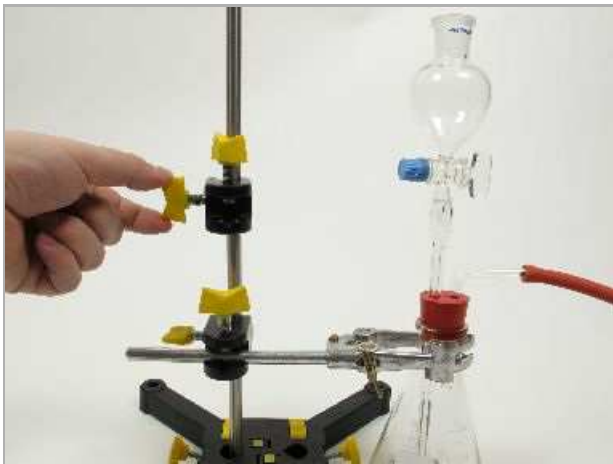


Fig. 12

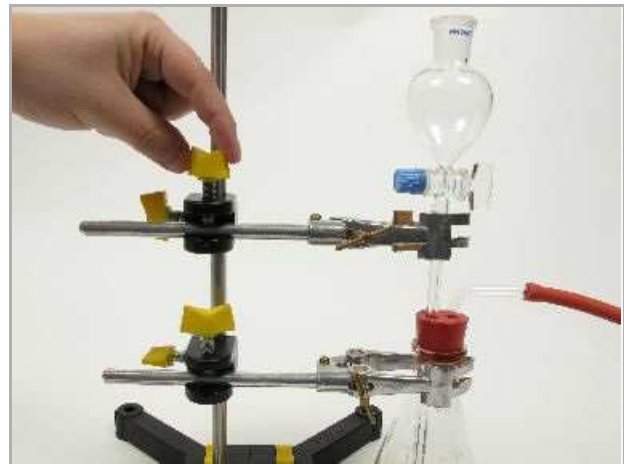


Fig. 13

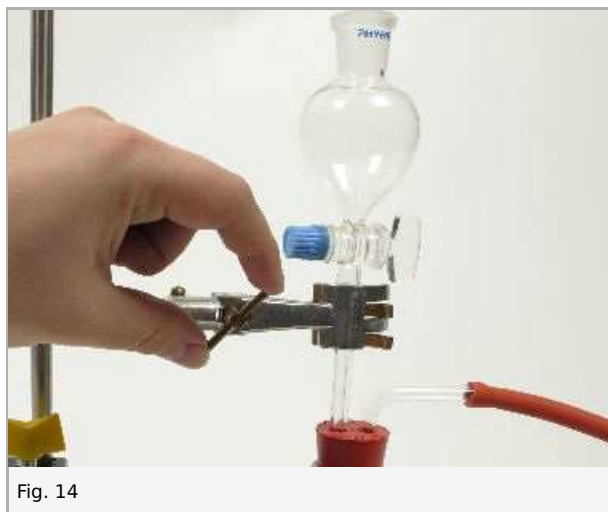


Fig. 14

Procedure

Close the tap of the dropping funnel (Fig. 15) and fill it with 50 ml of hydrogen peroxide (Fig. 16). Fill one of the test tubes half full with sulphurous acid and place it under the large right-angled glass tube (Fig. 17).

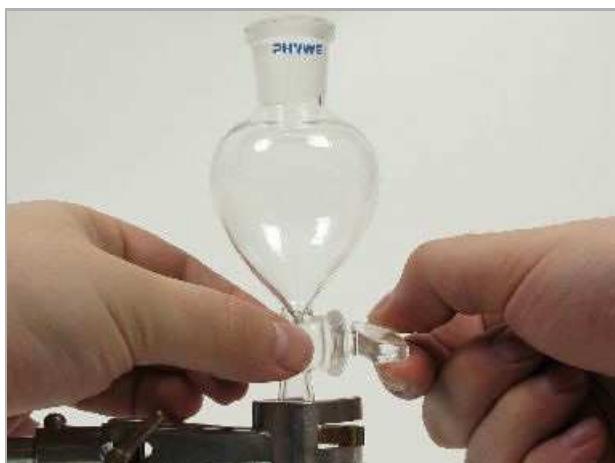


Fig. 15



Fig. 16

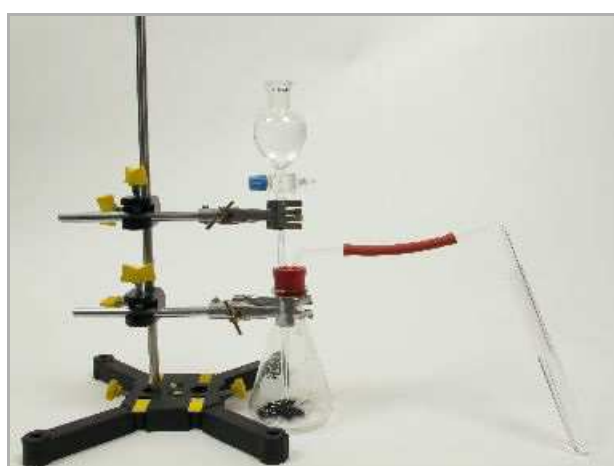


Fig. 17

Open the tap (Fig. 18) and let the evolving oxygen pass through the right-angled glass tube and thus through the sulphurous acid until the reaction taking place in the Erlenmeyer flask is completed.



Fig. 18

Fill the second test tube half full with sulphurous acid, too, and fill the third one with the same quantity of diluted sulphuric acid (Fig. 19). Add a few drops of barium chloride solution to the acids in the test tube by means of a pipette (Fig. 20) and then use the second pipette to add a few drops of hydrochloric acid.



Fig. 19



Fig. 20

Waste disposal

Precipitate the barium ions in the first two test tubes by adding some sulphuric acid and filter out the precipitates. Fill the filtrate into the collecting tank for acids and alkalis. Put the barium sulphate into the collecting reservoir for heavy metal wastes.

Report: Oxidation of sulphurous acid

Result - Observations

Write down your observations.

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Result - Table 1

Enter your observations into Table 1.

Test tube content	Reaction with barium chloride	Addition of hydrochloric acid
Sulphurous acid with oxygen	1	1
Sulphurous acid	1	1
Sulphuric acid	1	1

Evaluation - Question 1

Draw the conclusions from your observations.

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Evaluation - Question 2

What process took place when oxygen was added to the sulphurous acid? Sulphuric acid can thus be considered as the product of what substances? Describe both processes in the form of a word equation.

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Evaluation - Question 3

What additional potential hazards are there for the environment due to the combustion of sulphur-containing substances according to the result of the experiment?

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