Preparation and properties of sulphuric acid

(Item No.: P7158200)

Curricular Relevance

Area of Expertise: Chemie

Education Level: Klasse 7-10

Topic: Anorganische Chemie

Subtopic: Säuren und Basen, Protonenübergänge

Experiment: Darstellung und Eigenschaften von Schwefelsäure

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

Additional Requirements:

Experiment Variations:

Keywords:

sulphuric acid, preparation, material property

Task and equipment

Information for teachers

Learning objectives

- Sulphuric acid can be prepared by means of a thermal decomposition of sulphates.
- The presence of sulphuric acid can be indicated by means of barium ions (formation of a white precipitate of barium sulphate).

Notes on set-up and procedure

Preparations
Prepare a 5% hydrochloric acid solution (13 ml of concentrated HCl and 100 ml of water) and a 10% barium chloride solution. It is not necessary to keep the exact concentration levels.

Remarks on the students' experiments
Make sure that the apparatus is tightly sealed so that no SO_3 can escape. The right-angled glass tube must not be dipped into the water in the Erlenmeyer flask since otherwise water might flow into the test tube when it is heated and cause the test tube to crack thus allowing the sulphuric acid to escape.




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.
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.
Iron(II) sulphate:	
H302:	Harmful if swallowed.
H315:	Causes skin irritation.
H319:	Causes serious eye irritation.
P302 + P352:	IF ON SKIN: Wash with plenty of soap and water.
P305 + P351 + P338:	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and eaasy 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.

Hazards

- When the substances are heated, toxic and corrosive gases are released. The experiment must therefore be carried out under the fume hood!
- Acids are highly corrosive. Put on protective glasses!
- Barium compounds are hazardous to health when they are swallowed!
- Use glycerine to make the rubber-glass joints slippery!

Notes

When ferrous sulphate is heated, first constitutional water is liberated. When it is heated more vigorously, the ferrous sulphate decomposes according to the following equation:

$2\ FeSO_4 \rightarrow Fe_2SO_3 + SO_2 + SO_3$

In the presence of oxygen, the forming iron oxide has a catalytic effect so that as a consequence sulphur dioxide undergoes further reactions and turns into sulphur trioxide.

Remarks on the method

Draw the students' attention to the fact that this way of preparing sulphuric acid corresponds to the way the alchemists prepared sulphuric acid (vitriol acid) in the Middle Ages on the basis of vitriols (sulphates containing constitutional water), preferably copper sulphate.

The technological preparation of sulphuric acid can be discussed on this occasion or in the context of the special topic "technological chemistry" which includes several experiments for students.

Waste disposal

Collect the decomposed ferrous sulphate. Filter out the barium sulphate precipitates. Treat both as heavy-metal wastes. Collect

the liquids in the collecting tank for acids and alkalis.

Preparation and properties of sulphuric acid **(Item No.: P7158200)**

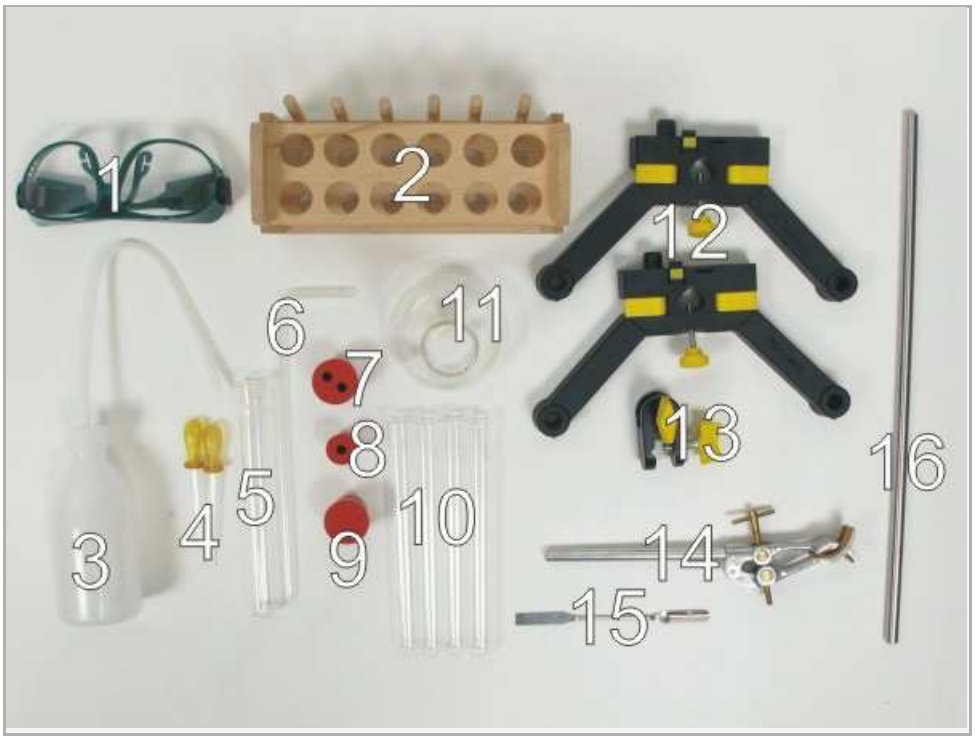
Task and equipment

Task

What are the properties of sulphuric acid?

Prepare sulphuric acid and study its properties.

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	Wash bottle, 250 ml, plastic	33930-00	1
4	Pipette with rubber bulb	64701-00	2
5	Test tube,180x20 mm,DURAN, PN19	36293-00	1
6	Glass tubes,right-angled, 10	36701-59	(1)
7	Rubber stopper 26/32, 2 holes 7 mm	39258-02	1
8	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	1
9	Rubber stopper 26/32 , without hole	39258-00	1
10	Test tube, 18x188 mm, 10 pcs	37658-03	(4)
11	Erlenmeyer flask, narrow neck, PN 29	36424-00	1
12	Support base, variable	02001-00	1
13	Boss head	02043-00	1
14	Universal clamp	37715-00	1
15	Spatula, powder, steel, l=150mm	47560-00	1
16	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
	Butane burner f.cartridge 270+470	47536-00	1
	Butane catridge CV 300 Plus, 240 g	47538-01	1
	Barium chloride 250 g	30033-25	1
	Iron-II sulphate 500 g	30072-50	1
	Glycerol, 250 ml	30084-25	1
	Hydrochloric acid 37 %, 1000 ml	30214-70	1
	Water, distilled 5 l	31246-81	1
	Cotton wool, white 200 g	31944-10	1
	Liquid Indicator pH1-13 UNISOL113	47014-02	1

Set-up and procedure

Set-up

Hazards

- When the substances are heated, toxic and corrosive gases are released. The experiment must therefore be carried out under the hume hood!
- Acids are highly corrosive. Put on protective glasses!
- Barium compounds are hazardous to health when they are swallowed!
- Use glycerine to make rubber-glass joints slippery!



Set-up

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

Fig. 1

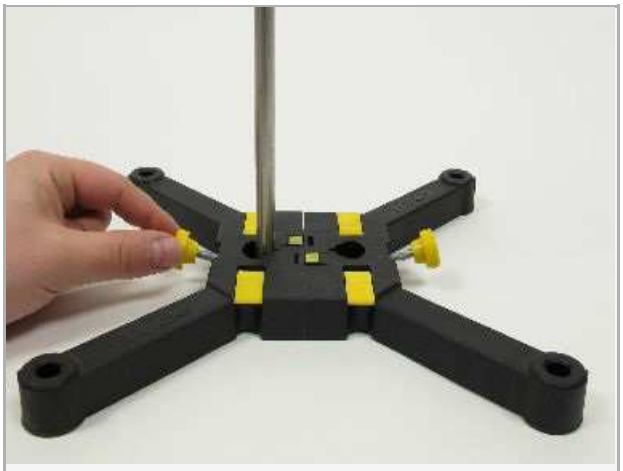


Fig. 2

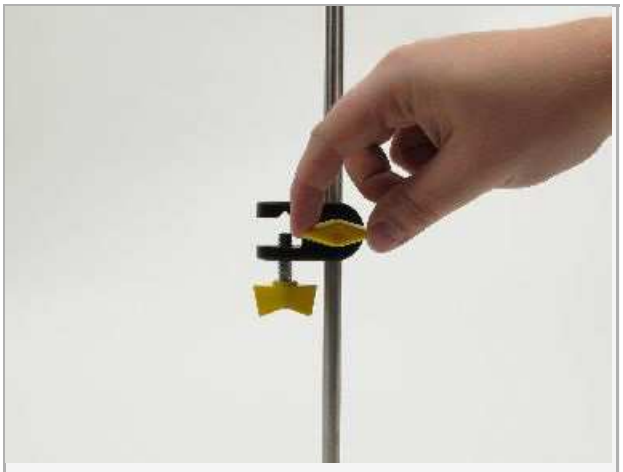


Fig. 3

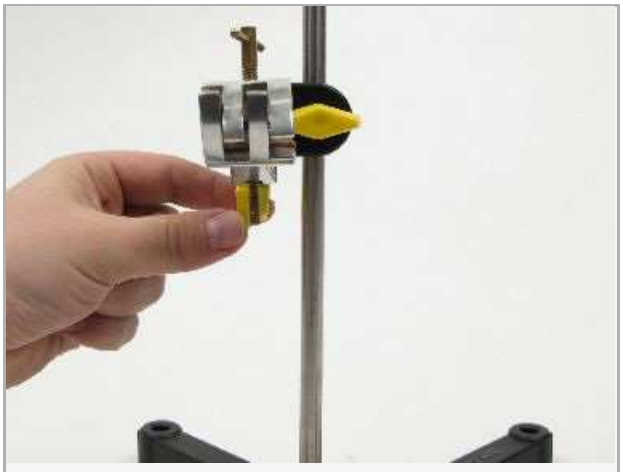


Fig. 4

Fill 4 spatulas of iron(II) sulphate into the Duran test tube (Fig. 5) and fix it in a horizontal position to the support system (Fig. 6).

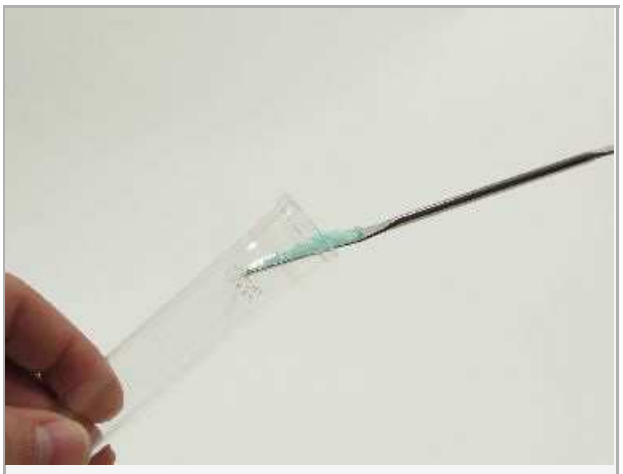


Fig. 5

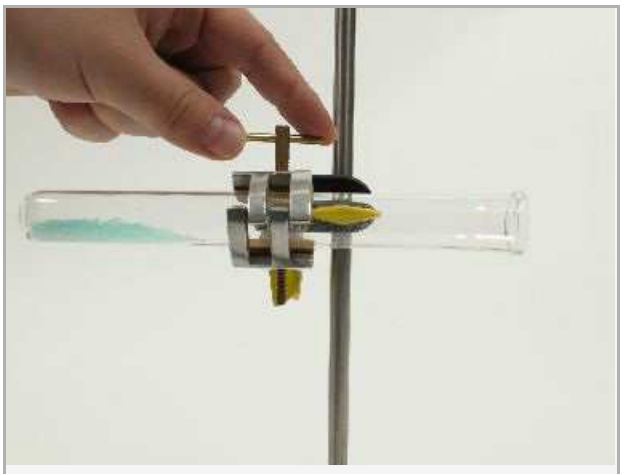


Fig. 6

Carefully slip the long leg of the right-angled glass tube through the rubber stopper with the two holes (use some glycerine to make it slippery) (Fig. 7). Slip the short leg through the smaller rubber stopper (Fig. 8) so that the test tube fixed to the support system can be sealed with it.


Fig. 7

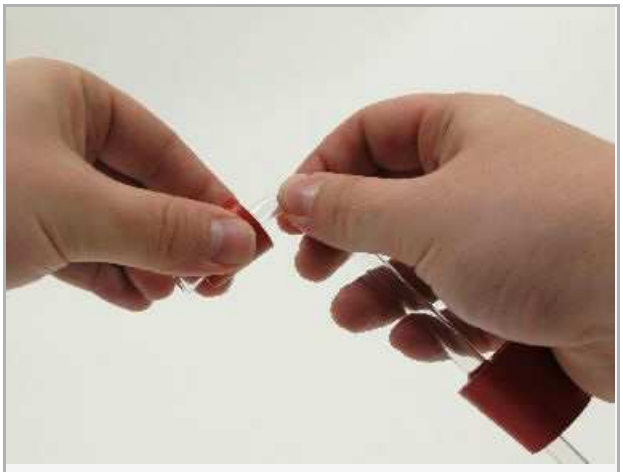


Fig. 8

Fill some distilled water into the Erlenmeyer flask (filling height approximately 1 cm) (Fig. 9) and seal it by means of the stopper holding the right-angled glass tube (Fig. 10). Slide the glass tube upwards or downwards so that its orifice is about half a centimetre above the water surface (Fig. 11). Slide the test tube fixed to the support system upwards or downwards so that it can be sealed with the other rubber stopper (Fig. 12). Put some cotton wool into the second hole of the rubber stopper sealing the Erlenmeyer flask (Fig. 13).

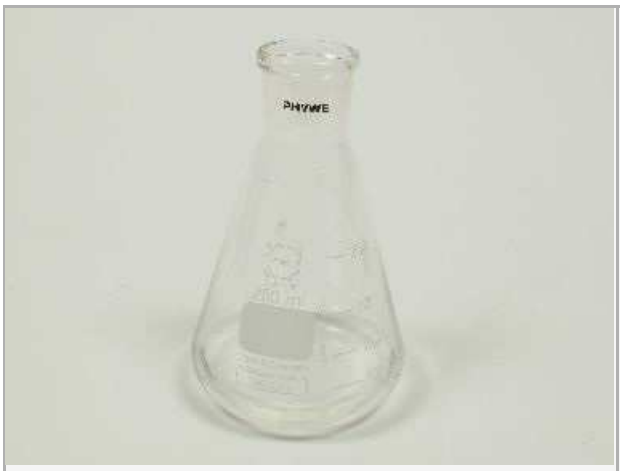


Fig. 9

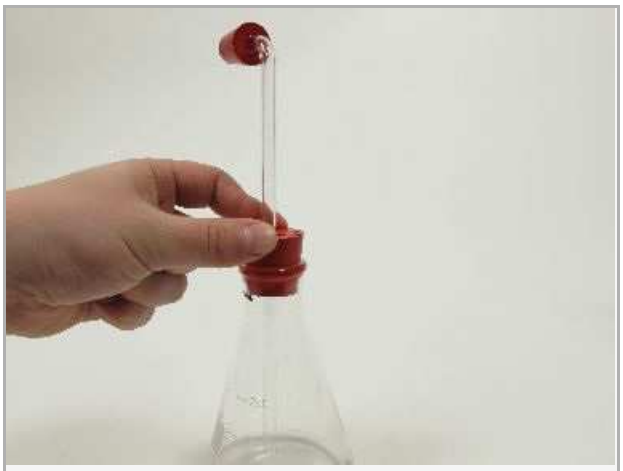


Fig. 10


Fig. 11


Fig. 12


Fig. 13

Procedure

Heat the iron(II) sulphate first with a small burner flame and then more vigorously for about 10 minutes (Fig. 14). Put out the burner flame, remove the stopper from the Erlenmeyer flask, seal it again by means of the stopper (Fig. 15) without hole and shake it vigorously (Fig. 16).

Fig. 14

Fig. 15

Fig. 16

Distribute the content of the Erlenmeyer flask into two test tubes (Fig. 17). Add some drops of universal indicator solution to the first test tube (Fig. 18) and some drops of barium chloride solution to the second test tube. Add some hydrochloric acid to the second test tube.

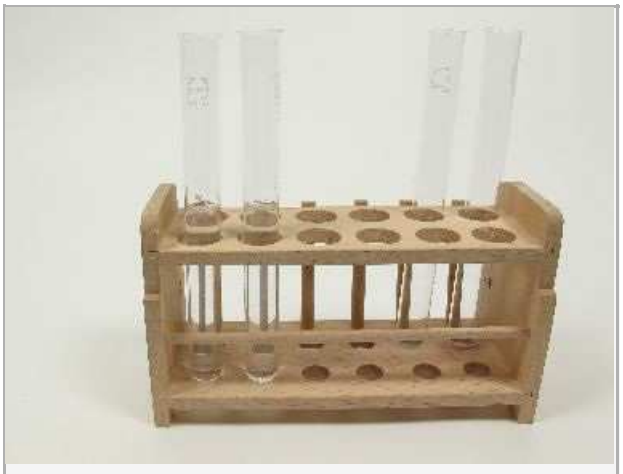


Fig. 17

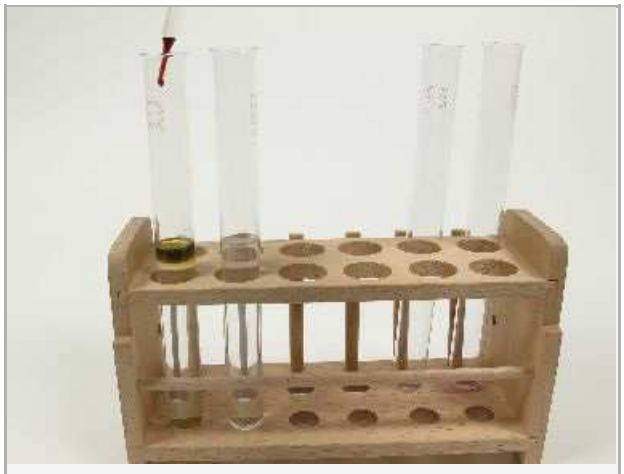


Fig. 18

Let the Duran test tube cool down, remove the stopper and use some distilled water to rinse the oily drops having precipitated on front of the stopper into a third test tube (Fig. 19). Fill half of this solution into a fourth test tube. Add some universal indicator solution to the third test tube and barium chloride solution and hydrochloric acid to the fourth test tube.

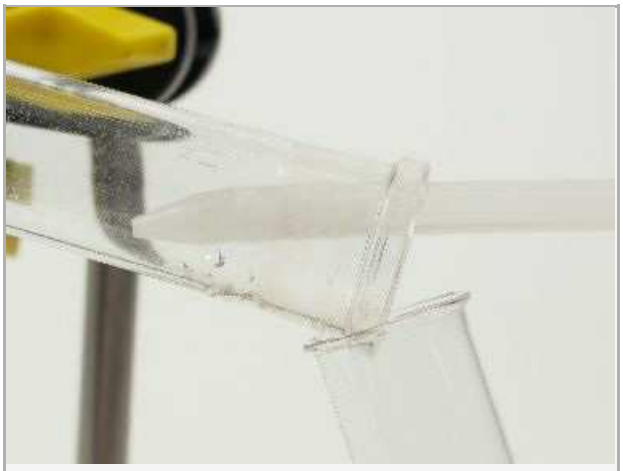


Fig. 19

Waste disposal

Collect the decomposed iron(II) sulphate. Fill the content of the test tubes into the collecting tank for acids and alkalis.

Report: Preparation and properties of sulphuric acid

Result - Observations

Write down your observations.

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Evaluation - Question 1

Draw the conclusions from your observations.

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Evaluation - Question 2

Enter the observed properties into the general substance description form. Add the missing information with the aid of the textbook.

	sulphuric acid	1
	H_2SO_4	1
	colourless	1
	liquid	1
	10.4 °C	1
	338 °C	1
	Reacts with barium chloride and forms a white, insoluble precipitate; causes the universal indicator to turn red; is highly dehydrating.	1
	desiccating agent, lead acid accumulators, production of colorants	1

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