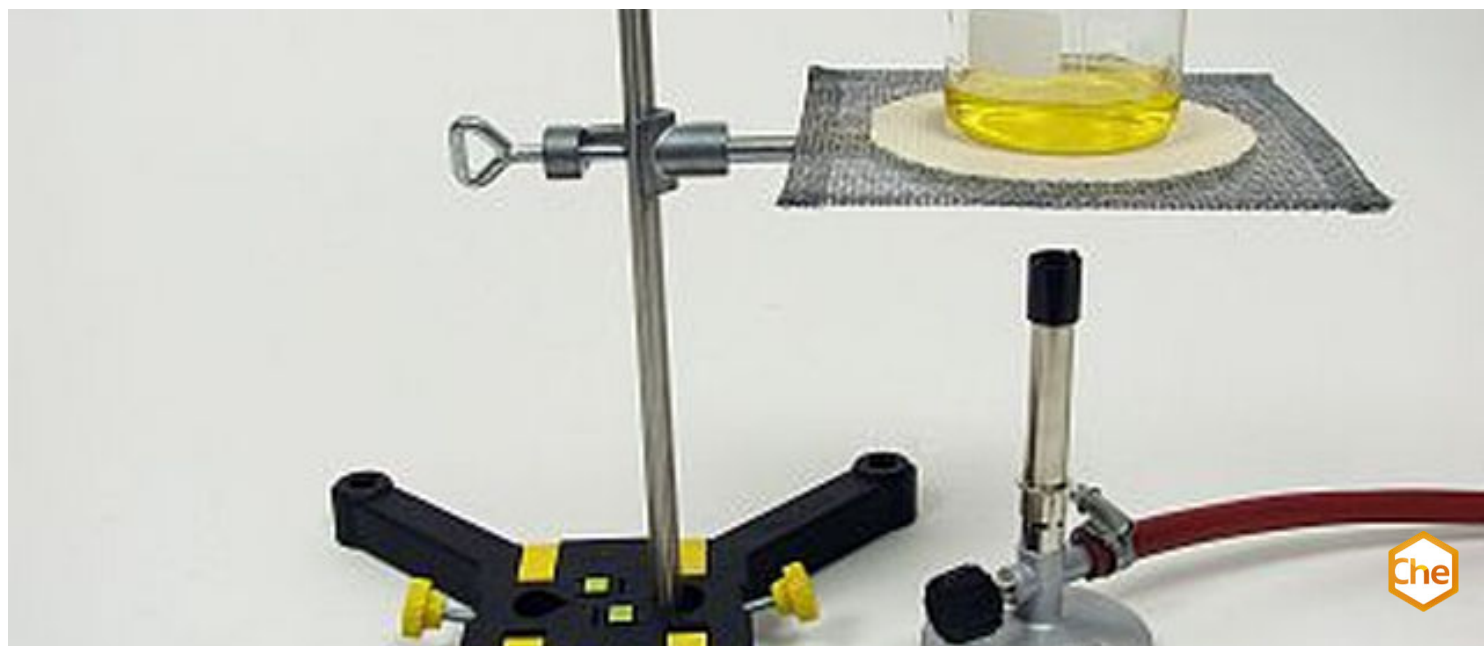


Ammonia fertilizer



Chemistry

Industrial Chemistry

industrial synthesis



Difficulty level

easy



Group size

2



Preparation time

10 minutes



Execution time

10 minutes

This content can also be found online at:

<http://localhost:1337/c/6341b180dddc3a0003017cb0>

PHYWE



Teacher information

Application

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Experimental setup

An essential component for plant growth is nitrogen. Plants absorb this nutrient via ammonium compounds or nitrate compounds. For industrial agriculture, nitrogen compounds from natural resources are no longer sufficient, so such nitrogen compounds are also produced industrially.

Nitrogen compounds used as fertilisers are generally referred to as nitrogen fertilisers. Fertilisers based on ammonia or ammonium are called ammonia fertilisers. In this experiment, the production of an ammonia fertiliser is investigated.

Other teacher information (1/2)

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Prior knowledge



- Students should be familiar with the term "fertiliser" and its application.
- Fertilisers or nitrogen fertilisers are the most important form of fertiliser.
- In the case of fertilisers, a distinction is made between mineral and organic forms of fertiliser (liquid manure).

Principle



In this experiment, ammonia fertiliser is produced from the reaction of sulphuric acid and ammonia.

This is a typical acid-base reaction (acid + base => salt + water). The reaction product (ammonium sulphate) is then evaporated so that it crystallises from the solution when it cools down.

Other teacher information (2/2)

PHYWE

Learning objective



- Fertilisers consist mainly of nitrogen compounds, as these contribute significantly to plant growth.
- Fertilisers are based on nitrate or ammonia as the basic ingredient
- Ammonia fertilisers can be produced from ammonia in an acid-base reaction.

Tasks



Production of ammonia fertiliser

- Production of ammonia fertiliser by reaction of ammonia and sulphuric acid.
- By heating or evaporating the reaction solution (removing the solvent water), the ammonia fertiliser crystallises during cooling.

Safety instructions (1/2)

PHYWE



- The general instructions for safe experimentation in science lessons apply to this experiment.

Dangers

- Sulphuric acid is highly corrosive. Wash out splashes on skin and clothing immediately with plenty of water!
- Wear protective goggles!
- Ammonia solution is irritating. Do not inhale! Ventilate the room well!

Disposal

- Keep the crystallised salt and solution for the next experiment ("Burnt lime").

Safety instructions (2/2)

PHYWE



Notes on preparation

- Prepare 10% sulphuric acid from 6.3 ml conc. sulphuric acid to 100 ml water
- Prepare 4% ammonia solution from 22 ml of the 25% ammonia solution to 100 ml of water.

Notes on the student experiments

- Be careful not to add too much ammonia solution, otherwise the odour will be too strong during evaporation.
- The evaporation can be stopped as soon as the first salt crystals appear.

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Student information

Motivation

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Fertilisers in use

Nitrogen compounds contribute significantly to plant growth. Due to industrial agriculture, the nitrogen compounds supplied from natural sources are no longer sufficient. Therefore, nitrogen compounds are also produced industrially. These nitrogen compounds, which contain ammonium or nitrate, are also called nitrogen fertilisers or ammonia fertilisers.

In order to provide the world's population with sufficient basic foodstuffs, the (ecologically sensible) use of fertilisers is necessary. This experiment investigates how fertiliser can be produced in a simple way.

Tasks

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Experimental setup

How is fertiliser made?

- Manufacture ammonia fertiliser from sulphuric acid and ammonia.
- Steam the solution of sulphuric acid and ammonia over a Bunsen burner.
- When the solution cools, ammonia fertiliser crystallises out of the solution.
- Note down your observations and answer the questions in the report.

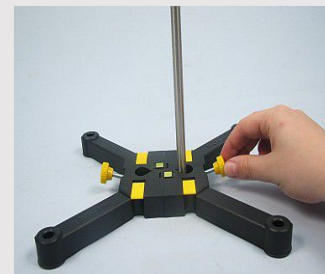
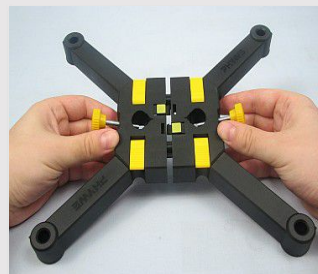
Equipment

Position	Material	Item No.	Quantity
1	Protecting glasses, clear glass	39316-00	1
2	Ring with boss head, i. d. = 10 cm	37701-01	1
3	Wire gauze with ceramic, 160 x 160 mm	33287-01	1
4	Support base, variable	02001-00	1
5	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
6	Grad.cylinder,high,PP,50ml	46287-01	1
7	Beaker, Borosilicate, low form, 250 ml	46054-00	1
8	Pipette with rubber bulb	64701-00	1
9	Glass rod, boro 3.3, l=200mm, d=5mm	40485-03	1
10	Sulphuric acid, 95-97%, 500 ml	30219-50	1
11	Ammonia solution, 25% 1000 ml	30933-70	1
12	Methyl orange soln., 0.1% 250 ml	31573-25	1
13	Butane burner with cartridge, 220 g	32180-00	1
14	Boiling beads, 200 g	36937-20	1

Set-up

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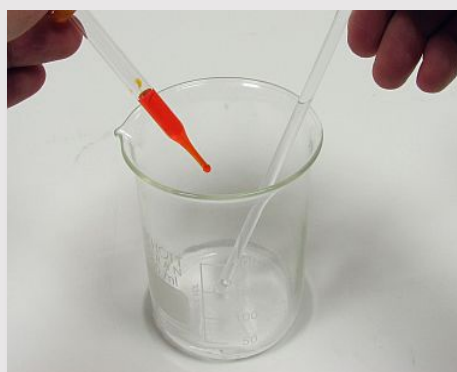
- Assemble the support from the support base and the support rod.
- See the top two illustrations.
- Attach the ring with boss head to the support rod and place the wire net on it.
- See the two illustrations below.



Procedure (1/2)

Add 20 ml of sulphuric acid to the beaker. Add about 5 drops of methyl orange solution to this while stirring so that the acid is slightly coloured.

Now add ammonia solution in small portions while stirring until the indicator changes permanently.



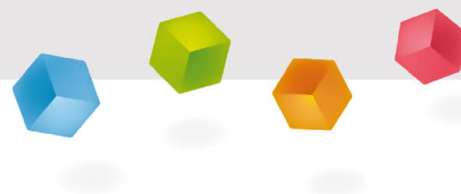
Procedure (2/2)



- As soon as the indicator has turned from red to yellow, both starting materials have reacted with each other.
- Stir the solution with the reaction product (the ammonia fertiliser) again briefly with a stirring rod.
- Place the beaker on the wire net and light the burner.
- Add three boiling stones to the solution and steam to 1/5 of the initial volume. Let the solution cool down.

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Report



Observation

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- Note your observations in the comments box on the right and consider the following questions
- What was the colour gradient of the indicator?
- Did the reaction solution heat up when mixing sulphuric acid and ammonia?
- Were any odour changes noticeable during the reaction?

Write down your observations!

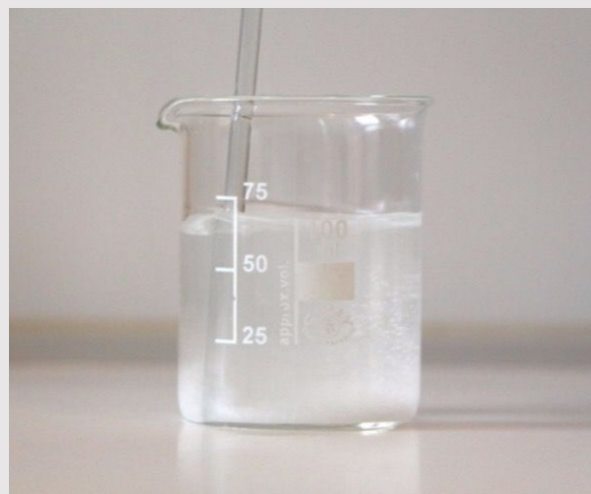
Task 1

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Fill in the gaps

Sulphuric acid and ammonia react to form . This reaction product is a typical ammonia fertiliser. The course of the reaction can be observed with an (methyl orange). The sulphuric acid reacts as and as a base.

✓ Check



Fertiliser crystallises when cooling down

Task 2



What is the name given to the reaction of sulphuric acid and ammonia carried out in the experiment?

☐ as implementation

☐ as a neutralisation reaction

☐ as redox reaction

✓ Check

Slide

Score/Total

Slide 16: Acid Base Reaction

0/4

Slide 17: Reaction type

0/2

Total  0/6

 Solutions

 Repeat

 Export text