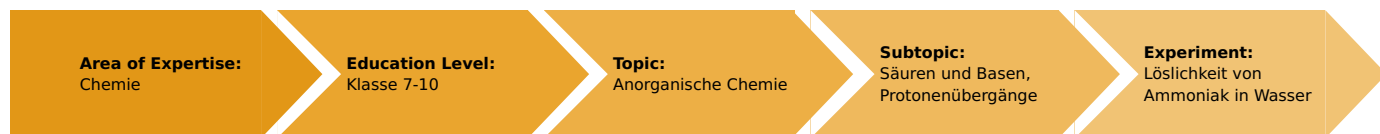


Aqueous solubility of ammonia (Item No.: P7158800)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

ammonia, solubility, material property

Task and equipment

Information for teachers

Learning objectives

- Ammonia is a strong smelling substance (horse stable) which is highly soluble in water.
- The aqueous solution of ammonia shows the typical properties of alkalis.

Notes on set-up and procedure

Preparations

The set-up of the preceding experiment can be used again to a large extent. If, however, it is no longer available, it is recommended to fill the dry tube and to prepare the required concentrated ammonium chloride solution before the lesson starts in order to save time.

Remarks on the students' experiments

In order to reduce the number of instruments needed it is possible to simplify the whole experiment by heating solid ammonium chloride together with sodium hydroxide and by catching the ammonia which is thus formed. The following parts of the experiment can be taken over from the mode of experimental procedure.



Hazard and Precautionary statements

Sodium hydroxide:

- 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 + 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.

Phenolphthalein:

- H226: Flammable liquid and vapour.
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233: Keep container tightly closed.

Ammonium chloride:

- H302: Harmful if swallowed.
H319: Causes serious eye irritation.
P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Hazards

- Sodium hydroxide is highly corrosive. Do not touch it with bare fingers! Put on protective glasses!
- In the course of the experiment harmful and evil smelling gases are released. The experiment must thus be carried out under the fume hood!
- Use some glycerine to make the rubber-glass-joints slippery!

Notes

One part by volume of water dissolves about 700 parts by volume of gaseous ammonia at room temperature.

Remarks on the method

This experiment goes back to the experiment on the "hydrochloric acid fountain" though it can be carried out independently.

Waste disposal

Put the content of the Erlenmeyer flask and of the test tube into collecting tank for acids and alkalis.

Aqueous solubility of ammonia (Item No.: P7158800)

Task and equipment

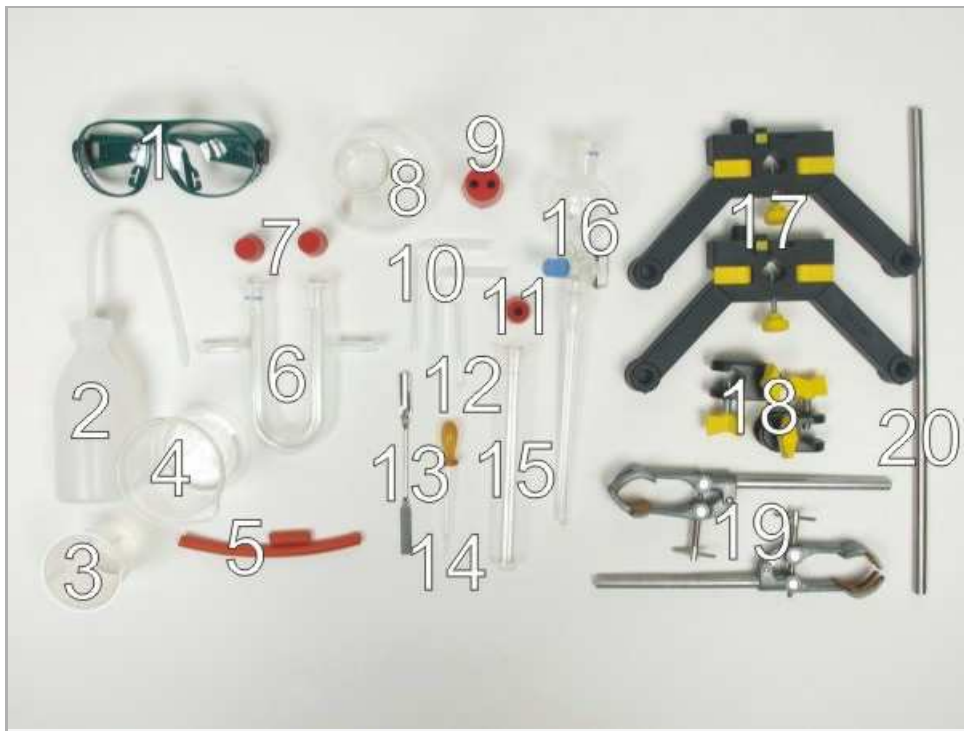
Task

What are the properties of ammonia?

Prepare ammonia on the basis of "salmiac" and study its additional properties.



Equipment



Position No.	Material	Order No.	Quantity
1	Protecting glasses, clear glass	39316-00	1
2	Wash bottle, 250 ml, plastic	33930-00	1
3	Beaker, 100 ml, low form, stackable, plastic	36081-00	1
4	Glass beaker DURAN®, short, 250 ml	36013-00	1
5	Rubber tubing, i.d. 6 mm	39282-00	1
6	U-tube w. 2 lat tubulure PN19	36966-00	1
7	Rubber stopper, d=22/17 mm, without hole	39255-00	2
8	Erlenmeyer flask, narrow neck, PN 29	36424-00	1
9	Rubber stopper 26/32, 2 holes 7 mm	39258-02	1
10	Glass tube, right-angled, 10 pcs.	36701-52	(2)
11	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	1
12	Glass tubes, straight with tip, 10	36701-62	(1)
13	Spatula, powder, steel, l=150mm	47560-00	1
14	Pipette with rubber bulb	64701-00	1
15	Test tube, 180x20 mm, DURAN, PN19	36293-00	(1)
16	Dropping funnel with drip nozzle, 50ml	36912-00	1
17	Support base, variable	02001-00	1
18	Boss head	02043-00	3
19	Universal clamp	37715-00	3
20	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
	Ammonium chloride 250 g	30024-25	1
	Glycerol, 250 ml	30084-25	1
	Sodium hydroxide, flakes, 500 g	30157-50	1
	Water, distilled 5 l	31246-81	1
	Phenolphthalein, 0,5% solution in ethanol, 100 ml	31715-10	1

Set-up and procedure

Set-up

Hazards

- Sodium hydroxide is highly corrosive. Do not touch it with bare fingers! Put on protective glasses!
- In the course of the experiment harmful and evil smelling gases are released. The experiment must thus be carried out under the fume hood!
- Use some glycerine to make rubber-glass-joints slippery!



Set-up

Set up the support system according to Fig. 1 - Fig. 6 by means of 2 bossheads and 2 universal clamps.

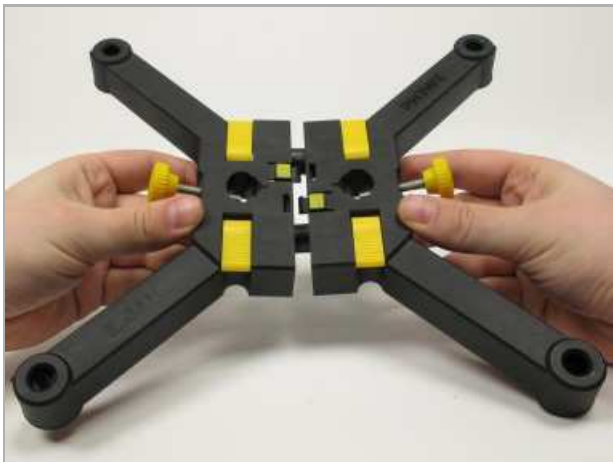


Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6

Fix the Erlenmeyer flask into one of the clamps in such a way that it is placed on the working surface in a stable way (Fig. 7). Fill two spatulas of sodium hydroxide into the flask (Fig. 8).



Fig. 7



Fig. 8

Carefully slip the dropping funnel into the rubber stopper with two holes (Fig. 10) (use some glycerine to make it slippery (Fig. 9)) and one of the right-angled glass tubes into the second hole (Fig. 11). Use this rubber stopper to seal the Erlenmeyer flask (Fig. 12).

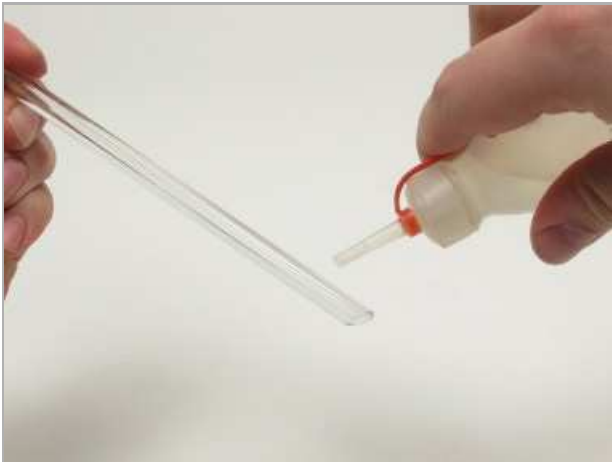


Fig. 9

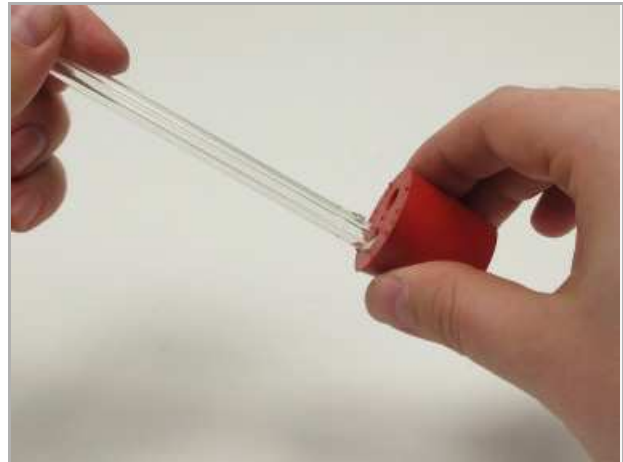


Fig. 10



Fig. 11



Fig. 12

Fill the U-tube with sodium hydroxide until both legs are about half full (Fig. 13) and seal them with the rubber stoppers without holes (Fig. 14). Fix the U-tube into the second clamp (Fig. 15) and use a rubber tubing to connect the right-angled glass tube with the side arm of the U-tube (Fig. 16). Take another rubber tubing and connect the other side arm of the U-tube with the second right-angled glass tube. Turn the glass tube so that its orifice points upwards (Fig. 17).



Fig. 13



Fig. 14



Fig. 15



Fig. 16



Fig. 17

Fill a glass beaker with approximately 100 ml of distilled water (Fig. 18) and add some ammonium chloride while stirring everything with the aid of a glass rod until the salt no longer dissolves (Fig. 19).



Fig. 18



Fig. 19

Slip the tipped glass tube with the tip ahead into a rubber stopper so that the tip projects about 1 cm out of the narrow end of the stopper (Fig. 20).



Fig. 20

Procedure

Fill the dropping funnel with the ammonium chloride solution with the tap being closed (Fig. 21). Fill the second glass beaker two thirds full with distilled water (Fig. 22) and add some drops of phenolphthalein solution.



Fig. 21



Fig. 22

Open the tap of the dropping funnel to such an extent that the concentrated ammonium chloride solution drops onto the sodium hydroxide (Fig. 23). Put the Duran test tube with its orifice down over the right-angled glass tube and let the evolving gas stream in for about 30 seconds (Fig. 24).



Fig. 23



Fig. 24

Seal the Duran test tube immediately with the rubber stopper in such a way that the tip of the glass tube pierced through the stopper is inside the test tube (Fig. 25). Dip the free end of the tipped glass tube into the water inside the beaker with the test tube and the tip pointing upwards (Fig. 26). Move the test tube slightly.



Fig. 25



Fig. 26

Waste disposal

Put the content of the Erlenmeyer flask and that of the test tube into the collecting tank for acids and alkalis. Reuse the dry tube containing the sodium hydroxide pellets for similar experiments.

Report: Aqueous solubility of ammonia

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 of the formed gas into the general substance description form and complete it by also entering the properties determined in the course of the preceding experiments and other missing information taken from the textbook.

	ammonia	1
	NH ₃	1
	colourless	1
	gaseous	1
	77,7 °C	1
	33,4 °C	1
	Forms a mist when it comes into contact with humid air; forms an alkaline solution (ammonium hydroxide) together with water; highly water-attracting (ammonia fountain).	1
	as a refrigerant for producing artificial ice; solvent for many salts; household detergent.	1

Evaluation - Question 3

Explain the formation of the "fountain".

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