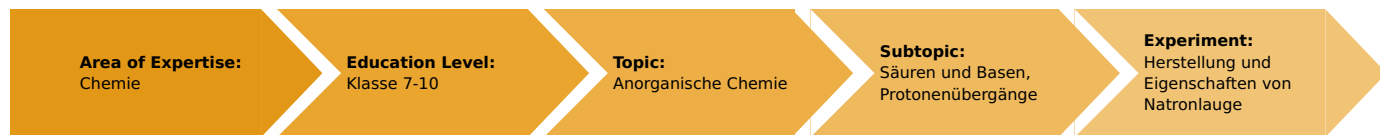


Preparation and properties of caustic soda solution

(Item No.: P7159000)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

alkalis, caustic soda solution, material property

Task and equipment

Information for teachers

Learning objectives

- Caustic soda solution can be prepared on the basis of sodium hydroxide and water.
- During this process, energy is released in the form of heat. The sodium hydroxide solution thus produced shows the typical properties of an alkaline solution.

Notes on set-up and procedure

Preparations

Get the steel cylinder containing carbon dioxide ready or prepare some carbon dioxide, for instance on the basis of marble.

Remarks on the students' experiments

Generally, the reaction of aluminium with caustic soda is triggered spontaneously. If, however, this should not be the case due to a thick layer of aluminium oxide, the substance mixture must be heated carefully. Heating must be stopped immediately when the reaction is triggered. It is recommended to carry out the oxygen-hydrogen detonation test when the reaction is more moderate. Not only phenolphthalein solution but also every other indicator can be used. However, phenolphthalein shows the most impressive change in colour.



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.

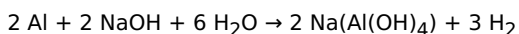
Hazards

- Sodium hydroxide is highly corrosive. Do not touch it with bare fingers!
- Put on protective glasses!
- Remove spilled sodium hydroxide pellets with a spatula or a pair of tweezers!

Notes

The temperatures given are only examples. They depend to a large extent on the ratio of addition and dissolution. The enthalpy of solution of sodium hydroxide in water is very high (43 kJ/mole).

Aluminium reacts with strong alkaline solution while forming an aluminate. This can be taken as an indication of the amphoteric character of aluminium. The reaction takes place according to the following equation:



Remarks on the method

Some of the information to be entered into the substance description form can also be taken from the experiment on the safety precautions to be taken when handling alkalis which partly serves as a basis for the current experiment. However, both experiments can also be carried out independently.

Waste disposal

Put all the solutions into the collecting tank for acids and alkalis. The caustic soda solution prepared in the course of this experiment can be diluted and reused for other experiments.

Preparation and properties of caustic soda solution

(Item No.: P7159000)

Task and equipment

Task

What are the properties of caustic soda solution?

Prepare a caustic soda solution 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 | Spatula, powder, steel, l=150mm | 47560-00 | 1 |
| 5 | Glass rod, boro 3.3, l=200mm, d=5mm | 40485-03 | 1 |
| 6 | Students thermometer, -10...+110°C, l = 180 mm | 38005-02 | 1 |
| 7 | Beaker, 100 ml, low form, stackable, plastic | 36081-00 | 1 |
| 8 | Pipette with rubber bulb | 64701-00 | 1 |
| 9 | Test tube, 18x188 mm, 10 pcs | 37658-03 | (4) |
| 10 | Digital stop watch, 24 h, 1/100 s & 1 s | 24025-00 | 1 |
| 11 | Test tube holder, up to d 22mm | 38823-00 | 1 |
| | Butane burner f. cartridge 270+470 | 47536-00 | 1 |
| | Butane cartridge CV 300 Plus, 240 g | 47538-01 | 1 |
| | Aluminium sheet, 0.2mm 50 g | 30017-05 | 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 |
| Additional material | | | |
| | Carbon dioxide | | |

Set-up and procedure

Set-up

Hazards

- Sodium hydroxide is highly corrosive. Do not touch it with bare fingers!
- Put on protective glasses!
- Remove spilled sodium hydroxide pellets with a spatula or a pair of tweezers!



Procedure

Fill the beaker half full with distilled water (Fig. 1). Start stirring with the thermometer (Fig. 2) and add a single sodium hydroxide pellet every 10 seconds (Fig. 3). Determine the temperature of the solution and enter it into Table 1.



Fig. 1



Fig. 2



Fig. 3

Fill two test tubes one quarter full with the sodium hydroxide solution (Fig. 4) and put some drops of the phenolphthalein solution into one of these two test tubes with the aid of the pipette (Fig. 5).



Fig. 4



Fig. 5

Put some strips of aluminium sheet into the second test tube (Fig. 6). If, however, no reaction takes place, heat the solution gently (Fig. 7). When the reaction has started, put the test tube into the test tube rack and put another test tube with the orifice down over the test tube in the rack (Fig. 8). Allow the gas that forms to ascend for about 1 minute and then carry out an oxygen-hydrogen detonation test with the second test tube (Fig. 9).



Fig. 6



Fig. 7

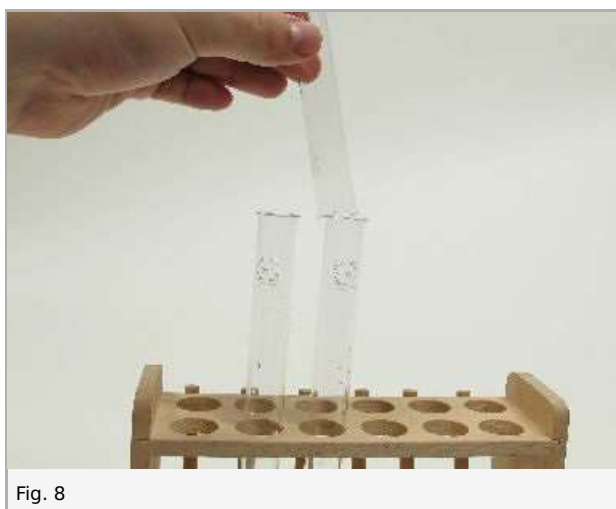


Fig. 8

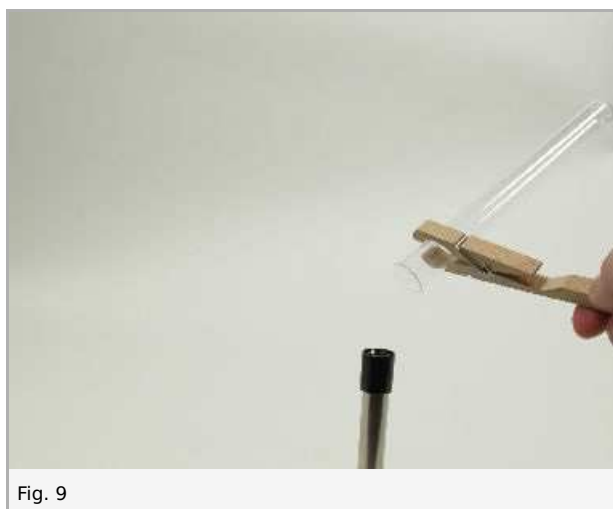


Fig. 9

Fill the last test tube with carbon dioxide and place it with the orifice down into the residual sodium hydroxide solution in the beaker (Fig. 10).



Fig. 10

Waste disposal

Put all the solutions into the collecting tank for acids and alkalis.

Report: Preparation and properties of caustic soda solution

Result - Observations

Write down your observations in a general form.

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Result - Table 1

Enter the temperatures measured into Table 1.

| Time in sec | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Temperature in °C | 1 ±2 | 1 ±2 | 1 ±2 | 1 ±2 | 1 ±2 | 1 ±2 | 1 ±2 | 1 ±2 | 1 ±2 | 1 ±2 |

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 and complete it by adding the missing information taken from the textbook.

| | | |
|--|-------------------------------------------------------------------------------------------------------------------|---|
| | caustic soda solution | 1 |
| | NaOH _(aq) | 1 |
| | colourless | 1 |
| | liquid | 1 |
| | The melting point depends on the concentration of the alkaline solution. | 1 |
| | The boiling point depends on the concentration of the alkaline solution. | 1 |
| | Causes indicators to change their colour; react with aluminium while issuing hydrogen; absorbs carbon dioxide. | 1 |
| | As a paint stripper; drainpipe detergent; production of soaps; cellulose industry. | 1 |