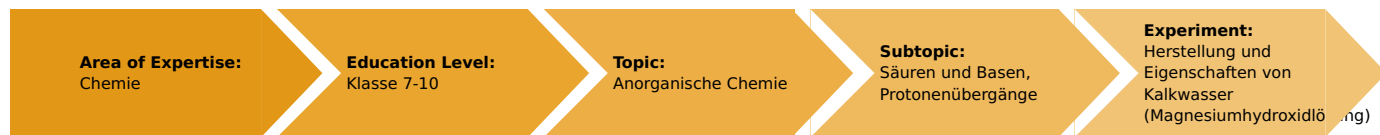


Preparation and properties of lime water (magnesium hydroxide solution) (Item No.: P7158900)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

lime water, magnesium hydroxide solution, material property, preparation of lime water

Task and equipment

Information for teachers

Learning objectives

- Calcium and magnesium react with water to form alkaline-earth hydroxides while at the same time issuing hydrogen.
- The aqueous solution of such hydroxides shows the typical properties of an alkaline solution. Calcium hydroxide solution also referred to as lime water is used for indicating the presence of carbon dioxide.

Notes on set-up and procedure

Preparations

Get some carbon dioxide taken from a steel cylinder ready or set up an apparatus for preparing carbon dioxide, for instance on the basis of marble.

Magnesium reacts more vigorously when it has been activated by means of some iodine beforehand.

Remarks on the students' experiments

Make sure that the heating procedure is stopped when the magnesium starts to react with the water. If, however, the reaction should stop again, heating can continue for a short period of time.



Hazard and Precautionary statements

Phenolphthalein:

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

Magnesium,
powder:

H260: In contact with water releases flammable gases which may ignite spontaneously.

H250: Catches fire spontaneously if exposed to air.

P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

P402 + P404: Store in a dry place. Store in a closed container.

Calcium, granular:

H261: In contact with water releases flammable gases.

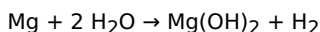
P402 + P404: Store in a dry place. Store in a closed container.

Hazards

- Calcium has a corroding effect on the skin. Do not touch it with bare fingers!
- Calcium reacts vigorously with water while releasing inflammable gases. Magnesium is easily inflammable!
- Put on protective glasses!

Notes

This reaction of the alkaline-earth metals with water corresponds to that of alkaline metals. In this case, alkaline solutions and hydrogen are formed like, for instance,



Remarks on the method

This experiment should be preceded by a demonstration experiment showing the reaction of alkaline metals in an analogue way. This allows to draw the students' attention to the diagonal relationship (periodic table) of the reactivity between alkaline metals and alkaline-earth metals. The difference in reactivity can then be explained by means of the number of outer electrons and the number of shells.

Waste disposal

Filter out the magnesium residues and let them react completely after heating them. Add the calcium hydroxide solution in the beaker to the lime water or put it into the collecting tank for acids and alkalis together with the magnesium hydroxide solution.

Preparation and properties of lime water (magnesium hydroxide solution) (Item No.: P7158900)

Task and equipment

Task

What are the properties of alkaline solutions of calcium and magnesium?

Prepare a solution of calcium hydroxide (alkaline solution of calcium) and a solution of magnesium hydroxide (alkaline solution of magnesium) and study their 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	Tweezers, straight, blunt, 160 mm	64610-02	1
6	Glass tubes, straight with tip, 10	36701-63	(1)
7	Pipette with rubber bulb	64701-00	1
8	Glass rod, boro 3.3, l=200mm, d=5mm	40485-03	1
9	Rubber tubing, i.d. 6 mm	39282-00	1
11	Test tube, 18x188 mm, 10 pcs	37658-03	(3)
12	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
	Calcium, granular 50 g	30049-05	1
	Magnesium, powder 100 g	30133-10	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

- Calcium has a corroding effect on the skin. Do not touch it with bare fingers!
- Calcium reacts vigorously with water while releasing inflammable gases. Magnesium is easily inflammable!
- Put on protective glasses!



Procedure

Fill the glass beaker two thirds full (Fig. 1) and the test tube completely full with distilled water (Fig. 2). Seal the test tube with your thumb (Fig. 3) and place it with the orifice down into the glass beaker (Fig. 4). Make sure that no water leaks out of the test tube.



Fig. 1

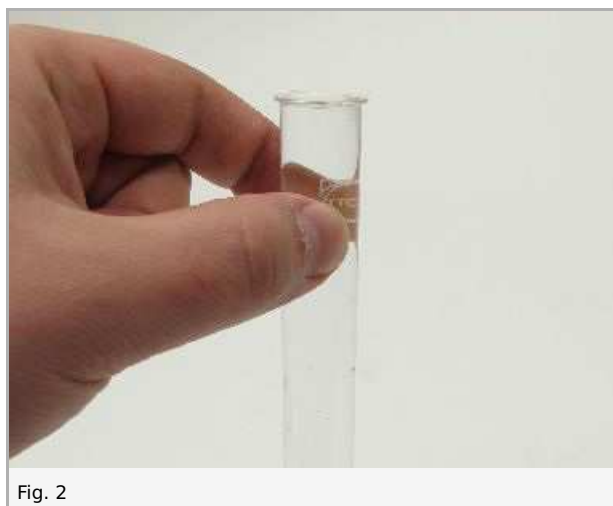


Fig. 2



Fig. 3



Fig. 4

Use the tweezers to put 10 grains of calcium through the orifice of the test tube in the glass beaker so that they ascend inside the test tube (Fig. 5). When the test tube is filled with gas, take it out of the beaker and hold it with the orifice towards the flame of the Bunsen burner (Fig. 6). Make sure that the calcium residues remain in the glass beaker.



Fig. 5



Fig. 6

Fill the test tube half full with the solution formed in the beaker (Fig. 7) and add some drops of the indicator solution (Fig. 8). Use the glass tube to add some carbon dioxide to the residual solution in the glass beaker (Fig. 9).



Fig. 7

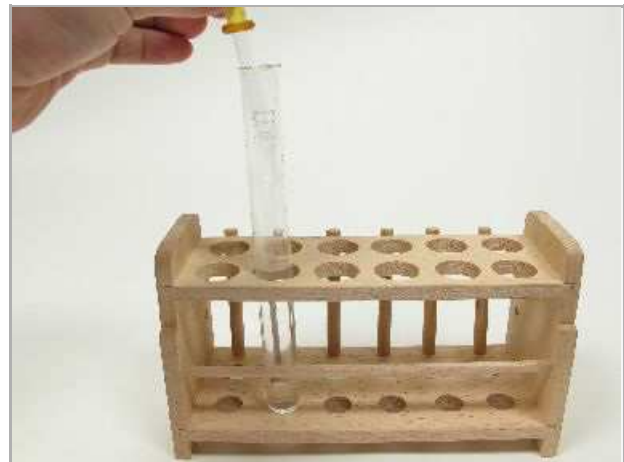


Fig. 8



Fig. 9

Fill a spatula-tipfull of magnesium powder into the third test tube (Fig. 10) and fill it one quarter full with distilled water (Fig. 11). Add some drops of phenolphthalein solution (Fig. 12) and heat the test tube carefully until a reaction takes place (Fig. 13).

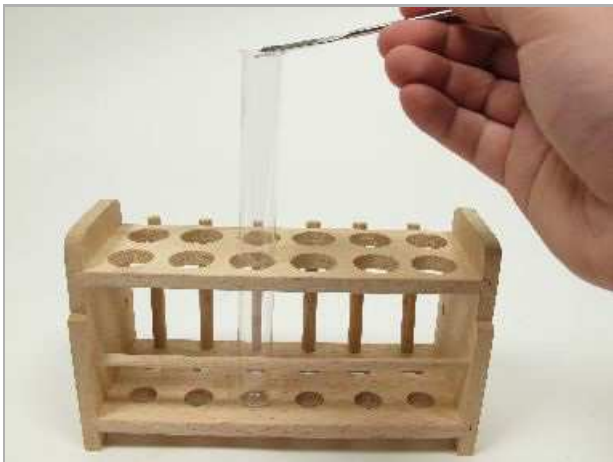


Fig. 10



Fig. 11

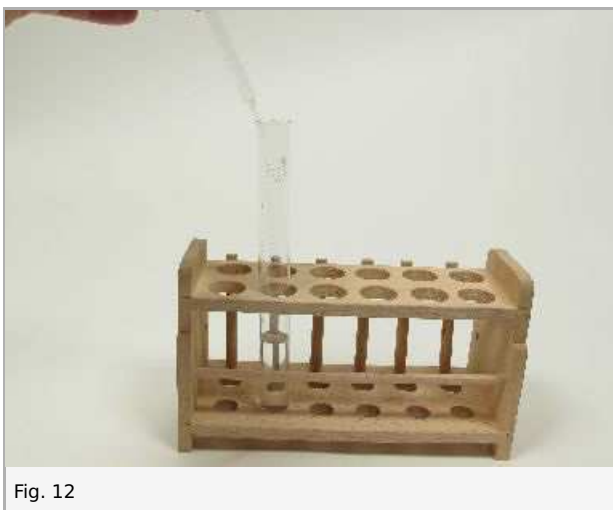


Fig. 12

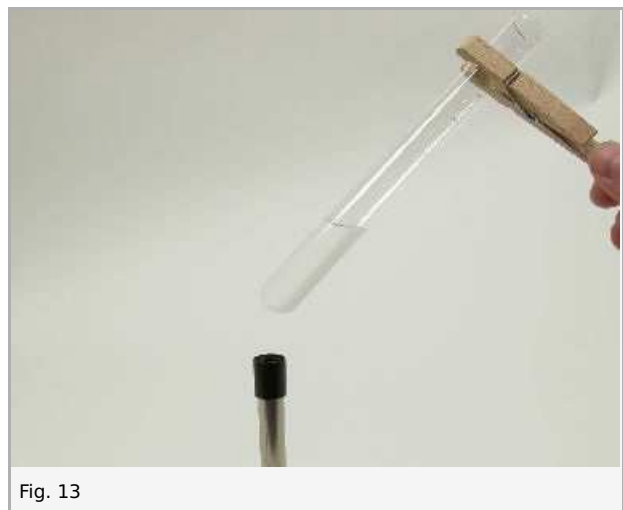


Fig. 13

Waste disposal

Let the magnesium react completely. Put the content of all vessels into the collecting tank for acids and alkalis.

Report: Preparation and properties of lime water (magnesium hydroxide solution)

Result - Observations

Write down your observations on

- the reaction of calcium.
- the reaction of magnesium.

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Evaluation - Question 1

Draw the conclusions from your observations:

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Evaluation - Question 2

Describe the reactions observed in the form of a word equation.

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Evaluation - Question 3

Summarize the way of producing alkaline solution represented in this experiment in the form of a general catchword.

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Evaluation - Question 4

Under which name and for what purpose has the calcium hydroxide solution already been used?

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