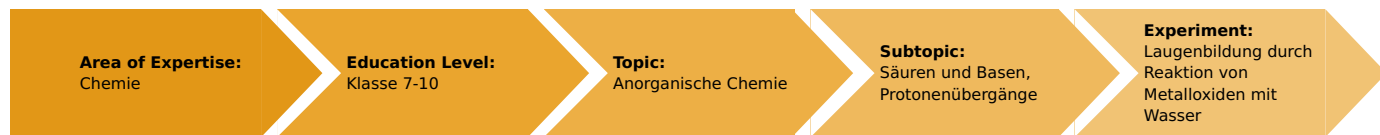


# Formation of alkaline solutions due to a reaction of metal oxides with water

(Item No.: P7159200)

## Curricular Relevance



### Difficulty



Easy

### Preparation Time



10 Minutes

### Execution Time



10 Minutes

### Recommended Group Size



2 Students

### Additional Requirements:

### Experiment Variations:

### Keywords:

alkalis, preparation of alkalis, metal oxides

## Task and equipment

## Information for teachers

## Learning objectives

- Alkaline solutions can be obtained from a reaction of metal oxides and water.
- Alkaline solutions must contain hydroxide ions.

## Notes on set-up and procedure

Remarks on the students' experiments

Make sure that the students do not look at the flame during both experiments. Calcium, too, can burn vigorously after the oxide layer has been removed. If necessary, sunglasses should be put on.



## 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.

Calcium, granular:

H261: In contact with water releases flammable gases.

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

Magnesium ribbon:

H228: Flammable solid.

## Hazards

- Calcium has a corroding effect on the skin. Do not touch it with bare fingers!
- Magnesium burns with a blinding flame. Do not look at the flame!
- Put on protective glasses!

## Notes

The oxides obtained in this experiment do not dissolve completely in water. Instead of that a suspension forms. The alkaline solution of magnesium thus obtained is very weak.

## Remarks on the method

Though, of course, the derivation of the concept of hydroxyl ions is not easy at this point, it is the natural consequence of the evaluation results of this experiment and the preceding one. The type of charge of these ions can be derived from electrolysis experiments which allow to show that since the metal ions are charged positively the hydroxide ions must be charged negatively. If the students have already a sufficient knowledge in this field, this can also be deduced from the electron balances of the reaction.

## Waste disposal

Put the content of both glass beakers into the collecting tank for acids and alkalis.

# Formation of alkaline solutions due to a reaction of metal oxides with water (Item No.: P7159200)

## Task and equipment

### Task

#### What can alkaline solutions be obtained from? (2)

Oxidise metals and prepare alkaline solutions from the oxides thus obtained.



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	Scissors, l = 110 mm, straight, point blunt	64616-00	1
4	Tweezers, straight, blunt, 160 mm	64610-02	1
5	Pipette with rubber bulb	64701-00	1
6	Glass beaker DURAN®, tall, 50 ml	36001-00	1
7	Crucible tongs, 200mm, stainl. steel	33600-00	1
8	Glass rod, boro 3.3, l=200mm, d=5mm	40485-03	1
9	Combustion spoon, l=300 mm	33346-00	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, ribbon, roll, 25 g	30132-00	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

- Calcium has a corroding effect on the skin. Do not touch it with bare fingers!
- Magnesium burns with a blinding flame. Do not look at the flame!
- Put on protective glasses!



### Procedure

Use the scissors to cut off some of the magnesium ribbon (length about 5 cm) (Fig. 1), hold it by means of the crucible tongs, ignite it in the burner flame (Fig. 2) and let it burn over a glass beaker (Fig. 3). Do not look at the flame while the magnesium ribbon burns!

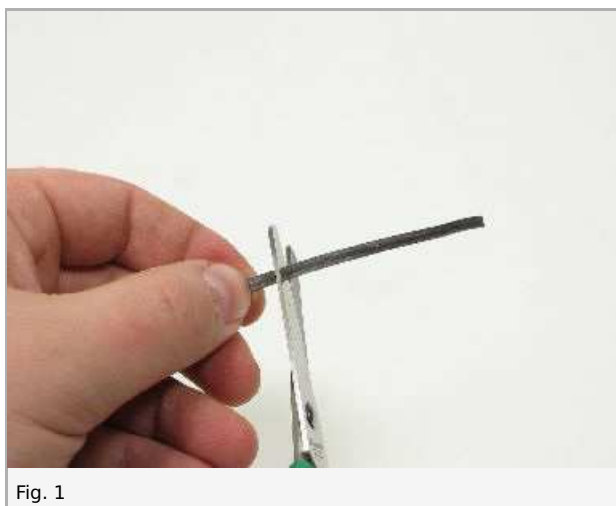


Fig. 1



Fig. 2

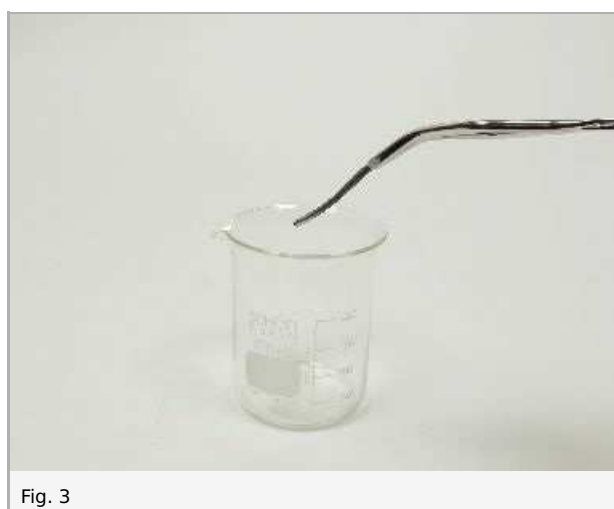


Fig. 3

Put the whole combustion product into the glass beaker and fill it up with distilled water (filling height about 0.5 cm) (Fig. 4). Stir it with the aid of a glass rod (Fig. 5) and add some drops of phenolphthalein solution.



Fig. 4



Fig. 5

Use the tweezers to withdraw 3 grains of calcium from the storage reservoir and put them into the combustion spoon (Fig. 6). Heat it vigorously until the metal glows intensely (Fig. 7).



Fig. 6



Fig. 7

Let everything cool down and then put the reaction product into the second glass beaker. Fill it with distilled water as described above, stir it by means of the second glass rod and add some drops of the phenolphthalein solution (Fig. 8).



Fig. 8

## Waste disposal

Put the content of both glass beakers into the collecting tank for acids and alkalis.

# Report: Formation of alkaline solutions due to a reaction of metal oxides with water

## Result - Observations

Write down your observations on

- Magnesium.
- Calcium.

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## Evaluation - Question 1

Draw the conclusions from your observations. Describe the processes that have taken place during the heating of the metals in the form of a word equation.

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### Evaluation - Question 2

Describe the way of producing an alkaline solution presented here in the form of a catchword.

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### Evaluation - Question 3

Take the result of the experiment as a basis for stating what type of ions must be contained in alkaline solutions.

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