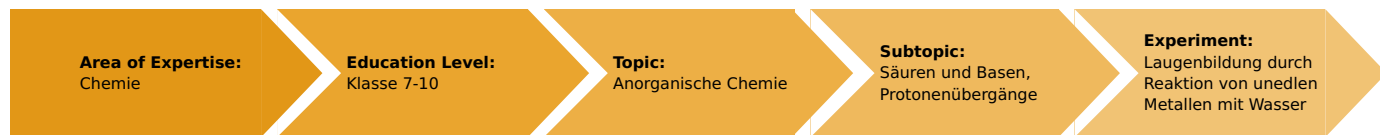


Formation of alkaline solutions due to reaction of base metals with water

(Item No.: P7159100)

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

Task and equipment

Information for teachers

Learning objectives

- Alkaline solutions can be obtained from a reaction of base metals with water.
- The formation of the alkaline solution is indicated by the change in conductivity (the filament lamp lights up or starts to glow more intensively) and by the change in colour of the indicator.

Notes on set-up and procedure

Preparations

It is recommended to let the students cut the lithium into pieces themselves in order to allow them to determine its specific characteristics (tarnish colour, hardness). Draw their attention to the fact that the metal and especially the cut surface must not come into contact with the skin.



Hazard and Precautionary statements

Lithium:

| | |
|---------------------|--|
| H260: | In contact with water releases flammable gases which may ignite spontaneously. |
| H314: | Causes severe skin burns and eye damage. |
| EUH014: | Reacts violently with water. |
| P280: | Wear protective gloves/protective clothing/eye protection/face protection. |
| P301 + P330 + P331: | IF SWALLOWED: rinse mouth. Do NOT induce vomiting. |
| P305 + P351 + P338: | IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. |
| P309 + P310: | IF exposed or if you feel unwell: Immediately call a POISON CENTER or doctor/physician. |
| P370 + P378: | In case of fire: Use metal fire powder for extinction. |
| P402 + P404: | Store in a dry place. Store in a closed container. |

Phenolphthalein:

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

Hazards

- Lithium has a corroding effect on the skin. Do not touch it with bare fingers! Put on rubber gloves!
- Explosive gas mixtures are formed in the course of the experiment. Extinguish all open flames!
- Put on protective glasses!

Remarks on the method

The demonstration experiments with sodium and potassium should be carried out in parallel with this experiment though in this case it is recommended not to measure the conductivity since otherwise the experiment would be rendered too complex.

Apart from showing a certain way of producing alkaline solution this experiment also serves for introducing the hydroxyl ions. In conjunction with the following experiment it can be shown that the reaction does not lead to the formation of O^{2-} -ions from the water which means that in fact hydroxyl ions are formed. This can be shown in an analogue way when other alkaline solutions are prepared.

Waste disposal

Let the Lithium react completely and then put the content of the trough into the collecting tank for acids and alkalis.

Formation of alkaline solutions due to reaction of base metals with water

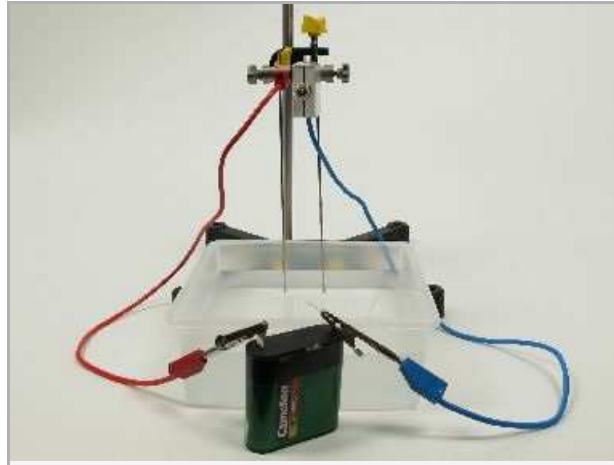
(Item No.: P7159100)

Task and equipment

Task

What can alkaline solutions be obtained from? (1)

Prepare an alkaline solution of lithium and study the conductivity during the reaction.



Equipment



| Position No. | Material | Order No. | Quantity |
|--------------|---|-----------|----------|
| 1 | Rubber gloves, size S (7) | 39325-00 | 1 |
| 2 | Protecting glasses, clear glass | 39316-00 | 1 |
| 3 | Wash bottle, 250 ml, plastic | 33930-00 | 1 |
| 4 | Iron rods, flexible, 5 off | 45127-00 | (2) |
| 5 | Flat battery, 4.5 V | 07496-01 | 1 |
| 6 | Lampholder E10, case G1 | 17049-00 | 1 |
| 7 | Lamp 4 V/0,04 A,E 10 | 06154-00 | 1 |
| 8 | Connecting cord,19A,50cm, blue | 07314-04 | 1 |
| 9 | Connecting cord,19A,50cm, red | 07314-01 | 1 |
| 10 | Alligator clips, bare, 10 pcs | 07274-03 | (2) |
| 11 | Knife, stainless | 33476-00 | 1 |
| 12 | Pipette with rubber bulb | 64701-00 | 1 |
| 13 | Holder for two electrodes | 45284-01 | 1 |
| 14 | Tweezers, straight, blunt, 160 mm | 64610-02 | 1 |
| 15 | Support base, variable | 02001-00 | 1 |
| 16 | Boss head | 02043-00 | 1 |
| 17 | Dish, plastic, 150x150x65 mm | 33928-00 | 1 |
| 18 | Support rod, stainless steel, l=370 mm, d=10 mm | 02059-00 | 1 |
| | Water, distilled 5 l | 31246-81 | 1 |
| | Lithium metal, bottle w.can, 25 g | 31523-03 | 1 |
| | Phenolphthalein, 0,5% solution in ethanol, 100 ml | 31715-10 | 1 |

Set-up and procedure

Set-up

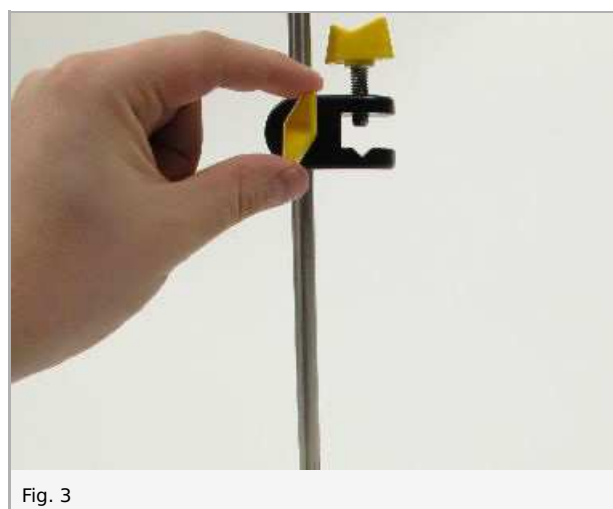
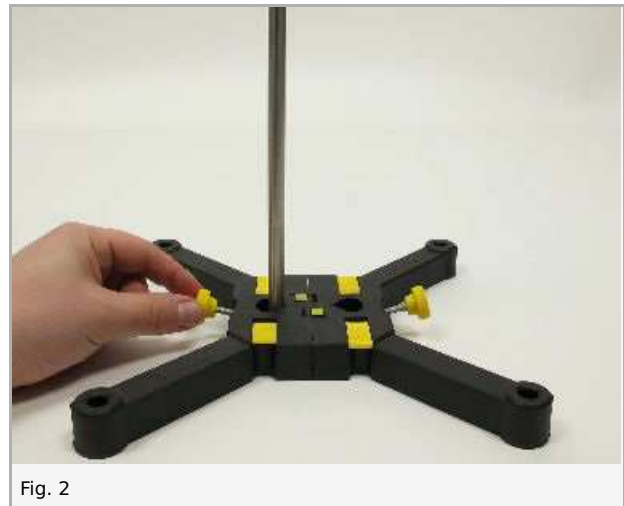
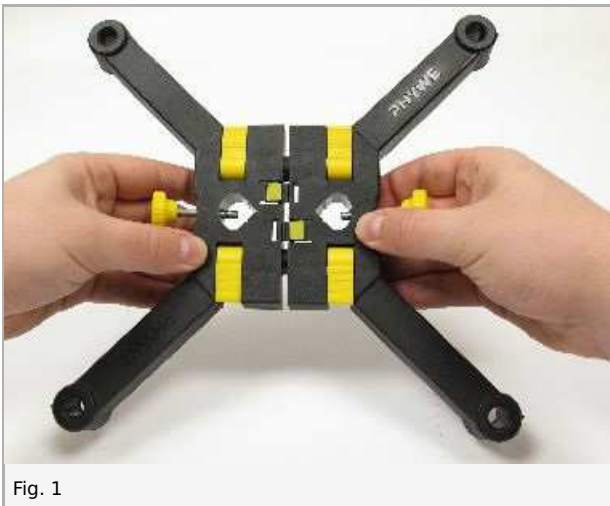
Hazards

- Lithium has a corroding effect on the skin. Do not touch it with bare fingers! Put on rubber gloves!
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- Put on protective glasses!



Set-up

Set up the support system according to Fig. 1-3.



Fix the two iron rods into the electrode holder (Fig. 4) and clamp it into the bosshead in such a way that the iron rods point downwards (Fig. 5) and nearly touch the bottom of the trough placed underneath (Fig. 6).

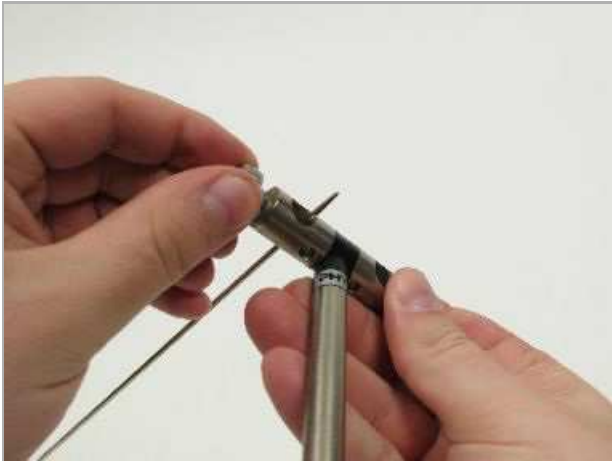


Fig. 4

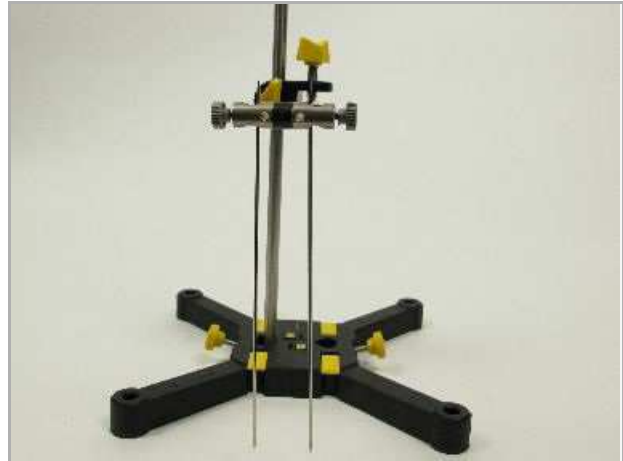


Fig. 5

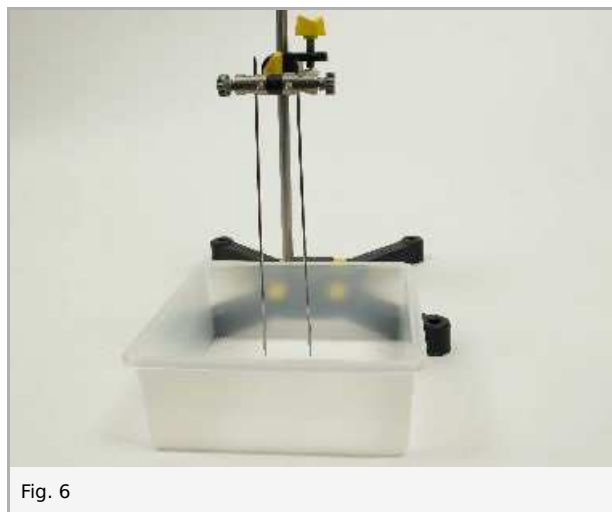


Fig. 6

Screw the filament lamp into the lampholder (Fig. 7). Insert the plug of a connection cord into one of the free sockets of the electrode holder (Fig. 8). Plug one plug of the lampholder into the socket of a plug head of the other connection cord (Fig. 9). The other free plug of the lampholder must be plugged into the free socket of the electrode holder (Fig. 10).

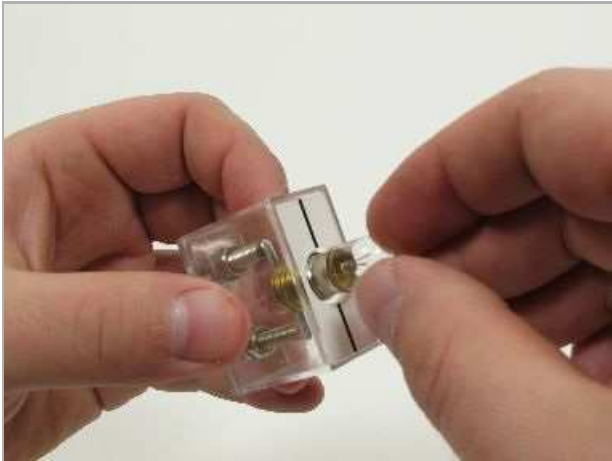


Fig. 7

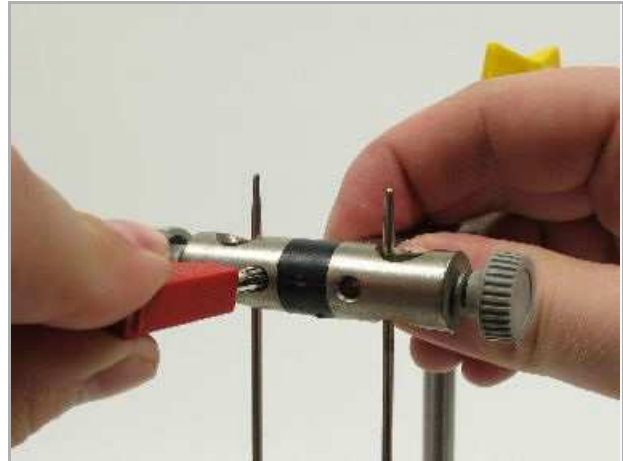


Fig. 8

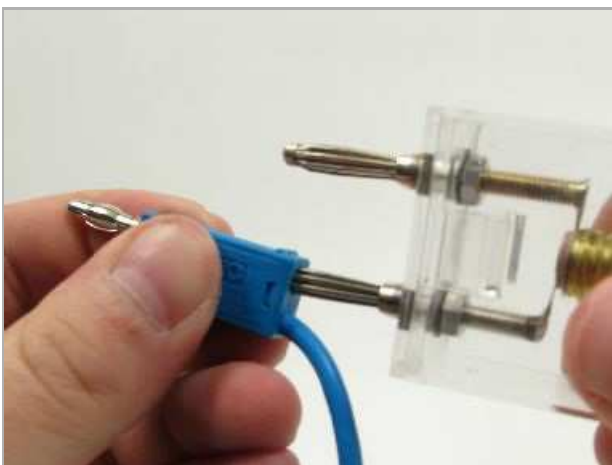


Fig. 9

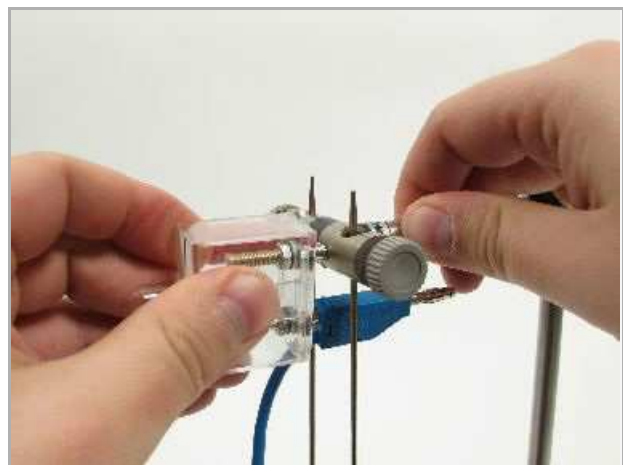


Fig. 10

Procedure

Fill the trough with distilled water until the electrodes are dipped about 2 cm deep in the water (Fig. 11). Add some drops of phenolphthalein solution. Connect the end terminals of the connecting cords with the battery by means of some crocodile clips (Fig. 12).

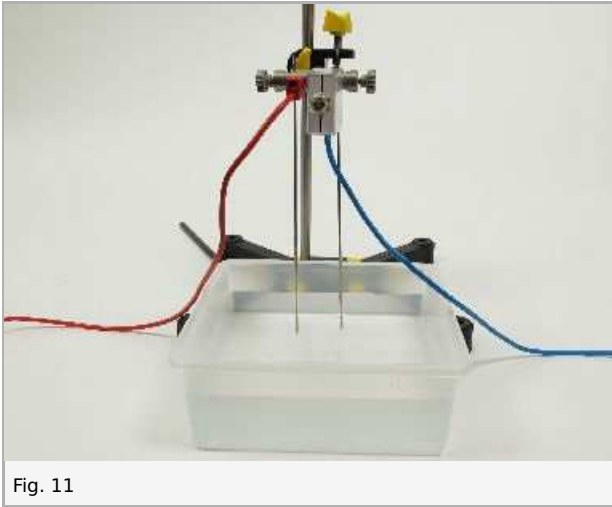


Fig. 11

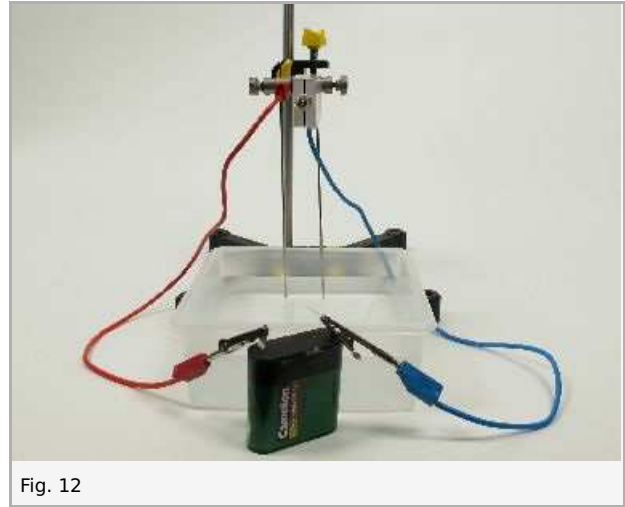


Fig. 12

Use some tweezers to withdraw a piece of lithium of about the size of a fingernail from the storage reservoir and cut it into 5 small pieces.

Put the lithium pieces one by one into the water (Fig. 13). Wait in between the individual steps until the lithium piece added last has completely dissolved. Observe the filament lamp during this process.

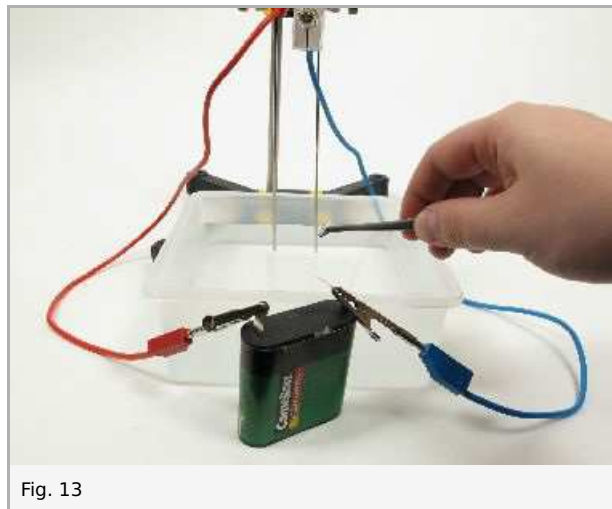


Fig. 13

Waste disposal

Put the content of the trough into the collecting tank for acids and alkalis.

Report: Formation of alkaline solutions due to reaction of base metals with water

Result - Observations 1

Write down your observations.

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Result - Observations 2

State the properties of the lithium observed in the course of the experiment.

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Evaluation - Question 1

Draw the conclusions from your observations.

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Evaluation - Question 2

What other alkaline solutions can be obtained in just the same way? Summarize the way of producing an alkaline solution presented here in the form of a catchword.

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Evaluation - Question 3

What type of ions could be formed in this experiment?

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