End of chapter test

WORKSHEET 9.2 (TRB page 72)

1 a) e.g. sodium
b) iron, nickel or cobalt
c) gold or copper
2 a) You hear a ringing sound.
b) The non-metal breaks easily.
3 e.g. gold, silver
4 a rock which is rich in a metal compound
5 an alloy
6 a) iron ore, coke, limestone, hot air
b) molten iron, slag, waste
7 nitrogen
8 graphite, diamond, charcoal, coke (any two forms)
9 a yellow solid, brittle, does not dissolve in water (any two properties)
10 open cast mining
11 fossil fuels: coal, oil and gas
12 zinc + sulphur → zinc sulphide
13 a) A – rocksil wool, soaked in water
B – metal sample (e.g. magnesium, zinc, iron)
C – hydrogen
b) action of steam on a metal
14 carbon + nitric acid → water + nitrogen dioxide + carbon dioxide

Activities

Activity 9.1 Properties of metals and non-metals

Introduction (PB page 109)

Details of this activity are given in Activity 3.6 (see page 26), where the physical properties of metals and non-metals are studied is more detail. You may wish to re-visit it here as a reminder.

Safety 

- Eye protection must be worn.
- Do not allow pupils to test mercury, bromine, nitrogen or oxygen in an electrical circuit.
- Do not let pupils handle the very reactive elements: sodium, lithium, bromine or mercury. These should not be used in any way other than for observation. Teachers could demonstrate the conductivity of mercury or sodium (with care).
- Bromine is corrosive and very toxic (would require a fume cupboard, gloves, and great care).
- Mercury is toxic.
- Ensure that lead is secure at all times and cannot be stolen.

Activity 9.2 Investigating the hardness of minerals

Comparing hardness (PB page 109)

When pupils have read about comparing hardness you may like to extend the work with this activity, in which they examine a hardness scale.

Friedrich Mohs (1773–1839) was a German scientist who studied minerals and invented a scale of hardness which could be used in their identification. He arranged minerals on a ten-point scale, giving the softest a value of 1 and the hardest a value of 10. (These values cannot be calibrated in SI units.) Each mineral in the scale can be scratched by the one above it in the scale and can scratch the one below it. Introduce this information to the pupils and then let them investigate samples of quartz, gypsum, calite, fluorite, apatite and feldspar and see if they can arrange them in the correct order in the scale (which is gypsum 2, calcite 3, fluorite 4, apatite 5, feldspar 6, quartz 7).

Extend by introducing talc and asking the pupils to assign it to a position on the scale. (It is position 1.)

Preparation

- For each class group: samples of gypsum, calcite, fluorite, apatite, feldspar, quartz and talc

Safety 

- Eye protection must be worn.

Activity 9.3 Comparing minerals

Comparing hardness (PB page 109)

Present the pupils with a selection of ores and ask them to work out an identification scheme. Introduce the streak test with an unglazed white tile. When some minerals are rubbed on the tile they leave a characteristic coloured streak which can be used for identification purposes; for example iron pyrites (iron sulphide) has a greenish-black streak while haematite (iron oxide) has a red or red-brown streak. In the comparison, look for descriptions featuring colour, crystal shape, streak and weight. Some pupils may also try the hardness test if they have already done Activity 9.2. The hardness of the minerals is given in brackets under 'Preparation' on the next page.

Extend by introducing bauxite and see whether the pupils can correctly suggest that it is made from several minerals. (These are diaspore, AlO(OH), which is translucent white, pink, brown or grey; gibbsite, Al(OH)3, which is transparent or translucent and white, red or pink; boehmite, AlO(OH), in tiny crystals; and oxides of iron.)

Preparation

- For each class group: samples of silver glance ($2\frac{1}{2}$), chalcopyrite ($3\frac{1}{2}$), galena ($2\frac{1}{2}$), haematite (5–6) and sphalerite (4). (The figures in brackets refer to the hardness of each substance on the Mohs scale (see Activity 9.2).

Safety

- Eye protection must be worn.

Activity 9.4 The density of solids

Comparing density (PB page 109)

Details of this activity are given in Activity 2.1 (see page 19), where pupils calculate the density of a variety of materials by weighing and measuring blocks. You may like to re-visit the activity, focusing on the difference between metals and non-metals, or refer back to the densities obtained then.

Safety

- Wash hands after handling lead.
- Make sure that the lead is secure at all times and cannot be stolen.

Activity 9.5 Reaction of copper oxide with carbon

Extracting and using metals (PB page 110)

The pupils may have the idea that if a metal ore is heated the metal will simply melt and flow out of it. In the extraction of copper the ore is roasted, but this is to melt the sulphur and remove it. In the blast furnace the iron ore is heated too, but coke must also be present to provide the carbon to react with the iron oxide and remove the oxygen from the metal; this process is called 'reduction'. Although reduction is not used in the extraction of copper, heating copper oxide with carbon can be used to illustrate the reduction process and help clarify the pupils' ideas on the extraction of iron.

Let the pupils mix a small quantity of a charcoal/carbon mixture with an equal quantity of copper oxide and heat the mixture in an ignition tube. The tube should be heated strongly until the mixture glows, then it should be allowed to cool. The pupils should look for a thin pink layer of copper in the tube.

Preparation

- For each class group: ignition tube, test-tube holder, test-tube rack, Bunsen burner, heatproof mat
- Chemicals: charcoal/carbon mixture, copper oxide

Safety

- Eye protection must be worn.
- Copper oxide is harmful.

Activity 9.6 Recycling survey

Recycling (PB page 124)

Ask the pupils to conduct a survey to find out how many families in the class recycle paper, cans, glass and clothes. (This could be extended to include other environmentally helpful activities such as using unleaded petrol and public transport.)

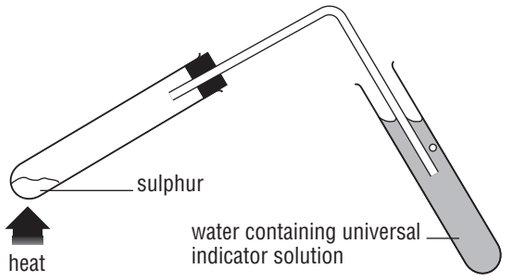
Activity 9.7 Investigating the oxides of metals and non-metals

Reaction with oxygen (PB page 127)

Once the physical properties of metals and non-metals have been characterised, the pupils may look at the oxides of metals and non-metals. They can burn the element in oxygen and then dissolve the product in water to give a solution. A study of the alkalinity or acidity of the oxides can be performed.

This could be a full investigation. The teacher should demonstrate sodium, lithium and potassium, as these are very reactive metals. The pupils will have to decide the best way of burning the other elements. Some are relatively easy, for example the burning of magnesium has already been studied in Activity 7.5. Some elements will be more difficult, for example sulphur, but pupils can use the investigation proformas to plan their experiments. A useful way of testing the oxide of sulphur is to burn sulphur in a test-tube and place a delivery tube

from the test-tube into a test-tube of water with universal indicator solution in it. As the sulphur dioxide is produced and bubbles through the water, the colour will change from green to red.



Care should be taken: because of the solubility of sulphur dioxide, there is a considerable risk of suck-back.

Preparation

- For each class group: beakers, test-tubes, test-tube holder, test-tube rack, bung with delivery tube attached, Bunsen burner, heatproof mat
- Chemicals: calcium, magnesium, sulphur (very small amounts), universal indicator solution
- Access to a fume cupboard

Safety

- Eye protection must be worn.
- Sulphur must be burned in a fume cupboard as sulphur dioxide is toxic and corrosive and dangerous to asthmatics.
- Sodium, lithium and potassium are corrosive and highly flammable, forming corrosive oxides.

Activity 9.8 Reaction of acids and metals

Reaction with acid (PB page 129)

WORKSHEET 9.1 Acids and metals (TRB page 71)

This practical is used to show how metals dissolve in acid to produce a salt with the evolution of hydrogen. It may be performed as in Activity 11.2 on pages 76–77 (Procedure 2) or it may be done to show the production of a salt, as in Activity 7.2 on pages 49–50. The gas may be collected under water via a delivery tube to another tube and the gas tested for hydrogen (by producing a squeaky pop with a lighted splint).

Preparation

- For each class group: conical flask, two-holed bung with delivery tube attached, dropping funnel, water bath, test-tubes, splints
- Chemicals: magnesium, calcium, iron, zinc, 1.0 M hydrochloric acid

Safety

- Eye protection must be worn.
- Do not allow pupils to light hydrogen as it comes out of the delivery tube.