WORKSHEET 18

EXPERIMENT: COMPARING DIFFERENT TYPES OF SUBSTANCES

Syllabus reference 8.2.5

INTRODUCTION

Solids can be divided into four categories—metallic, ionic, covalent molecular and covalent network.

Solids are classified into each of these four categories on the basis of their properties. One property which effectively distinguishes between metallic, ionic and covalent is electrical conductivity. To distinguish between covalent molecular and covalent network, melting point must be considered.

In this investigation you will classify a number of given substances on the basis of their ability to conduct electricity in the solid, molten and/or aqueous states.

Note: Because of the amount of equipment and time involved, this investigation is best done by rotating through stations at each of which the properties of one substance will be tested.

AIM

To classify substances according to their physical properties.

EQUIPMENT

All stations

- power pack, kit for measuring conductivity (stations 1–5 need 2 kits)
- See figure below for examples of conductivity kits.

Station 1–2

- crucibles with lids (2), Bunsen burner, tripod, pipe clay triangle

Stations 3–5

- crucible with lids (2), hotplate

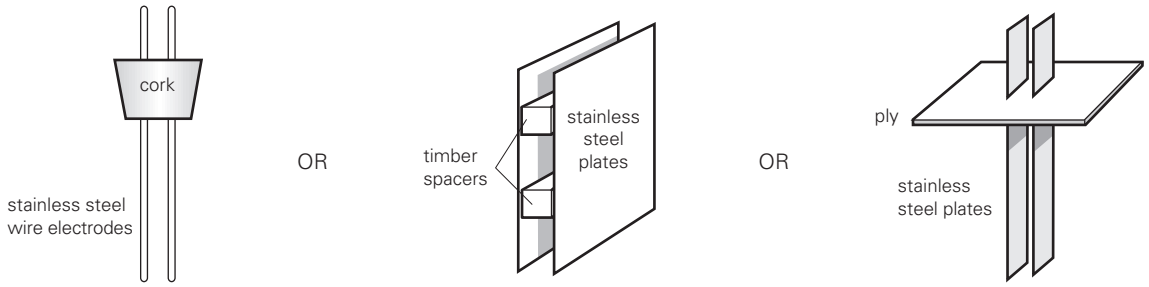
Stations 6–12

- 100 mL beaker

  Because of contamination of the electrodes in silver nitrate, platinum electrodes work better at this station.

Station 13

- one piece each of copper sheet, tin foil, aluminium foil and quartz



Examples of conductivity kits

CHEMICALS

Station 1

NaOH (sodium hydroxide pellets to half fill 2 crucibles)

Station 2

$AgNO_3$ (silver nitrate crystals to half fill 2 crucibles)

Station 3

candle wax to half fill 2 crucibles

Station 4 (place in fume cupboard if possible)

S (sulfur to half fill 2 crucibles)

Station 5

naphthalene to half fill 2 crucibles

Station 6

distilled water (50 mL)

Station 7

kerosene (50 mL)

Station 8

C_2H_5OH (ethanol, 50 mL)

Station 9

0.1 mol/L sucrose (sugar solution, 50 mL)

Station 10

0.1 mol/L NaCl (sodium chloride solution, 50 mL)

Station 11

0.1 mol/L NaOH (sodium hydroxide solution, 50 mL)

Station 12

0.1 mol/L HCl (hydrochloric acid, 50 mL)

SAFETY: Safety glasses and protective clothing must be worn. Molten sodium hydroxide and silver nitrate are dangerous—wear gloves and safety goggles, do not allow these substances to touch skin. Heat sulfur and naphthalene in the fume hood.

PROCEDURE

1 At all stations start the power pack at 2 V. If you get a reading record it. If not, turn the voltage up one step at a time until you get a reading or until you get to a maximum of 6 V. Record the result, either a current reading or no current.

2 At stations 1 and 2, place one of the crucibles on the tripod and heat it with a quiet blue flame until it melts. Turn the Bunsen onto a very low flame or off. Use one of the conductivity kits to test the molten substance. Use the other kit to test the solid in the other crucible. If the electrodes in the molten substance are covered in solid it will need to be melted before testing the conductivity.

3 At stations 3–5, there is a chance of the substance catching fire. If it does, place the lid on the crucible to put it out. Heat the crucible on the hotplate till the substance melts. Use one of the conductivity kits to test the molten substance. Use the other kit to test the solid in the other crucible.

4 At stations 6–12, dip the conductivity kit into the solution and record the result.

5 At station 13 place the electrodes against each sample.

RESULTS

Record your results in the following table.

CHEMICAL	STATE	CONDUCTIVITY	CLASSIFICATION

QUESTIONS

1 What, if any, pattern is there to the conductivity results?

2 What generalisations can you make about particles in substances and conductivity?

CONCLUSION