

All quantities are per pupil or per group of pupils working together

1: Crystal Garden

● Basic level ● 30 minutes

Requirements

3-5 mm diameter crystals of the following:

iron(II) sulphate (**harmful**)

copper(II) sulphate (**harmful**)

calcium nitrate

manganese(II) sulphate

iron alum

potash alum

cobalt chloride (**toxic**)

iron(III) chloride (**irritant**)

zinc sulphate

nickel sulphate (**irritant/sensitiser**)

200 cm³ thick water glass

(a solution of sodium silicate)

glass jar with lid

glass rod

forceps to pick up crystals

Advance preparation

Dilute the thick water glass (density ca 1.5) in the ratio water glass:water 1:3.

Method

See pupils' sheet.

Safety advice

Nickel sulphate and cobalt chloride solids may cause sensitisation by skin contact. If the pupils cannot reasonably be trusted to use forceps the teacher should demonstrate these two.

The pupils must wash their hands after this activity.

Chemical background

When a crystal of, say, copper sulphate is placed in a solution of sodium silicate it dissolves to form a concentrated solution around the crystal. This solution reacts with the sodium silicate to form a hard shell of copper silicate, which surrounds the crystal. The shell acts as a semi-permeable membrane separating the concentrated solution within from the more dilute solution outside. Water passes into the shell until osmotic pressure causes it to burst. Once it escapes the copper sulphate solution reacts with the silicate to form a new shell a little farther from the original crystal. The process continues with repeated breaking and forming until the crystalline shoot reaches the surface.

Extension

After a day the sodium silicate solution can be siphoned off using a syringe and replaced with water. The metal silicates do not dissolve so the garden should last until the structures break (when the jar is moved or knocked).



eye
protection
must be
worn



TOXIC
cobalt
chloride



HARMFUL
iron(II)
sulphate
copper(II)
sulphate



IRRITANT
iron(III)
chloride
nickel
sulphate



forceps to
pick up
crystals