

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



eye protection must be worn



IRRITANT
propanone



HIGHLY
FLAMMABLE
propanone

1: Alien Blood and Messy Volcanoes

● Basic level ● 30 minutes total

Requirements

ALIEN BLOOD

spatulas
10 cm³ measuring cylinder
dropping pipette
pestle and mortar to grind up chalk
stirring rod

orange chalk (ground up) or curry powder
liquid detergent
expanded polystyrene tiles or packaging chips
propanone
'liver salts' mixture; equal amounts of sodium hydrogencarbonate, NaHCO₃, citric acid and magnesium sulphate, MgSO₄

eye protection
disposable gloves for clearing up afterwards

MESSY VOLCANO

sodium hydrogencarbonate, NaHCO₃
flour or polystyrene for packing
newspaper

red food colour
ethanoic acid, (0.1 mol dm⁻³), or colourless vinegar

Method

See pupils' sheet.

Safety advice

Ensure good ventilation so that propanone fumes do not build up.

Chemical background

ALIEN BLOOD

The propanone dissolves the polystyrene. In the presence of water, the 'liver salts' mixture then reacts to produce carbon dioxide gas which fizzes. The dyes are added to look like Alien blood.

MESSY VOLCANO

The ethanoic acid reacts with the sodium carbonate to produce carbon dioxide. This is messy, so use newspaper to cover working surface.



eye protection must be worn



IRRITANT
sodium hydroxide solution



HARMFUL
barium chloride solution



HIGHLY
FLAMMABLE
phenolphthalein solution

2: Chemical Magic

● Basic level ● 30 minutes total

Method

See pupils' sheet.

Water into wine Requirements

wine glasses (2)
milk bottle
wine carafe (or similar)

sulphuric acid, H₂SO₄ (0.1 mol dm⁻³)
barium chloride, BaCl₂ (0.1 mol dm⁻³)
sodium hydroxide, NaOH (0.1 mol dm⁻³)
phenolphthalein indicator solution

eye protection

Safety advice

Pupils should be warned not to drink any of the solutions they make.

Wash the carafe and milk bottle carefully after use.

Chemical background

Phenolphthalein is a narrow range indicator. It is purple coloured within the pH range 9-14. At other pH it is colourless. A faint white precipitate forms at pH 1-2.

Barium chloride reacts with sulphate ions to form a white precipitate, barium sulphate:



Mysterious jug Requirements

weighing balance
500 cm³ measuring cylinder
500 cm³ beaker
stirring rod
spatula
1 jug and 6 glasses

eye protection

iron(III) ammonium sulphate, $\text{FeAl}(\text{SO}_4)_2$
potassium thiocyanate, KSCN
barium chloride, BaCl_2
potassium hexacyanoferrate(II), $\text{K}_4[\text{Fe}(\text{CN})_6]$
tannic acid (gallotannic acid)
tartaric acid, 2,3-dihydroxybutanedioic acid
sodium hydrogensulphite, NaHSO_3

Safety advice

Pupils should be warned not to handle any of the solids or drink any of the solutions they make.

Sodium hydrogensulphite liberates toxic sulphur dioxide with acid and thiocyanates liberate toxic gases with concentrated acids.

Chemical background

The iron(III) aluminium sulphate reacts with the other dilute solutions in the following ways:

- Glass A: The thiocyanate ion forms a deep red complex with iron(III).
- Glass B: Barium ions form a white cloudy precipitate with sulphate ions.
- Glass C: The hexacyanoferrate ion forms a deep blue complex with iron(III), Prussian Blue.
- Glass D: Tannic acid forms a greenish complex with iron(III).
- Glass E: Tartaric acid forms a greenish complex with iron(III).
- Glass F: Hydrogensulphite ion forms an amber product with iron(III).

3: Crunchy Foam and Microwave Meringues

● Basic level ● 30 minutes total

Introduction and chemical background

When sugar solution is heated to high temperature, it begins to break down into glucose and fructose. This breakdown is speeded up by the addition of an acid. The result is a syrup containing a mixture of three sugar solutes - glucose, fructose and sucrose. Crystals will not easily form in such a mixture.

Syrup or honey contain weak acids. These acids react with hydrogencarbonate to release CO_2 gas. The trapped gas forms a solid foam in the sugar/syrup mixture and makes a sweet honeycomb.

This is a solid foam - gas is dispersed in a sugar matrix.



eye
protection
must be
worn



HARMFUL
barium
chloride
sodium
hydrogen-
sulphite
potassium
thiocyanate
solid



do not drink



hot sugar can
cause bad
burns



the product
must not be
eaten if made
in the
laboratory

Requirements

large saucepan	4 tablespoons of sugar
greased dish	2 tablespoons of golden syrup or honey
2 tablespoons	heaped teaspoon of sodium hydrogencarbonate, NaHCO_3
a teaspoon	
spoon or similar for stirring	
tripod, gauze mat, heat proof mat	
insulated glove (or similar) for carrying hot pans	

Method

See pupils' sheet.

Microwaves have different power ratings – you may need to adjust the timings to suit your appliance. To avoid overcooking the meringues, first cook on high power for 30 seconds. If the meringues are puffed up and white they are ready. If they look a little flat, cook for another 10 seconds.

Safety advice

Ensure that your pupils are aware of the danger of burns from hot sugar and protect themselves and the lab bench using insulated gloves (or similar) and heat proof mats.

Warn your pupils not to eat the foam if made in the laboratory.

This experiment could be done at home using edible quality sodium hydrogencarbonate.

Make sure that you have parent's/guardian's consent (for suggested permission form see page 13).

4: Crystal Growing

- Basic level
- 30 minutes to prepare
- Several days to crystallise

Requirements

sodium chloride, NaCl	weighing balance
copper sulphate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	filter funnels
sodium sulphate, Na_2SO_4	filter paper
potassium chromium sulphate, $\text{KCr}(\text{SO}_4)_2$	250cm ³ beakers
iron(II) sulphate, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	evaporating basins
ammonium sulphate, $(\text{NH}_4)_2\text{SO}_4$	cotton thread
potassium aluminium sulphate, (alum), $\text{KAl}(\text{SO}_4)_2$	electrical wire (small gauge)
potassium hexacyanoferrate(III), $\text{K}_3[\text{Fe}(\text{CN})_6]$	object to coat in crystals (e.g. a cross)
	stirring rods
eye protection	forceps
disposable gloves	

Method

See pupils' sheet.

Safety advice

Pupils should avoid handling the crystals, use forceps or wear gloves, and wash their hands after handling these solutions.

