

8: Rainbow Reaction Neutralisation demonstration

● Basic level ● less than 30 minutes

Requirements

50 cm³ burette with bung
syringes to dispense up to 20 cm³

eye protection

sodium hydroxide, NaOH, (0.1 mol dm⁻³)
hydrochloric acid, HCl, (0.1 mol dm⁻³)
sodium carbonate, Na₂CO₃, (1.0 mol dm⁻³)
universal indicator solution

Method

See pupils' sheet.

Chemical background

Sodium carbonate produces carbon dioxide with acid which helps to mix the solution and assist the sodium hydroxide in neutralising the acid.

The densities of the liquids are different and the diameter of the burette slows down the mixing so that the rainbow layers will persist for several days.

9: Smell Molecules - Ancient and New!

● Basic level ● 30-60 minutes to prepare esters (teacher)
● 30 minutes to carry out (pupils)



Requirements

access to a fridge
gelatin
small pieces of absorbent card
glass dishes to place cards in
clean pipettes for dispensing esters

A. TO MAKE FRUIT SMELLING ESTERS
(TO BE CARRIED OUT BY TEACHER):
'isoamyl' alcohol (a mixture of isomers of pentanol)
ethanol
phenylmethanol
propan-1-ol
ethanoic acid
butanoic acid
concentrated sulphuric acid
small tubes with bungs for ester samples

B. AND C.
oils of jasmine, lily of the valley,
apple, heliotrope, peppermint
(available from chemists and
aromatherapy outlets)

Method

  To make small amounts of each ester:

1. Use 5-10 drops of undiluted acid with 5-10 drops of the alcohol in a boiling tube.
2. Add 1-2 drops of concentrated sulphuric acid.
3. Warm gently for about five minutes.
4. Cool down under a tap and then add the mixture to 5 cm³ of 1 mol dm⁻³ sodium carbonate solution to neutralise the concentrated acid. Store in small tubes with bungs.
5. Dispense 1-2 drops only, on to pupils' cards.



eye
protection
must be
worn



HARMFUL
sodium
hydroxide



eye
protection
must be worn



CORROSIVE
concentrated
sulphuric acid
ethanoic acid
butanoic acid



HIGHLY
FLAMMABLE
alcohols
and esters

The table below shows the combinations needed to make a range of esters :

Alcohol	Hazard	Acid	Hazard	Ester produced	Smell	Hazard
'isoamyl' (a mixture of isomers of pentanol)	highly flammable harmful	ethanoic	corrosive	'isoamyl' ethanoate	banana	highly flammable
ethanol	highly flammable	butanoic	corrosive	ethyl butanoate	pineapple	highly flammable
phenyl- methanol	harmful	ethanoic	corrosive	phenylmethyl ethanoate	peaches	highly flammable
propan-1-ol	highly flammable	ethanoic	corrosive	1-propyl ethanoate	pears	highly flammable

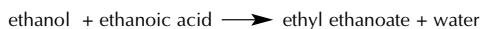
For rest of procedure see pupils' sheet.

Safety advice

Do not provide pupils with more than 1-2 drops of each ester unless they are age 14 or older.

Chemical background

Esters are produced by the combination of alcohols and acids in an esterification reaction.



Many of the natural flavours and smells of flowers and fruits result from the presence of volatile esters.

A substance has a smell because its molecules can excite the nerve endings in the nose. The nervous system is in direct contact with the outside world through the sense of smell. It is thought that molecules of a smelly substance interact with a protein molecule in the nerve endings and hence stimulate the nerve cell to send a message to the brain. The smell molecule has to be a particular shape to fit a particular olfactory site and so trigger a nerve impulse.

10: T-Shirt Chromatography

- Basic level
- 30 minutes to prepare; at least 30 minutes to run chromatogram (preferably longer)

Requirements

access to a fume cupboard
T-shirt, pre-washed (preferably white & 100% cotton)
large plastic bag
permanent felt-tip pens
4 dm³ glass beaker or similar container

ethanol
textile medium (optional) available from
haberdashery stores (this fixes the dye)

eye protection
disposable plastic gloves (to protect hands
from staining)

Method

See pupils' sheet.

Chemical background

The ink dyes are separated out as they pass through the cotton of the T-shirt and are carried along by the ethanol solvent. The separation depends on the differing solubility of the dyes in ethanol and their differing affinity for the cotton fibres.

