

Introduction

This mini-project allows students to explore and develop different techniques for comparing the viscosity of liquids, and to use the techniques to study relationships between viscosity and molecular structure, solution concentration or temperature. The study can lead in many directions, allowing individuals to explore different questions either independently or as part of a whole-class study.

Safety issues specific to this mini-project:

Eye protection should be worn at all times when any of this practical work is in progress.

A wide range of liquids may be used in these studies (e.g. sugar syrups, or suspensions made by dispersing cornflour in boiling water, then cooling, a series of different alcohols or liquid alkanes). Before students are allowed to work with any liquid, the associated hazards should be carefully checked so that appropriate precautions can be taken.

Students will work with glass apparatus, some of which will be clamped into position. Care is needed to avoid apparatus rolling off benches or being broken by clamping wrongly or too tightly.

In some activities, students may wish to work at temperatures above room temperature. These can be provided by water baths (e.g. large beakers) filled from hot water taps or kettles. An upper limit of 40°C is recommended for this work.

Requirements

For **Slippery slopes**: microscope slides or glazed white tiles; stands and clamps or wooden blocks; blu-tack or sellotape; liquids to be tested; dropping pipettes; stop clocks or watches; paper towels to mop up any spillages. If tiles are used, two marks will be needed, either made with permanent OHP pen or by small pointers made from sticky labels. If using slides, draw two parallel lines on the sticky side of a label, then stick the slide onto it, so that the lines can be seen through the slide.

For **Ball-fall**: measuring cylinders of different sizes, or large test tubes; ball bearings of different sizes, glass marbles, small stones of different shapes; liquids to test; stop clocks or watches. Some activities may need water baths which can be filled from kettles or hot taps.

For **Run-out**: large size Pasteur pipettes with bulbs (or pipette fillers) or 20cm lengths of 6, 7 or 8 mm dia glass tube, with short (1cm) lengths of 1mm capillary tubing attached on one end; beakers, liquids to test; stop watches or clocks

Liquids to test: suitable sets of liquids might include:

- milk (skimmed, semi-skimmed, full-fat), single cream, double cream
- hexane (extremely flammable, harmful), heptane (highly flammable), octane (highly flammable), decane (harmful), liquid paraffin
- ethanol (highly flammable), propanol (highly flammable), butanol (harmful), pentanol (harmful)
- sugar syrups of different concentration
- diluted suspensions of starch (or corn-flour)
- a variety of motor vehicle lubricating oils (note hazards on packaging)

General safety requirements

The Health and Safety at Work *etc* Act 1974¹ requires a risk assessment to be carried out before hazardous chemicals are used or made, or a hazardous procedure is carried out. Risk assessment is the responsibility of the employer. The task of assessing risk in particular situations may well be delegated by the employer to the Head of Science, who will be expected to operate within the employer's guidelines. Most education employers have adopted various nationally available texts as the basis for their model risk assessments. Those commonly used include the following:

Safeguards in the School Laboratory, 10th edition, ASE², 1996

Topics in Safety, 3rd edition, ASE², 2001

Hazcards, CLEAPSS³, 1998 (or 1995)

Laboratory Handbook, CLEAPSS³, 1997

Safety in Science Education, DfEE, HMSO, 1996

Hazardous Chemicals Manual, SSERC³, 1997 (A CD ROM version is also available, 1998)

If your employer has adopted one or more of these publications, you should follow the guidance given there, subject only to a need to check whether modification is required to deal with any special situation in your class/school. We have outlined safety considerations for the practical activities given on this CDROM. However, teachers must still verify that what is proposed conforms with any code of practice produced by their employer.

¹The COSHH Regulations and the Management of Health and Safety at Work Regulations.

²ASE publications are available to order from ASE Headquarters, College Lane, Hatfield, Hertfordshire AL10 9AA Tel: 01707 283000

³CLEAPSS and SSERC publications are available only to members.

CLEAPSS School Science Service, Brunel University, Uxbridge UB8 3PH Tel: 01895 251496

SSERC, St. Mary's Building, 23 Holyrood Road, Edinburgh EH8 8AE Tel: 0131 558 8180