Viscosity: Overview

Summary

We deal with flowing liquids all the time. Getting sauce out of a bottle. The spread-ability of honey, jam and butter. Whether dressing stays on salad or drips off. The time taken for water to flow through the tap to fill the kettle. The flow-ability of shampoo is one of the factors that determine how shampoo spreads through our hair.

Viscosity is the resistance to flow. Liquids with high viscosity do not flow easily; liquids with low viscosity flow easily.

This laboratory learning activity (LLA) has its origin in materials science; specifically, in research aimed at improving the rate of production of carbon fibre composite materials. Currently carbon fibre objects cannot be made fast enough to keep pace with the production lines of major car companies. So, rapid production of carbon fibre composite material is necessary if this very strong and lightweight material is ever to replace metals in the mass manufacture of motor vehicles.

In the production of carbon fibre composite, the resin component must spread through the carbon fibre cloth, and the rate at which the resin spreads through the fibre cloth depends on the viscosity of the resin.

There are many other industrial examples. Paint needs to be thin enough to spread with a brush or roller or to be sprayed from a spray gun, but also viscous enough not to run off the surface to which it has been applied before it "dries". 'Oils' and lubricants have been devised to achieve a viscosity at the operating temperatures of the machine so they will penetrate the narrow spaces between moving parts to lubricate the surfaces. Liquids that are packaged must be able to flow through the packaging machinery, but have the appropriate qualities for use after packaging.

The viscosity of a liquid changes with temperature. In this activity, students investigate changes in the viscosity of honey at different temperatures. This has further relevance in the context of the carbon

fibre problem because the curing of the resin also has an optimum temperature. If the temperature is too high the resin may harden before it has spread through the fibres.

The LLA also provides a context in which students can develop science inquiry skills and a conceptual understanding of how the properties of materials are determined by the forces between particles both within materials (cohesive forces) and between materials and the surfaces with which they are in contact (adhesive forces).

This LLA addresses learning outcomes related to the particle model of matter, science inquiry with specific focus on Identify questions, problems and claims that can be investigated scientifically and make predictions based on scientific knowledge. The application of science understanding in solving problems will also be considered.

Curriculum Outcomes: Australian Curriculum - Science F-10 [Footnote [1]]

Years 5 and 6

Science as a human endeavour: Use and influence of science

- Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE083 & ACSHE100)

Year 7

Science as a human endeavour

- People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity (ACSHE121)

Year 8

Science as a human endeavour

- People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity (ACSHE136)

Science Understanding: Chemical Sciences

- Properties of the different states of matter can be explained in terms of the motion and arrangement of particles (ACSSU151)

[1] http://www.australiancurriculum.edu.au/science/curriculum/f-10?layout=1#level5

Curriculum Outcomes: Australian Curriculum - Design Technologies

Years 5 and 6

Design Technologies

- Explore the characteristics and properties of materials and components that are used to produce designed solutions (ACTDEK004)

Curriculum Outcomes: Victorian Curriculum F-10 [Footnote 2]

Levels 5 and 6

Science Understanding: Science as a human endeavour

- Scientific understandings, discoveries and inventions are used to inform personal and community decisions and to solve problems that directly affect people's lives(VCSSU073)

Levels 7 and 8

Science Understanding: Science as a human endeavour

- Scientific knowledge and understanding of the world changes as new evidence becomes available; science knowledge can develop through collaboration and connecting ideas across the disciplines and practice of science (VCSSU089)
- Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations (VCSSU090)

[2] http://victoriancurriculum.vcaa.vic.edu.au/Print

Science Understanding: Chemical Sciences

- The properties of the different states of matter can be explained in terms of the motion and arrangement of particles (VCSSU096)
    - modelling the arrangement of particles in solids, liquids and gases.

Science Understanding: Physical sciences

- Change to an object's motion is caused by unbalanced forces acting on the object; Earth's gravity pulls objects towards the centre of Earth (VCSSU103)
    - investigating the effects of applying different forces to familiar objects.

Curriculum Outcomes: Victorian Curriculum – Technologies F-10 [Footnote 3]

Design and Technologies: Technologies Contexts

- **Materials and technologies specialisation**. Analyse ways to produce designed solutions through selecting and combining characteristics and properties of materials, systems, components, tools and equipment (VCDSTC048)

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[3] http://victoriancurriculum.vcaa.vic.edu.au/level8?layout=1&d=DE