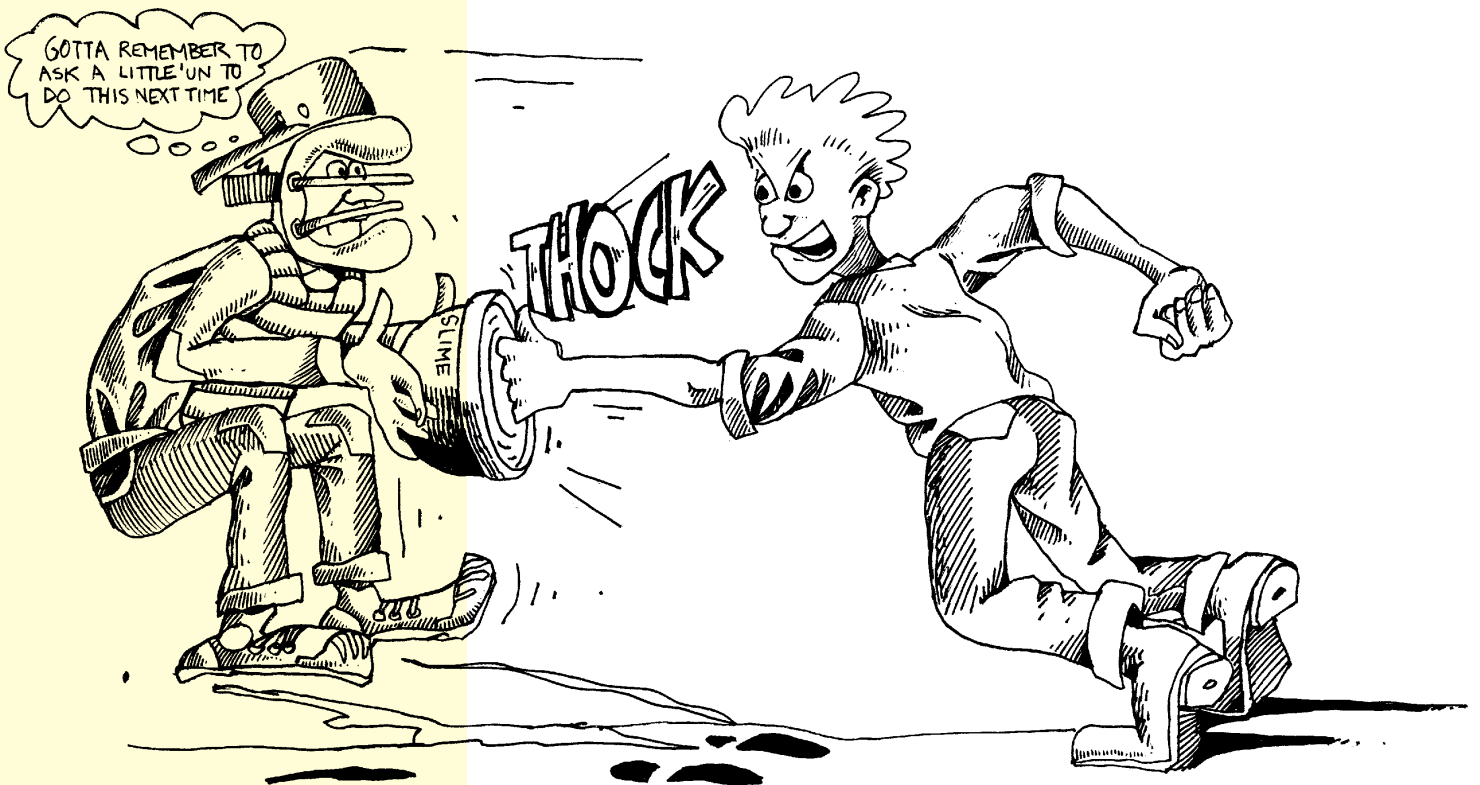




Post-visit
resource
for teachers



The Slime Show



Supplementary information for teachers whose classes have experienced the Shell Questacon Science Circus Shows

Post-it notes

A Post-it note is used to demonstrate that the application direction of force determines the effect the force has on fluids. A shear force is one that acts parallel to two attached surfaces.

Glue slime

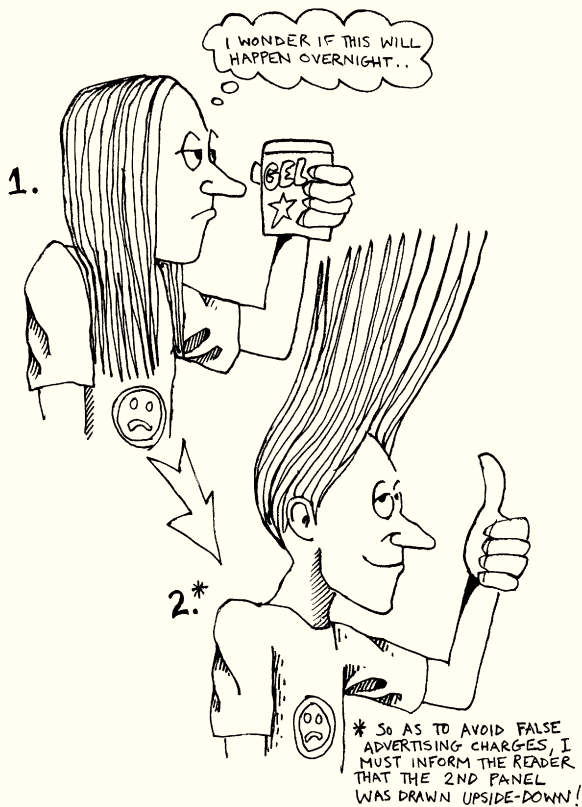
A method is demonstrated of making slime with polyvinyl alcohol (PVA) and borax.

Safety caution and disclaimer

This show has been developed to be presented by scientists with technical training. It is not implied by the provision of these notes or the show performance that the demonstrations are safe for students or teachers to perform. Teachers should do their own health and safety assessments of materials and techniques before using them

Scientific principles demonstrated in the Slime Show

- A fluid is anything that flows. A fluid does not have a fixed shape. Liquids and gases are both fluids. Like all matter, fluids are composed of particles called atoms and molecules. The behaviour of fluids can be explained in terms of the arrangement and energy of the particles which they are composed of.
- Viscosity is the rate at which a fluid flows.
- Different fluids have different viscosities.
- The viscosity of Newtonian fluids is affected only by temperature.
- The viscosity of non-Newtonian fluids is affected by shear forces (stirring) as well as temperature.
- Some non-Newtonian fluids are stir-thinning (thixotropic). Others are stir-thickening (dilatant).
- Polymers are very large molecules made by linked monomers.
- Polymer molecules can cross-link with weak and strong chemical bonds.
- Some non-Newtonian fluids are both stir-thickening and stir-thinning depending on the rate that force is applied.



Hair gel flows when it is stirred



The ink in ball-point pens is a stir thinning liquid



Suggested follow-up activities

1 Review the show by having students describe their favourite demonstration from the Slime Show and explain what it showed.

2 Ask students to explain and discuss other examples (from their own experiences) where they have seen or used fluids.

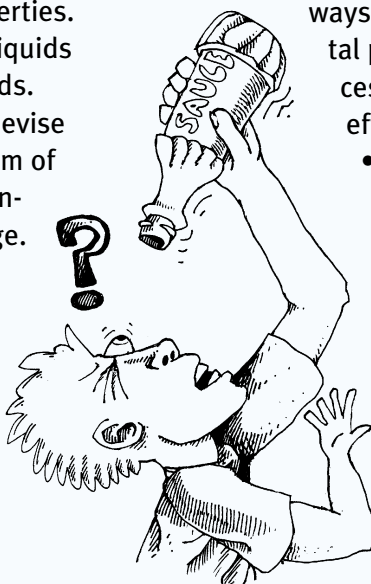
3 Discuss or indicate products, industries or natural phenomena from your local area which exemplify any of the specific science in the show. For example, factories which produce products such as soups and paints; tar which melts and flows on hot days; paints designed to be non-drip; observations of hair gel properties.

4 Pumping and storing stir thickening liquids presents different problems to normal fluids. Set a design project for your students to devise and perhaps build a model pumping system of an industrial scale for moving a stir thickening liquid from a production tank to storage.

5 Provide time and materials for students to extend their knowledge of some of the phenomena, concepts and inventions mentioned in the show. Examples include fluid flow rates; general properties of elastic polymers; chemical properties of corn starch.

6 Ask students to devise and carry out their own experiments on fluids.

Divide your class into groups (research teams) of 3 for experiment planning. You may like to allocate specific roles eg recorder, equipment manager, communicator within each group. Emphasise the cooperative nature of laboratory work. Teamwork is essential in science! Include a good reader in each group. Safety is paramount in any science project, especially experiments with solids, liquids and gases. Textbooks and the Internet are useful starting points. Encourage students to gather as much information as they can before they begin to do anything. Before any practical work begins, provide a few basic project management guidelines for your students.



Tomato sauce used to be a stir thinning liquid. Food chemists modified the recipe to improve the flow.

Did you know?

A fluid of major importance in the construction industry is pre-mixed concrete. Australian innovations in the design of pre-mixed concrete trucks have put Australia in the forefront of pre-mixed concrete truck technology. We now export this technology to many parts of the world.

7 Look for science activities and demonstrations on the Questacon Web site.

Visit <http://www.questacon.edu.au/>

8 (For senior secondary students)

Extend studies of fluid mechanics and polymer chemistry.

9 Initiate discussion on the general contribution of science and scientists to our culture, economy and environment. For example:

- Discuss or find examples of how science and technology have improved our standard of living. There are numerous examples including more productive crop plants; more effective medicines; new and better materials and processes; faster and more reliable communication and information technology; more effective ways of identifying and treating environmental problems; better food production, processing and storage; cleaner and more efficient mineral extraction methods.

- Discuss past and present examples of people being curious about nature and how scientific study is one way of satisfying our curiosity. For example, compare ancient and modern ways of explaining natural phenomena.

- Discuss the skills we need to develop for doing experiments. For example, observing, imagining, recording, discussing, interpreting, and designing are a few of the things we need to practice in

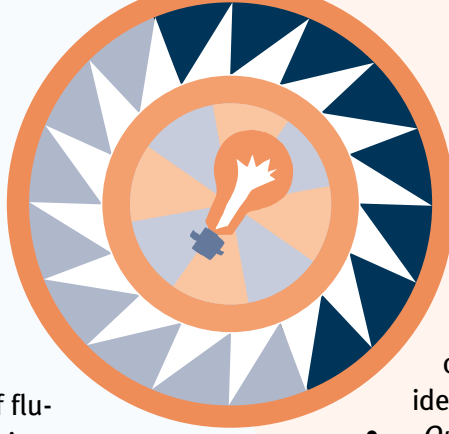
science. Model building is one of these skills.

- Research the lives and achievements of some of Australia's past and present outstanding scientists. There are numerous people who could be included.

eg Macfarlane Burnet; Carolyn Mountford; Gustav Nossal; Peter Doherty; John Eccles; Mark Oliphant; Don Metcalfe; Frank Fenner; William Farrer; Peter Medawar; Kate Helms; Helen Newton Turner; Howard Florey; Nancy Millis; Ernest Titterton; Bede Morris; Nancy Burbidge; Paul Wild; Susan Serjeantson; Peter Bishop; Elizabeth Truswell; and Kerin O'Dea.



10 Arrange an excursion to Questacon: Australia's leading interactive Science and Technology Centre is Questacon in Canberra. Exhibitions are constantly changing. There are a number of remarkable exhibits which are exciting examples of the science of fluids. For example, there is an intriguing exhibit called Hourglass which shows the extremely high viscosity of synthetic rubber which has taken more than 17 years to flow through a perspex funnel to the base of a container! There are numerous other fascinating exhibits which model scientific concepts, natural phenomena and inventions. Tel. (02) 6270 2893 for group bookings.



Student and teacher resources

There are many resources available for inspiration and information. Some of our favourites which contain up to date ideas are:

- *Questacon Exsciter Science kits*. These contain numerous tried and tested ideas and materials for hands-on activities. Tel (02) 6270 2807 for details.
- *Questacon's award winning web site:* <http://www.questacon.edu.au/>
- *Ingenious CD* Tel. (02) 6270 2807 for details
- *Questacon Mag* Tel. (02) 6270 2855 for subscription details
- *Australian Science (incorporating Search)* Tel. (03) 9824 1699 for subscription details
- *Science Australia* by the Curriculum Corporation (national secondary science texts) Tel 1800 337 405
- *Primary Investigations* by the Australian Academy of Science (national primary science texts) Tel (02) 6247 5777 for a free information package.
- *New Scientist* Tel 1300 360127 for subscription details
- *Scientriffic magazine* Tel. (02) 6276 6643 for subscription details
- *The Helix magazine* Tel. (02) 6276 6643 for subscription details
- *Australian Innovation Magazine* Department of Industry, Science and Resources GPO Box 9389 Canberra ACT Australia 2601 Tel. (02) 6213 6304 or fax (02) 6213 6818
- *Australian Academy of Science web site:* <http://www.science.org.au/nova/>
- Contact ASTA, PO Box 334 Deakin West ACT 2600 Tel (02) 6282 9377 email: asta@asta.edu.au for information about professional associations.
- An extensive range of kits, books and fascinating science teaching resources are available from the Questacon shop in Canberra or by mail order from Questacon, King Edward Terrace, Canberra ACT 2600 Request a catalogue by Fax (02) 6273 5100 or Tel (02) 6270 2807.



Some fluids flow extremely slowly. This exhibit is in Questacon at Canberra. It has been flowing for 17 years and had still not reached the bottom of its container in 1999!

Try this!

Make your own slime! You need a bowl, water, cornflour and spoon. Add one part water to three parts cornflour. Stir the mixture very slowly until it is an even consistency. Try the experiments you saw in the show. Stir it fast, then stir it slow. Tap it hard with your finger. Tap it slowly. Pour some in your hand and roll it fast. What happens when you stop rolling?

National curriculum links

Show presentations are varied by presenters according to the age and level of audience. Accordingly, curriculum links will also vary. The following table indicates which outcomes can be achieved with the Slime Show.

Key scientific words and concepts

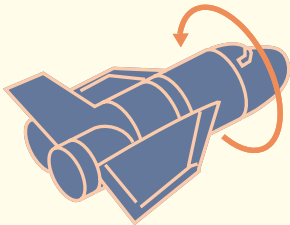
Fluid, gas, atom, liquid, particles, molecule, viscosity, observations, evidence, shear force, polymers, monomers, dilatant, cross-linking, Newtonian fluids, non-Newtonian fluids, thixotropic, elasticity, stir thinning, stir thickening

The Shell Questacon Science Circus

The Shell Questacon Science Circus is one of several national Outreach Programs of Questacon–The National Science and Technology Centre. It is staffed by science graduates who are completing a Graduate Diploma in Scientific Communication at the Australian National University. The Science Circus takes the fascination and enjoyment of science throughout Australia by exhibiting in public venues and presenting shows in schools and other community places. Our other Outreach Education Programs include the Questacon Science Squad, Questacon Maths Centre, Starlab and NRMA RoadZone. Information about our Outreach Programs can be obtained by phoning (02) 6270 2820 or by visiting our Internet site <http://questacon.edu.edu.au>

STRAND	Energy and Change	Natural and Processed Materials	Working Scientifically
Science Outcomes linked to The Slime Show	1.5 2.5 2.6 3.5 4.5 6.6.	1.10 1.11 1.12 2.10 2.11 3.10 3.11 4.10 4.11 4.12 5.10 5.11 6.11 8.	1.16 1.17 2.13 2.14 2.17 4.17 6.13

*Source: Science – a curriculum profile for Australian schools (1994) Curriculum Corporation



Non-drip paint is a stir thinning liquid

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