

Post-visit
resource
for teachers



The Fire Show



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

Thank you for hosting a team from the Shell Questacon Science Circus. We hope you enjoyed our visit.

Our science shows are designed to educate and entertain. Did they spark your students' curiosity?

If so, you may be keen to extend the show with more activities. Enclosed is information to supplement your own ideas and resources with which to follow-up our visit.

FIRE

This show aims to spark an interest in the scientific principles of fire and how these principles have been applied in inventions, accident prevention and environmental protection. The demonstrations illustrate that fire results from a reaction requiring certain ingredients. Safety with fire is a primary issue throughout the show.

Show summary

The activities in the Fire Show vary considerably depending on the presenter's choice of demonstrations, time available, age of audience and available materials. The context of the demonstrations will also depend on the show emphasis and recent show updates. Demonstrations likely to be included in your show are summarised here.

Safety first

The presenter emphasises that fire is dangerous. Caution and safety procedures are essential when using fire. Safety apparatus is prominently displayed and referred to during the show.

Suffocating a flame

All fires require oxygen and these demonstrations illustrate how depriving a flame of oxygen will extinguish it.

Rising water

A flame burns all the available oxygen under a jar and then goes out. As the air inside the jar cools it contracts, reducing the pressure inside the jar. The higher pressure outside forces water into the jar.

Burning steel

A demonstration of the effect on flammability of increasing the surface area. When steel is in thin filaments (steel wool) with plenty of exposure to oxygen, it combusts more readily than solid steel.

Fireball and silo

Another example of combustibility depending on the availability of oxygen.

When the

cornflour is compacted together only the surface is exposed to oxygen and therefore only the surface burns.

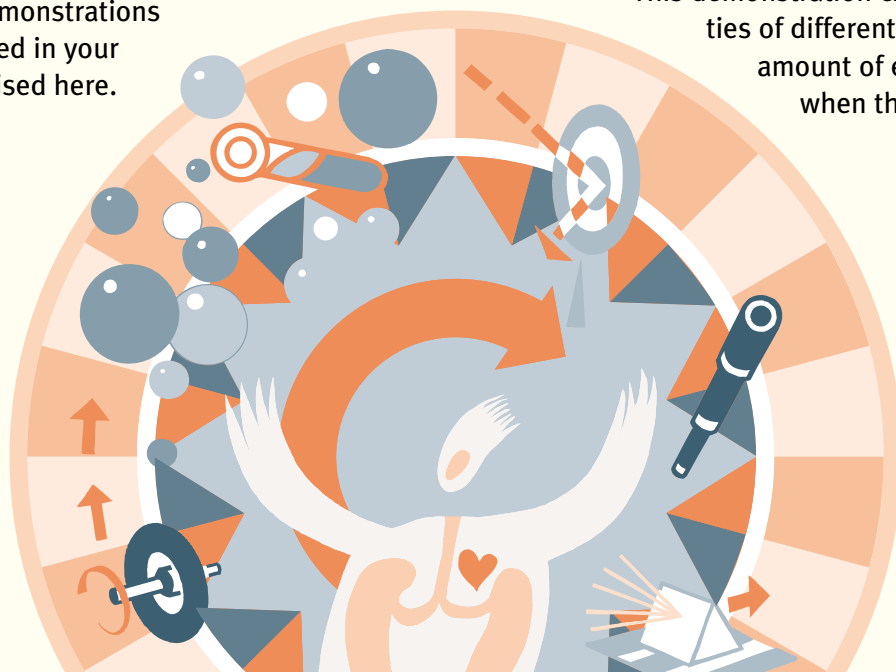
When blown into the air it combusts much more easily.

Methylated spirits versus petroleum oil

This demonstration explores the properties of different fuels and the amount of energy produced when they are burnt.



Cutting the air supply to a fire is one way to put it out. Removing the fuel supply or the heat source are other ways.



Relighting candle

A recently extinguished candle is relit to demonstrate that burning vapour, not wick or solid fuel provides the candle flame. The vapour trail burns back to the wick which is still hot enough to light.

Flaming money

Toy money is soaked in a 50% alcohol: 50% water mixture. When lit, the alcohol ignites but does not produce enough heat to cause combustion in the wet paper and the flame extinguishes.

Chemical energy

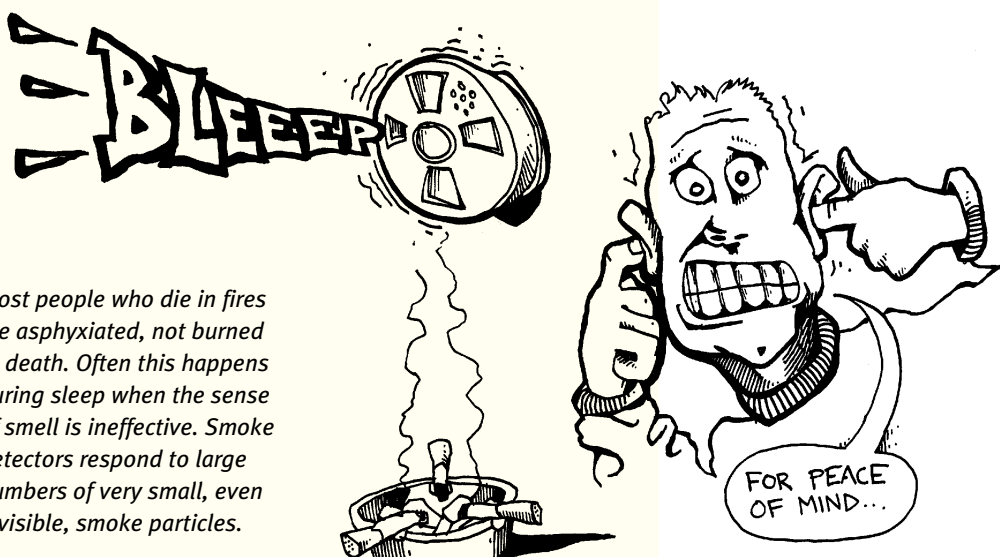
There are a number of possible chemical reactions that may be demonstrated here. All of these are examples of reactions which produce heat (exothermic reactions), where the reaction produces enough heat energy to self-combust or escalate once started.

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 carry out their own health and safety assessments of materials and techniques before using them

Scientific principles demonstrated in the Fire Show

- fire is a combustion reaction. For this reaction to occur, a fuel and oxygen must be present. Heat energy activates combustion and is released by the reaction. Combustion is also an example of an oxidation reaction.
- if any of the ingredients are not present or removed, the fire will go out. Extinguishers are designed using this principle, and work by depriving fire of oxygen.
- a mixture of fuel and oxygen is highly combustible. Optimising this mixture will increase the efficiency of the fire. Blowing cornflour into the air is a good example of this.
- various fuels burn differently and require different activation energies.
- efficient combustion, such as when methylated spirits burns, produces a clean, hot flame and by-products of only carbon dioxide, water and energy. Inefficient or incomplete combustion, as demonstrated when motor oil burns, results in a cooler, yellow flame and the production of soot.
- an exothermic reaction produces heat rather than absorbing it. Highly exothermic reactions can produce enough heat to ignite a fire.



Most people who die in fires are asphyxiated, not burned to death. Often this happens during sleep when the sense of smell is ineffective. Smoke detectors respond to large numbers of very small, even invisible, smoke particles.

Suggested follow-up activities

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

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

3 Discuss products, industries or natural phenomena from your local area which exemplify any of the specific science in the show. For example, how a fire blanket or extinguisher works; methods used by fire fighters to control fires; different fuels, their uses and the energy they produce. This could be extended to students doing an audit of fire safety equipment and procedures in the school or at home.

4 Fire can be dangerous if used incorrectly. Set a research project for your students to discover the types of hazards associated with a local industry. This information could be used to design a fact sheet or set of safety instructions.

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 the relative heat energies of fuels and their flame colour; how explosions are prevented in grain silos; principles of fuel combustion in cars; incomplete combustion and pollution.

6 Ask students to devise and carry out their own experiments on fuels. Divide your class into groups (research teams) of 3 for experiment planning. You may like to allocate specific roles eg recorder, equipment manager, communi-

cator 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 fire,

heat or chemicals. 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.

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 oxidation and reduction, exothermic reactions.

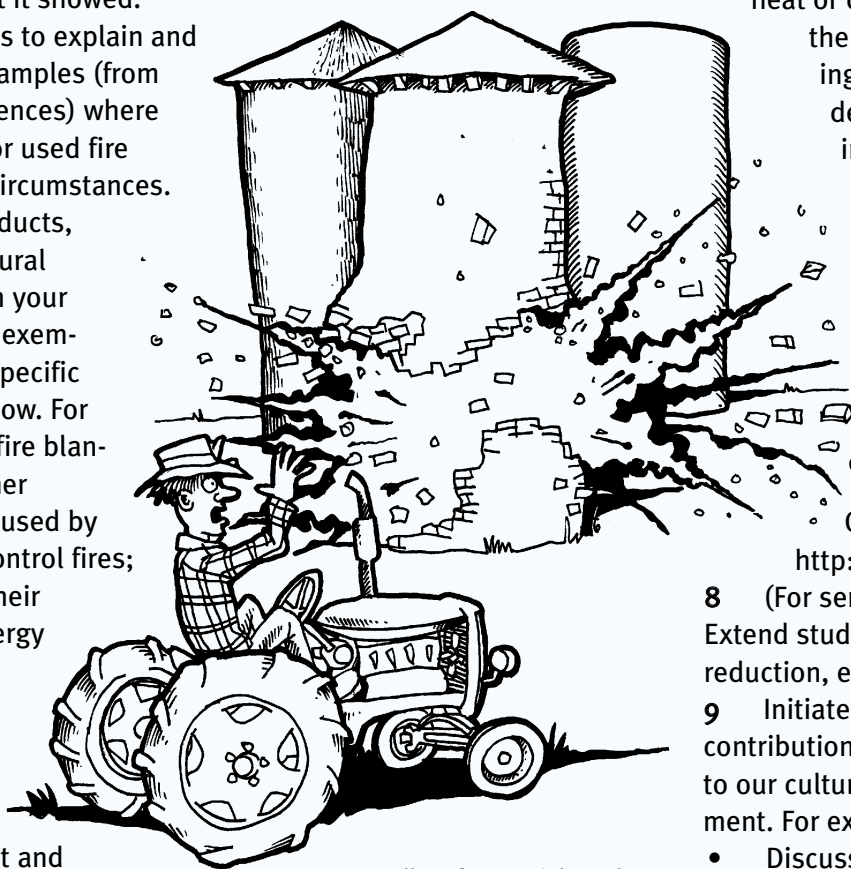
9 Initiate discussion on the general contribution of science and scientists to our culture, economy and environment. For example:

- 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 and studying the weather or the night sky.

- Discuss the skills we need to develop for doing experiments. For example, observing, imagining, recording, discussing, interpreting,



Normally safe materials such as flour can be extremely dangerous if they are suspended in dry air. Silo explosions are a high risk if grain dust, dry air and sparks occur together.

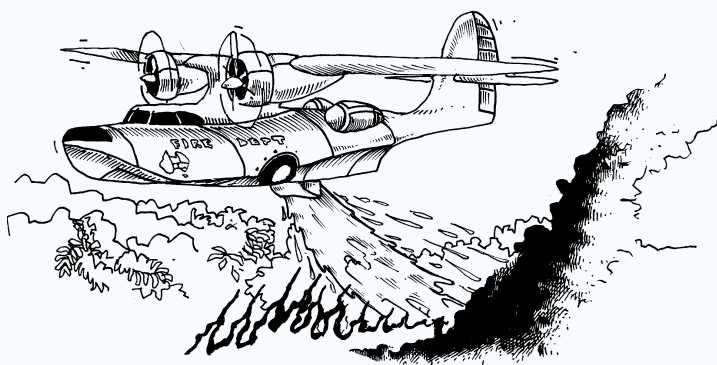
Did you know?

Two NSW banana growers, John and B. Angelo Notarus invented an electronic ignition system. This silicon chip or atom ignition system is used to start small engines such as those in lawn mowers, chainsaws and pumps.

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.

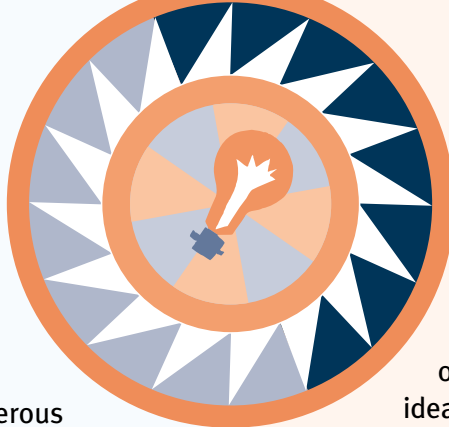
10 Arrange an excursion to Questacon: Australia's leading interactive Science and Technology Centre is Questacon in Canberra. Exhibitions are constantly changing. There are numerous other fascinating exhibits which model scientific concepts, natural phenomena and inventions. Tel. (02) 6270 2893 for group bookings.



Water bombing extinguishes fire by removing heat and cutting off air to the fuel supply.

Try this!

Make a candle see-saw! Sharpen the bottom of a candle so you have a wick at either end. Very carefully push a heated needle through the side of the candle, somewhere near the middle. Balance the candle see-saw between two glasses and light both ends. Use some scrap paper or old tin lids to catch the melting wax. Watch what happens to the rate of the see-saw as the candle gets shorter.



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.

National curriculum links

Presenters vary the show according to the age and level of audience. Accordingly, curriculum links will also differ on each occasion. The following table indicates which outcomes can be achieved with the Fire Show depending on the level and content that is emphasised.

STRAND	Energy and Change	Natural and Processed Materials	Working Scientifically
OUTCOMES* linked to the Fire Show	1.4, 2.4, 1.5, 2.5, 1.6, 2.6	1.10, 2.10, 3.10, 1.11, 1.12	1.13, 1.15, 2.16, 1.17, 3.18

*Cross reference to Science-a curriculum profile for Australian schools (1994) Curriculum Corporation

Key scientific words and concepts

fire, react, heat energy, chemical reaction, oxygen, energy, fuel, combustion, pressure, carbon dioxide, extinguish, vapour, flame colour, exothermic reaction

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>

