

WHAT'S IN A FIRE EXTINGUISHER?

Class discussion focuses on extinguishers, buckets and blankets, and their use in extinguishing fires. Children model how a fire extinguisher works by creating carbon dioxide gas from a solid – liquid mixture, to extinguish a candle flame. This activity can be recorded in a variety of ways and lead to opportunities for children to carry out and present their own research using secondary sources of information

TYPE OF ENQUIRY

Researching using secondary sources.

OBJECTIVES

- To observe the effect of mixing bicarbonate of soda and vinegar on a nearby candle flame

To be able to:

- Explain that some mixtures result in the formation of new materials and that this kind of change is not usually reversible
- To recognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigation

SCIENCE VOCABULARY

Solid	Liquid	Gas
Carbon Dioxide	Air	Oxygen
Mixture	Irreversible	Change
Burn	Extinguish	

RESOURCES

Per group of 4 children:

- 3 teaspoons of bicarbonate of soda (or baking powder)
- Small foil dish
- 50ml vinegar
- Safety lighter (or safety matches)
- Tea-light candle
- Transparent mixing bowl (or similar – with a flat bottom is best for this)
- Sand (for bottom of bowl)
- Children's hazard warning designs from activity 8 (Hazard Warning Design sheet)
- Extinguish the Flame
- Kitchen Chaos cartoon strip (optional)

[ACTIVITY DETAIL] continued

PRIOR KNOWLEDGE/EXPERIENCE

Children should be able to identify materials, according to whether they are solids, liquids or gases and also have a simple understanding of changes that are reversible such as dissolving, mixing and changes of state.

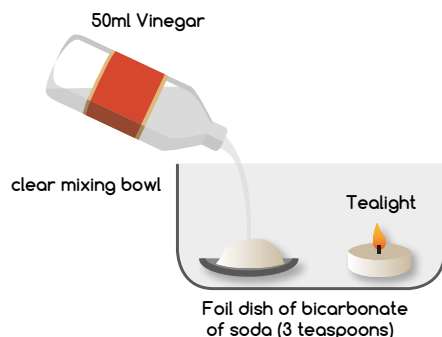
Prior knowledge of the fire triangle is beyond the primary national curriculum in England; however, teachers may wish to address this in response to children's questions and to extend their understanding of why the flame has been extinguished.

ACTIVITY NOTES

At any time during the nine activities in this resource, the Kitchen Chaos cartoon strip can be shared with the class on-screen.

The activity begins by revisiting the official 'flammable' hazard warning symbol as well as children's individual designs from Activity 8 and then discussing the kinds of equipment we might have at home, school, in public buildings and industry to help us to extinguish fires. Refer to Questions for thinking to aid and extend open questioning. Children should talk about safe and sensible behaviour as well as how fire buckets, blankets and extinguishers work by smothering a fire and blocking out the air that would otherwise keep it burning.

Explain to children that they are going to model how a carbon dioxide fire extinguisher works in order to further their understanding of the interesting mixture found inside. In small groups, they should discuss Job Roles and responsibilities before observing the teacher model how to set up the equipment, as shown in the accompanying diagram. Each Resource Manager should gather the equipment required for their group to arrange in the same way.



Note: The candle should be as far away from the foil dish as possible and a thin layer of sand added to the bottom of the bowl as an extra safety precaution before lighting the candle with a safety lighter. All children must recognise that working sensibly and safely is paramount for this activity. (Please refer to Safety Guidance).

As children pour the vinegar (liquid ingredient) onto the bicarbonate of soda (solid ingredient), they should observe the mixture fizzing as a gas, called carbon dioxide, is produced. The changes observed with the fizzing and foaming are irreversible due to a new material being formed. It would now be impossible or extremely difficult to recover the original materials.

It is not long before the candle flame is extinguished and those children who are observing closely may notice that this happens from the bottom of the flame upwards. Ask children for suggestions as to why the flame has been extinguished in this way (see Questions for thinking). Discuss how the candle needs air to keep burning but the carbon dioxide gas fills the tub from the bottom upwards and therefore pushes the air away from the flame and prevents the candle from burning any longer.

[ACTIVITY DETAIL] continued

ACTIVITY NOTES...continued

Explain how red fire extinguishers, found in school, work in the same way as their model fire extinguisher, by using carbon dioxide to displace the air that the fire needs to burn.

For a video demonstration of an alternative version of this activity, please refer to the **Learn Chemistry website**.

Children will need to recognise which secondary sources will be most useful in order to carry out their own research into different types of fire extinguisher and how they work, such as by excluding air with foam or carbon dioxide gas or by removing heat with water. They could utilise their research, perhaps in the form of a fire safety information poster to be placed around school or in a more formal way using Extinguish the Flame.

EXTENSION OR HOME-BASED ACTIVITIES

Children can learn about the 'fire triangle' which shows the three things needed for a fire to start and keep going: oxygen present in air, heat and fuel. They can explore how if one of the sides of the fire triangle is removed, a fire will not start, and how a fire that is already burning will go out. Children should understand that fire-fighting relies on this principle and also that different types of fires need to be tackled in different ways. Learning about fires and fire safety also has excellent links to outdoor learning and Forest Schools materials.

QUESTIONS FOR THINKING

- Does anyone have a fire extinguisher at home? If so, where is it kept and why?
- Does anyone have anything else at home for putting out fires? If so, what are they?
- What do we have at school to put out fires? Where can we find these?
- How do you know that a gas is being produced when bicarbonate of soda and vinegar are mixed together?
- Why do you think the candle flame is extinguished from the bottom upwards?
- What other reactions can you think of that produce a gas?
- Why is this kind of change not usually reversible?

SAFETY GUIDANCE

Please use the following health and safety information to produce your own risk assessment for this activity:

Prior to this activity, check for individuals who may be allergic to bicarbonate of soda and/or vinegar. Tealights should be placed securely in a container with a layer of sand and then lit using a safety lighter. All children should be warned about the hazards associated with heating and burning and carry out this activity under close adult supervision.

INDUSTRY LINKS AND AMBASSADORS

Children may be fascinated to learn that not all fires are the same and that they are identified using a classification system depending on the types of fuel involved. Different types of fire require different types of fire extinguisher. Carbon dioxide fire extinguishers, similar to the model made by children in this activity, extinguish flames by removing oxygen and are best used on Class B fires caused by flammable liquids or gases, and Class C fires involving electrical equipment. Class A fires, caused by burning wood, paper, cloth or plastics are best extinguished using water and foam extinguishers which remove the heat quickly from a fire.

All types of companies, whatever their size, must appoint a responsible person to minimise the risk of fire in and around the site. Fire extinguishers must be accessed at different points and it is the safety manager's responsibility to ensure that these are appropriate for different types of fire. Children could investigate who has been appointed as fire safety manager at their school. They could make a note of the different types of fire extinguishers and their location around the school building as well as help to review current fire drill procedures.

Teachers could also contact their local fire brigade for further information regarding fire safety and risk management.

CROSS CURRICULAR LINKS

English: opportunities to use spoken language to develop understanding through speculating, hypothesising, imagining and exploring ideas. Also links to reading and writing whereby pupils note and develop initial ideas and then draw upon reading and research where necessary.

Learning about fires and fire safety also has excellent links to outdoor learning and Forest Schools materials.