



Get set... demonstrate

Running inspiring science demos

Chip pan fire

A demonstration to show the dangers of adding water to a fat fire. A nickel crucible is used to model a scaled-down chip pan.

About these notes

These notes have been designed to accompany the film "Chip Pan Fire demonstration - Get set...demonstrate for Demo Day 2014", as part of the Get Set Demonstrate series of video guides. They are not a standalone guide to performing this demonstration. We want to encourage as many teachers as possible to try a new demonstration for National Science and Engineering Week. See www.getsetdemo.com for more information.

Equipment

Safety glasses

Cooking oil

Nickel crucible

Pipe clay triangle

Tripod

9 heatproof mats

Bunsen burner

Square of aluminium or hardboard (approx 50mm square)

Wooden test-tube holder attached to a metre rule; holding a test tube containing 5ml water

Equipment notes

Only use a nickel crucible as a porcelain one could break under these conditions. The crucible should be 25mm in diameter and have tall straight sides to prevent hot oil from being ejected sideways. Do not use a squat crucible.

A Bunsen burner with a slightly longer hose on it (at least 1.5 m) will give you more room to position safety screens and give clearance around the demonstration area. It will also reduce the risk of splattering the gas tap with cooking oil.

We've suggested using 9 heatproof mats to provide surface protection for the immediate area around the demonstration.

Procedure

The demonstration involves heating a small quantity of cooking oil in a nickel crucible over a Bunsen burner and then adding water to the oil. A fireball is produced.

1. Place about 5 ml of water in the test-tube ready for use during the demonstration. Set this to one side.
2. Ensure that the crucible is firmly seated in the clay triangle. Pour 3 ml of cooking oil into the crucible and place a lighted Bunsen burner beneath it.
3. Once the oil catches fire, switch off the gas supply to the Bunsen burner and extinguish the flame by placing a small square of hardboard or aluminium over

the crucible. This simulates placing a tray, fire-blanket or damp tea-towel over a burning chip pan to remove the oxygen from the fire. A fire blanket or damp tea-towel could be used in this demonstration, but care should be taken so as not to knock over the crucible in the process. **Please note:** The advice from the national *Fire Kills* campaign is that real chip pan fires should not be tackled: GET OUT STAY OUT AND CALL 999.

4. Remove the square and light the Bunsen burner again until the cooking oil re-ignites.
5. Switch off the gas supply to the Bunsen burner and holding the pole with the test-tube containing water attached at arm's length, add the water to the burning oil. This will cause a ball of fire to rise into the air (approx 1 m). It demonstrates the hazard of attempting to put out a chip-pan fire with water.
6. If the crucible remains alight after the water has been added and the fireball has receded, then extinguish the flame by placing the small square of hardboard or aluminium over the crucible

Safety notes

- Wear eye protection, heat resistant gloves and a lab coat for this demonstration.
- Place a safety screen between the demonstration and pupils. Pupils must be at least 4m away from the demonstration and they should be wearing eye protection.
- Do not exceed the maximum amount of oil, otherwise dangerous volumes of burning oil may be ejected when the water is added.
- Do not perform this demonstration in a fume cupboard.
- Seat the crucible firmly in the clay triangle beforehand. You don't want it to tip over when the flame is extinguished. TIP: Bend the ends of the wires over the edge of the tripod to secure it in place.
- Check for oil spills and splatter marks on the floor after completing the demonstration as these may induce a slip hazard. Wipe up any spills using a damp cloth and some washing-up liquid.
- The apparatus may stay hot for a few minutes. Ensure that it has cooled down fully before attempting to move it.
- Ensure you have between 1.5 and 2 m clear headroom directly above the demo. Keep away from over-hanging flammable materials, light fittings, projectors and heat detectors.

These are guidelines and do not constitute a formal risk assessment. Be sure to practise and carry out your own risk assessment before attempting this demonstration in front of a class. CLEAPSS Guide, L195: 'Safer Chemicals, Safer Reactions', section 9.5 provides further information about this demonstration.

Teaching tips

This is a demonstration that is both impressive and important for pupils to see. It carries a crucial safety message in addition to demonstrating the physical processes at play when water is added to hot burning oil. Although these notes refer to a chip pan fire, the science can be applied to any fat-pan fire (e.g. wok, frying pan, sauté pan, grill pan etc.).

It must be practised beforehand so that you can build up confidence in both setting up and performing this demonstration. It's a good one to bring along to a departmental meeting to share with your colleagues!

You can link it to combustion, fuels, fire safety in the home and rates of reaction. In the case of the latter, the fireball is an example of how increasing the exposed surface area of a fuel in air increases its burn rate.

It is important to emphasise that the cooking oil is very hot. It has a flash point of around 320 °C. Therefore, if the oil is burning and water is added, the water will instantly vaporise and expand (as it is well above its boiling point). This rapid expansion forces droplets of hot oil to be ejected from the crucible. The droplets have an increased surface area as they mix with the surrounding air and so they combust readily and result in a fireball.

The demonstration creates a controlled flame ball up to 1 metre in height from only 3 ml of oil. Ask your pupils to estimate how much cooking oil is in a typical frying pan or a chip pan and to imagine the destruction that the resulting fireball could cause.

Finally, it is easy to be distracted by the drama of the fire ball and overlook fire safety. There has been much debate by the Chief Fire Officers Association (CFOA) National Fire Prevention Committee about tackling fires in the home. Their advice is "**Get out, stay out and call 999**". They do not recommend you try and tackle a chip pan fire by yourself.

Useful reading

CLEAPSS Guide, TL1: 'Chip pan fire'

CLEAPSS Guide, L195: 'Safer Chemicals, Safer Reactions', section 9.5



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