

Top 10 Flash Bang Demos

This teachers' resource has been produced by the Institution of Chemical Engineers to encourage the inclusion of fun, safe and relevant demonstrations to the Key Stage 4 curriculum



Top 10 Flash Bang Demos

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The 'science bit' and 'demonstration tips' were written in collaboration with Tim Gayler, an experienced science teacher currently working at the North Oxfordshire Academy, Banbury.

IChemE wishes to thank the staff and pupils of Rugby High School who supported this project and gave us permission to film the demonstrations in their school.

The demonstrations have come from a variety of sources so no individual source is acknowledged. Training on how to perform many of the demonstrations correctly came from attending courses run for science technicians by the Science Learning Centres and CLEAPSS. All demos and instructions are in accordance with CLEAPSS guidelines and safety information.

The demonstrations have been compiled and tested by Julie Pollard, *whynotchemeng* Campaign Manager. Julie was formally a senior science technician at Drayton School and North Oxfordshire Academy.



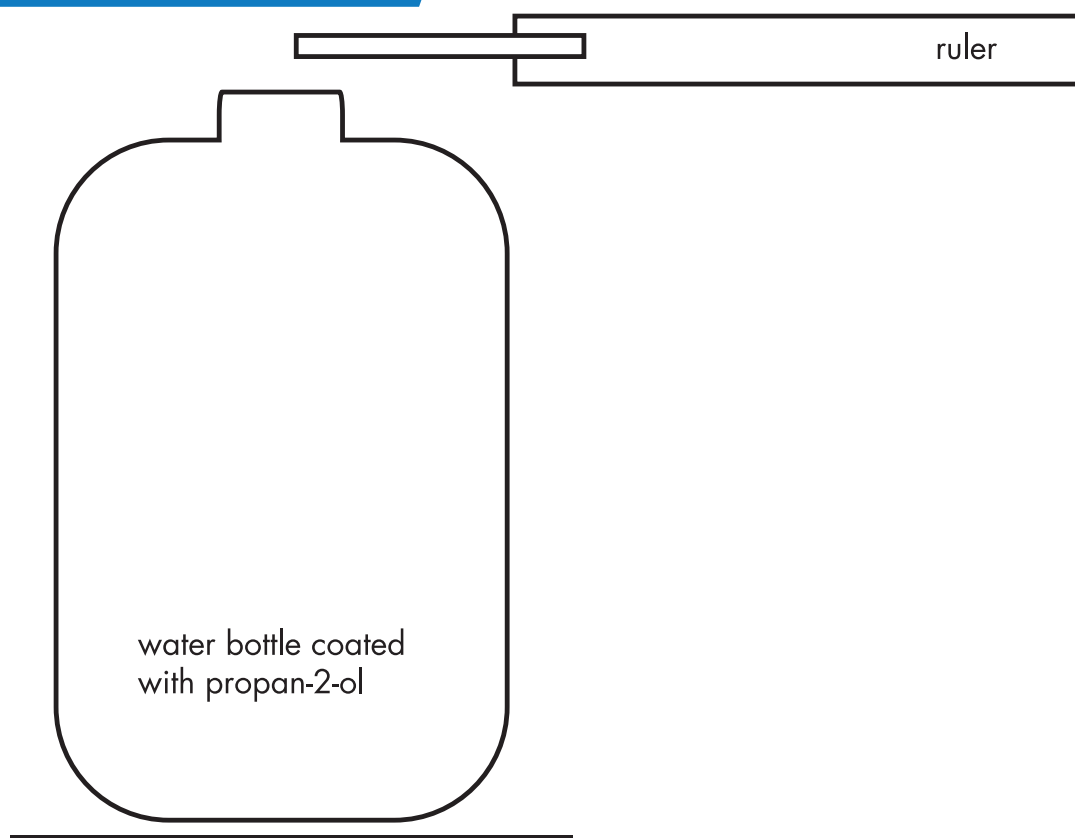
Top 10 Flash Bang Demos

Number 1 Whoosh bottle

See the **flames dance** and **listen** for the **whoosh** in this **bright** and impressive demonstration

Equipment

- 25 litre polycarbonate water bottle from a drinks dispenser
- 2 x 500ml beakers
- Long ruler
- Taper or spill
- 40ml propan-2-ol



Safety precautions



Demonstrator should wear safety goggles.
Ensure students are at least 3 metres away.
Propan-2-ol is highly flammable and an irritant (see hazzcard 84).
A 25L polycarbonate bottle must be used.
See CLEAPSS supplementary risk assessment SRA06
Always carry out your own risk assessment for this demonstration.



TOP 10 Flash Bang Demos

Number 1 Whoosh bottle

Method

- Ensure the water bottle is completely dry before starting this demonstration
- Attach a taper or spill to the end of the ruler
- Pour 40ml of propan-2-ol into the water bottle swilling it around to completely coat the inside
- Empty any remaining propan-2-ol into a beaker and remove to a safe distance
- Place the bottle on a bench, or on the floor
- Light the end of the spill
- Place the lit spill inside the rim of the bottle
- There will be a loud whoosh and visible blue and yellow flames
- Let the bottle cool slightly
- Tip up the bottle and pour out the contents into a beaker

The science bit

The propan-2-ol forms a vapour when swirled in the container. When ignited with the spill an exothermic reaction takes place, and the 'whoosh' sound is produced by the rapidly expanding gases leaving the bottle.

Once the bottle has cooled, a liquid will form in the bottom which can be poured into a beaker. This is a suspension of carbon particles in water which is the product of combustion.

Demonstration tips and interesting facts

Each bottle can only be used once per session - once the demonstration has been completed the bottle will need to be dried thoroughly before it can be used again. Store upside down if possible.

Pupils can touch the side of the bottle to feel how warm it is.

Other things to try

Methanol and ethanol can be used as an alternative to propan-2-ol. The reaction time is quicker, but the flames are less visible.

Debate the importance of cleaner fuels and discuss the role scientists and chemical engineers play in developing them.

Instructions are in accordance with CLEAPSS guidelines and safety information.

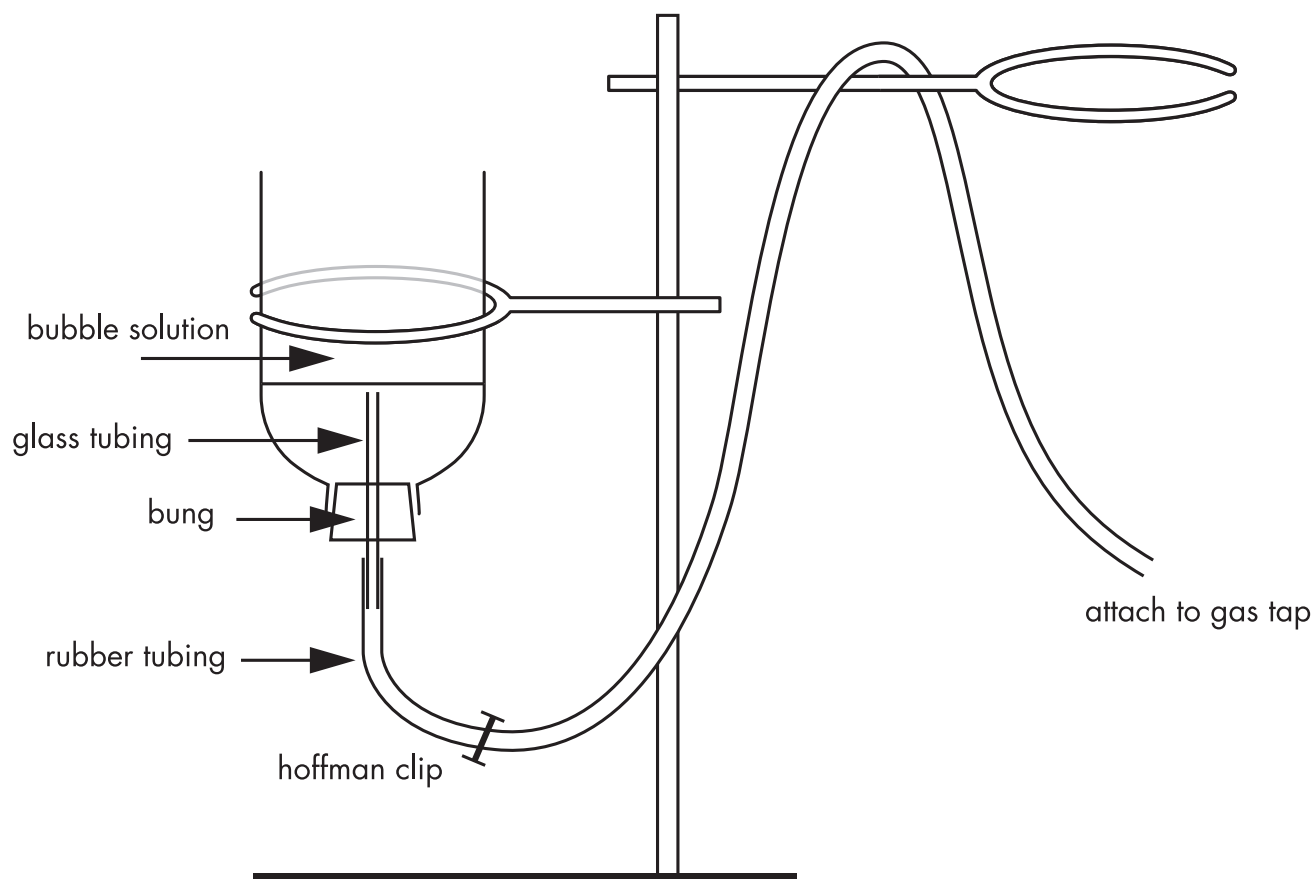
Top 10 Flash Bang Demos

Number 2 Flaming hands

Set light to bubbles of methane on your hands to **delight** and **amaze** your students

Equipment

- 500ml drinks container with the bottom removed, inverted and fitted with a bung and delivery tube
- 16ml washing up liquid for bubble solution (cheaper brands work best), plus a bit extra for coating hands
- 8ml glycerol
- 150ml water
- Ruler with spill attached
- Clamp stand



Safety precautions

Do not perform this demonstration on pupils.
Methane is extremely flammable.
Demonstrator should have hair tied back and wear safety goggles.
Hands must be properly covered with washing up liquid.
Ensure ceiling height is 3 metres or more from demonstration.
See CLEAPSS supplementary risk assessment SRA03
Always carry out your own risk assessment for this demonstration.



Top 10 Flash Bang Demos

Number 2 Flaming hands

Method

- Mix together the washing up liquid, glycerol and distilled water to make the bubble solution (this demonstration works best if solution is prepared at least one week beforehand)
- Assemble apparatus as shown in diagram, ensuring glass tube is just below bubble solution
- To prevent solution from sucking back into the gas tap, ensure a portion of the rubber tubing is higher than the bubble solution by hanging over a clamp
- Turn gas on, adjusting the flow with the Hoffman clip to ensure a steady rise of bubbles
- The bubbles will start to form a column above the apparatus, discard first 10cm of bubbles as these will contain air
- Cover your hands with washing up liquid
- Scoop up a handful of bubbles and hold at arms length
- Ask an assistant to light a spill attached to a metre rule and ignite the bubbles

The science bit

Methane becomes trapped in the bubbles and the slight heat from the spill ignites the gas and causes the bubbles to burst. The heat from each bubble causes a chain reaction, causing more bubbles to burst, but as the amount of methane being ignited is relatively small, the heat produced is easily bearable.

Demonstration tips and interesting facts

Methane is a gas produced by cows in large quantities.

Methane is 100 x more dangerous to the environment in terms of climate change than carbon dioxide.

Discuss with your students whether the column of bubbles resemble Marge Simpsons hair!

Other things to try

Slice off a section of the bubbles using a ruler, causing them to float towards the ceiling. Using a spill on the end of a wooden ruler ignite the bubbles as they float upwards. Only do this if the ceiling is over 3m in height and does not contain any combustible materials. Make sure you ignite the bubbles in plenty of time before they reach the ceiling.

Instructions are in accordance with CLEAPSS guidelines and safety information.

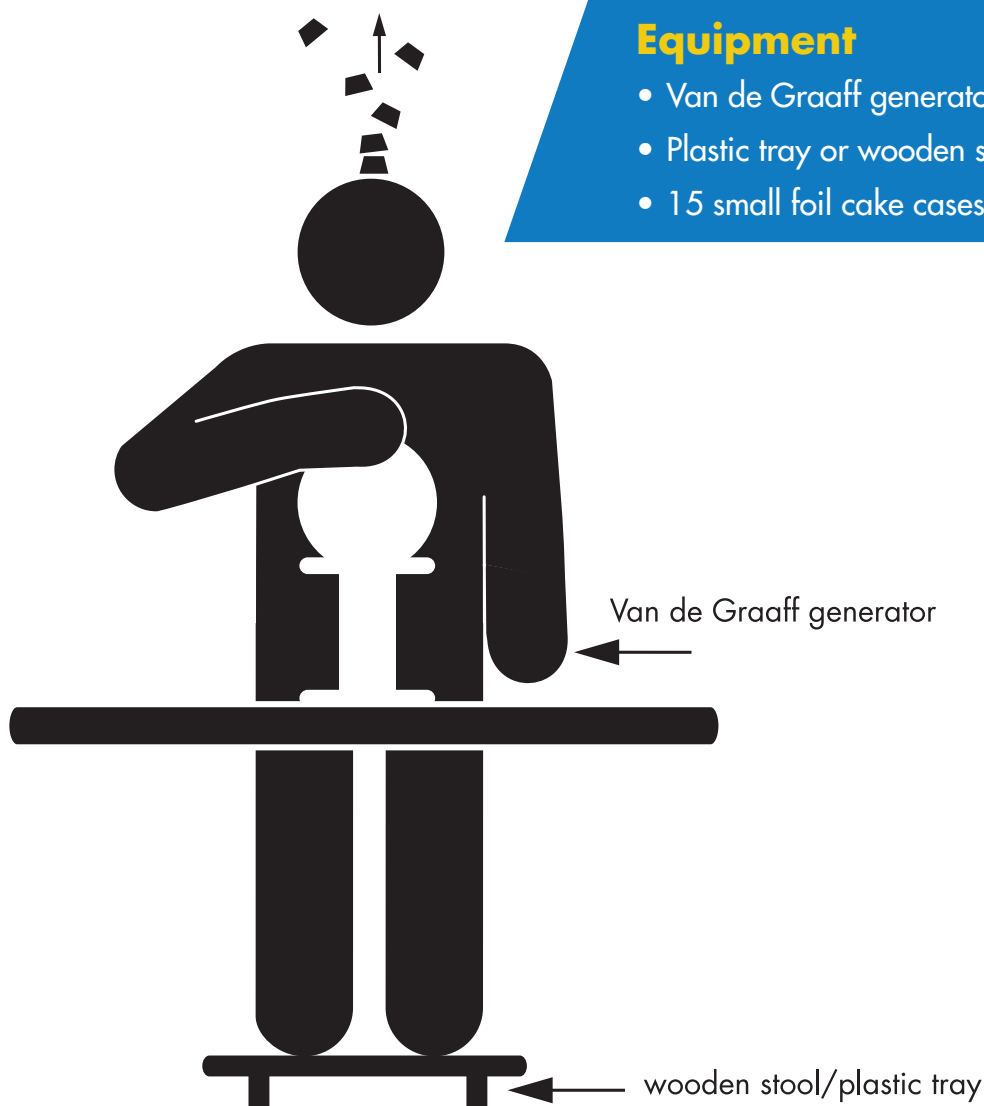
Top 10 Flash Bang Demos

Number 3 Flying cake cases

The **Van de Graaff** can be used for a variety of **demonstrations**, here's one you might not have seen!

Equipment

- Van de Graaff generator
- Plastic tray or wooden stool to stand on
- 15 small foil cake cases



Safety precautions

Do not allow students to operate the Van de Graaff. Always ensure the person touching the Van de Graaff is insulated by standing on something wooden or plastic.

The following pupils/adults should not stand close to the Van de Graaff:

- anyone with electrical implants e.g. hearing aids;
- people with coronary heart disease (e.g. angina, history of heart attacks); and
- those suffering from epilepsy.

To protect equipment keep the Van de Graaff away from USB sticks, computers, mobile phones and handheld devices.

Always carry out your own risk assessment for this demonstration.





Top 10 Flash Bang Demos

Number 3 Flying cake cases

Method

- Stand on the tray
- Ensure the Van de Graaff is discharged by touching the dome with the conductor sphere
- Turn cake cases upside down and place on your head (works best on those with little or no hair!)
- Touch the Van de Graaff with one hand and ask an assistant to turn the generator on
- The cake cases should start flying off your head!
- Turn off the generator

The science bit

The electrostatic charge created by the Van de Graaff goes through your body and charges the foil cake cases. The cases repel each other and fly off due to their minimal weight. When they settle on the ground they release any remaining charge to earth.

Demonstration tips and interesting facts

A Van de Graaff generator works best on a dry day.

In humid conditions you may need to dry the belt using a hair dryer.

If you do not have someone available for the demonstration, or simply can not get it to work, place the cake cases directly on top of the dome.

Instructions are in accordance with CLEAPSS guidelines and safety information.

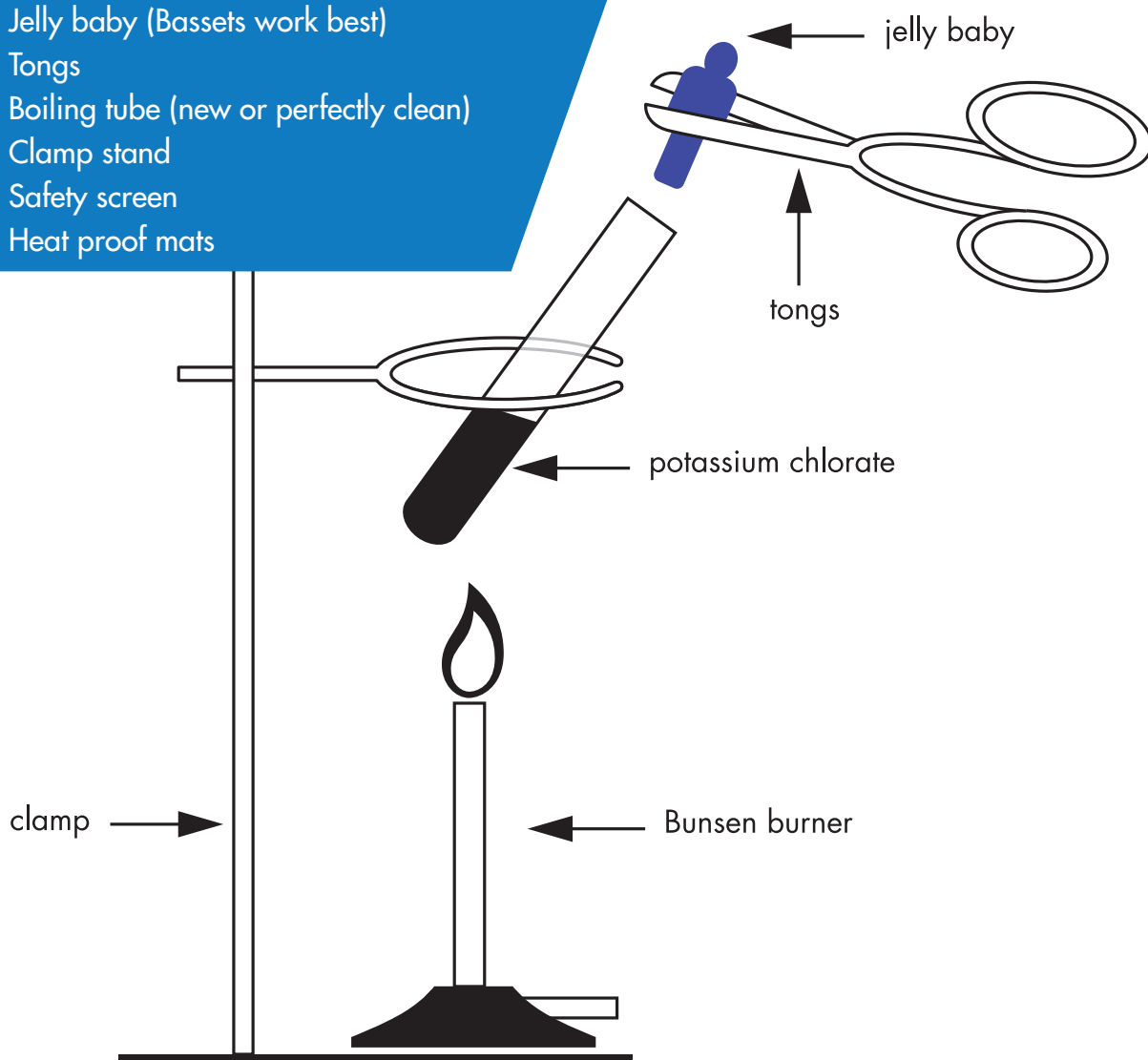
Top 10 Flash Bang Demos

Number 4 Screaming jelly babies

Horrify your students by **sacrificing** a jelly baby in the name of **science**

Equipment

- 7g Potassium chlorate
- Jelly baby (Bassets work best)
- Tongs
- Boiling tube (new or perfectly clean)
- Clamp stand
- Safety screen
- Heat proof mats



Safety precautions

A face shield and gloves should be worn by demonstrator. Students should be a minimum of 2 metres away and behind a safety screen. Potassium chlorate is oxidising, explosive and harmful (see hazcard 77).

Never substitute sugar for the jelly baby as this will cause a violent reaction and an explosion may result.

See CLEAPSS supplementary risk assessment SRA01

Always carry out your own risk assessment for this demonstration.



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Top 10 Flash Bang Demos

Number 4 Screaming jelly babies

Method

- Assemble apparatus as shown in the diagram
- Place one safety screen in front of the apparatus and the other to the side (to make a 90 degree angle)
- Check that the jelly baby will fit easily into the boiling tube, you may need to squash it, and place to one side
- Using a spatula, insert potassium chlorate in the boiling tube
- Secure boiling tube in the clamp and ensure it's at a 45 degree angle pointing towards a safety screen
- Heat the boiling tube using a Bunsen burner until the potassium chlorate is completely molten
- Use the tongs to place jelly baby in boiling tube
- Stand back! The reaction will result in lots of noise, lilac flames and smoke
- Dispose of boiling tube safely after leaving to cool

The science bit

The potassium chlorate rapidly oxidises the sugar in the jelly baby which produces carbon and other materials plus a large amount of heat. This ignites the jelly baby producing a smell reminiscent of candy floss. The production of gases in this demonstration produces a lot of noise - and if you're lucky - **a high pitched scream.**

Demonstration tips and interesting facts

Ask your pupils to vote for one of four different jelly babies to be sacrificed for this demonstration.

Instructions are in accordance with CLEAPSS guidelines and safety information.

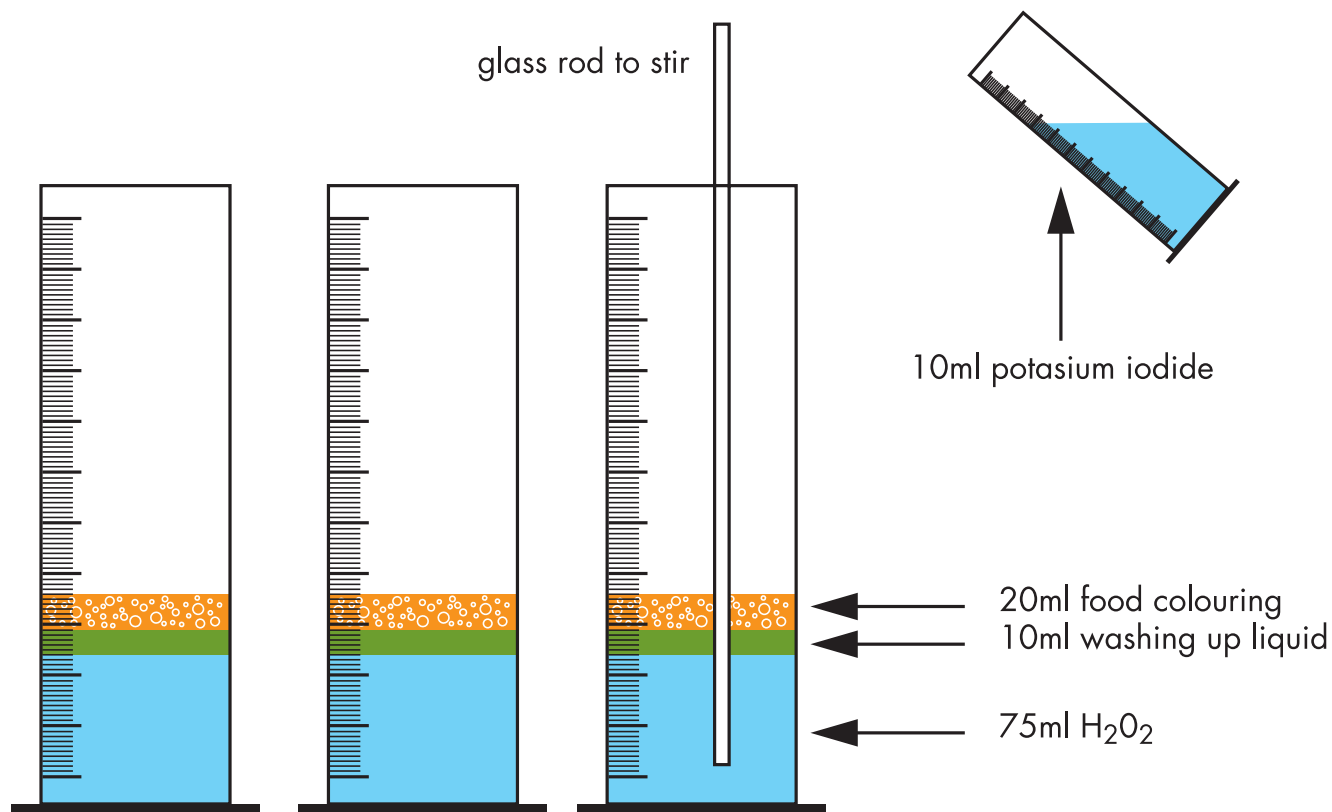
Top 10 Flash Bang Demos

Number 5 Frothy foam

An adaptation of the **classic** 'elephant's toothpaste' this demonstration produces **masses of coloured foam**

Equipment

- 3 x 500ml measuring cylinders
- 3 x 75ml hydrogen peroxide 100vol*
- 3 x 10ml potassium iodide solution
- 3 x 10ml washing up liquid
- 3 x 20ml red, blue and green food colouring
- Large bin bags



Safety precautions

Hydrogen peroxide is corrosive (see hazard 50).
Iodine can stain so wearing gloves is advisable.

See CLEAPSS supplementary risk assessment SRA11
Demonstrator should wear safety goggles.

Always carry out your own risk assessment for this demonstration.



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Top 10 Flash Bang Demos

Number 5 Frothy foam

Method

- Cover the bench and nearby floor with bin bags...it's going to be messy!
- Place the three cylinders side by side
- Put 75ml of hydrogen peroxide; 10ml washing up liquid and 20ml food colouring in each cylinder
- Stir
- Quickly add the potassium iodide to each cylinder
- Stand back!
- Masses of foam will be produced
- Test the foam for oxygen using a glowing spill.
Placing the spill inside an oxygen bubble will give the best effect

The science bit

The potassium iodide catalyses the decomposition of the hydrogen peroxide to water and oxygen. This is an exothermic reaction and the water is produced as steam. The oxygen is trapped in the bubbles by the washing up liquid.

Demonstration tips and interesting facts

Setting off multiple tubes at once in different colours is very visually effective. You can choose your colour to be the school/house colours or those of a country's flag.

The foam can look a little like toothpaste coming out of a tube which is why this reaction is also known as elephant's toothpaste. Interestingly, some treatments for teeth whitening contain a small amount of hydrogen peroxide.

Set tubes to go at the same time to 'race' them.

N.B. Hydrogen peroxide does deteriorate very quickly. It should be kept in the fridge and used within one year.

Instructions are in accordance with CLEAPSS guidelines and safety information.

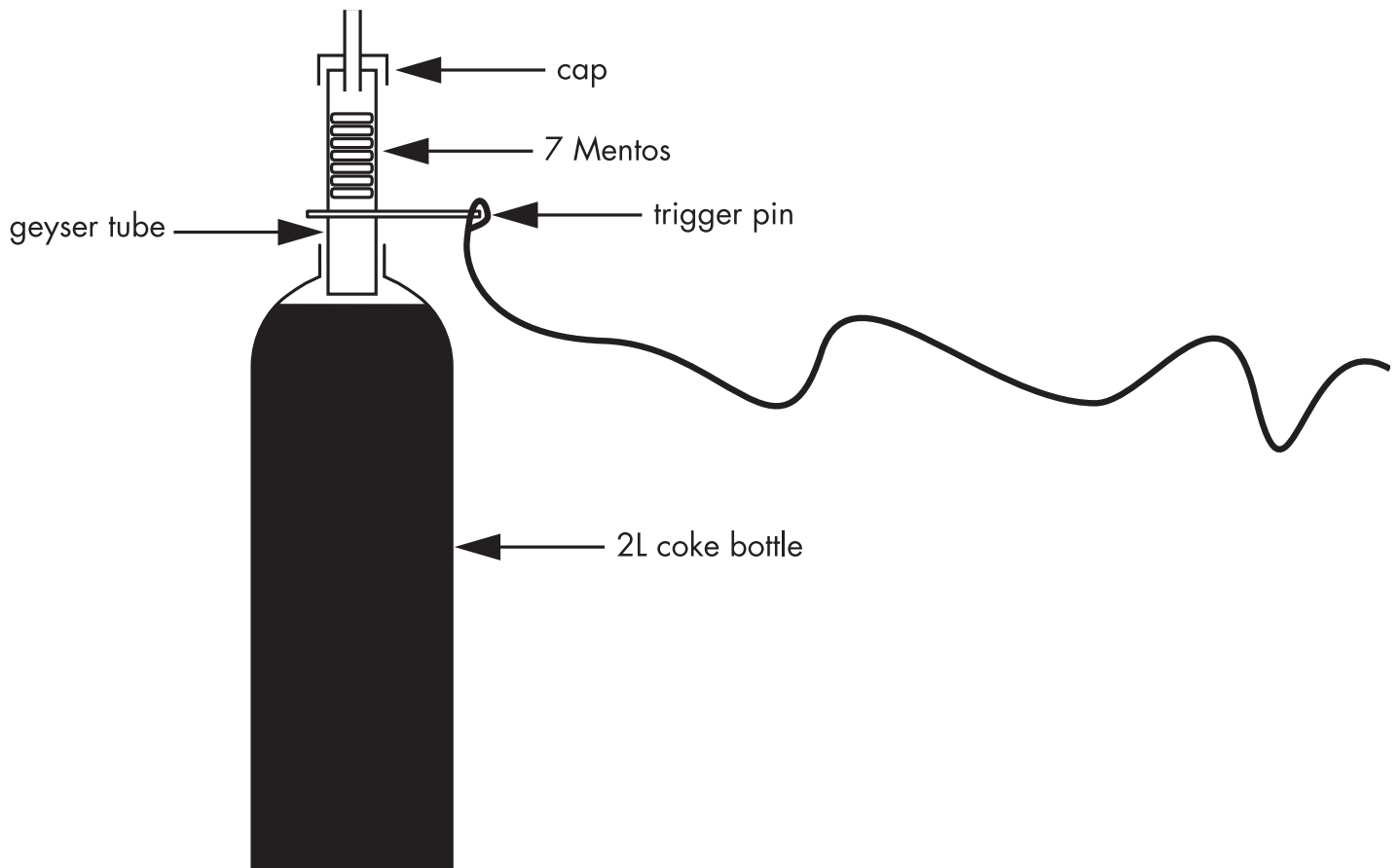
Top 10 Flash Bang Demos

Number 6 Coke fountain

Watch the coke **blast out** of its bottle in this **fun** but **messy** demonstration

Equipment

- Geyser tube (available from internet sites such as firebox)
- 2L bottle diet coke
- Tube of Mentos mints



Safety precautions

Outside demonstration only!

Always carry out your own risk assessment for this demonstration.

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TOP 10 Flash Bang Demos

Number 6 Coke fountain

Method

- Put the trigger pin into the geyser tube to block the hole
- Fill the geyser with seven Mentos
- Go outside!
- Remove the coke bottle lid and attach the geyser mechanism to the top of the bottle
- Pull trigger pin
- Coke will explode out of the bottle

The science bit

Each Mentos has thousands of tiny pits over the surface, called nucleation sites, which are perfect places for bubbles to form. As soon as the Mentos hit the coke they sink to the bottom of the bottle and bubbles of carbon dioxide form all over their surface. These bubbles then rise to the surface of the bottle pushing all the liquid up and out of the bottle in one blast!

Demonstration tips and interesting facts

Compare this to a real geyser - steam and water being ejected from underground, which can go a lot higher than the coke and Mentos experiment.

Make a big deal of releasing the Mentos into the coke, countdown from 10 and lift off; use the Thunderbirds music; or confirm to pupils that you are licensed to do this safely and your life insurance covers it!

Carry an umbrella - the front row of pupils could be given black plastic bags if you are feeling generous.

Other things to try

You could see if different types of coke affect the height of the coke fountain.

Does the temperature of the coke have an effect?

Does the size of the bottle have an effect?

Instructions are in accordance with CLEAPSS guidelines and safety information.

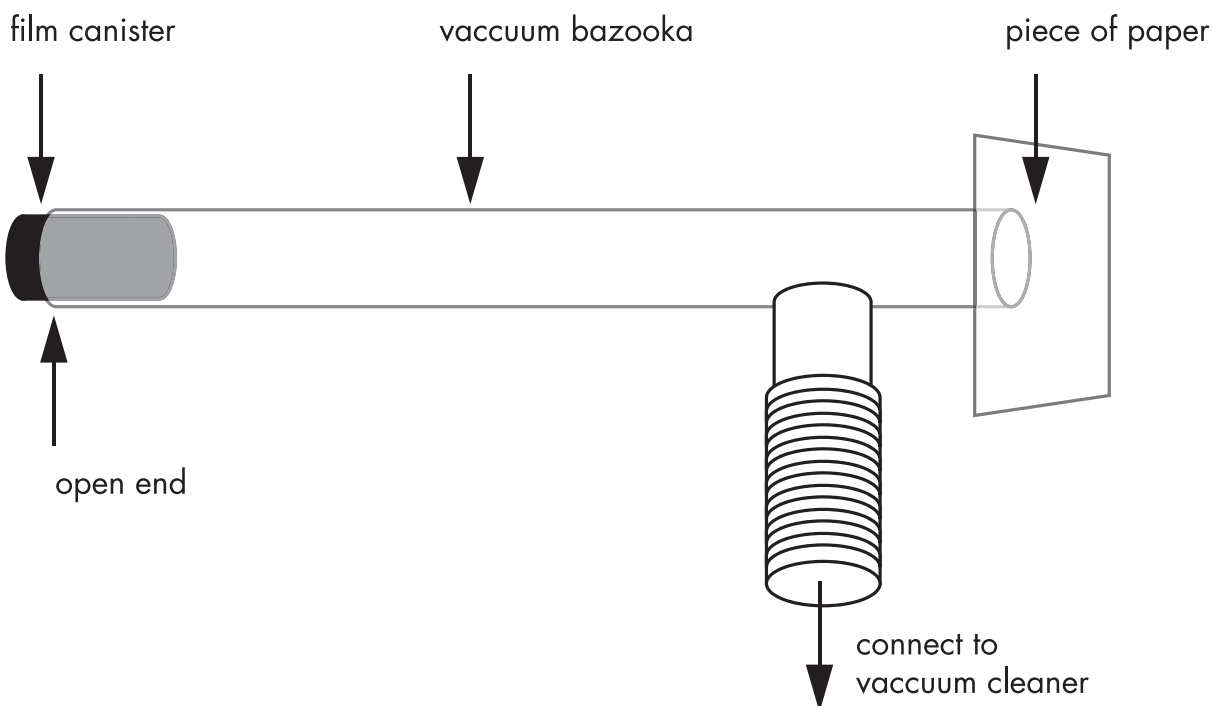
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Number 7 Vacuum bazooka

Launch film canisters **10 metres or more** using this powerful device

Equipment

- 1 Vacuum Bazooka (available from suppliers including Scientific and Chemical Ltd)
- 1 vacuum cleaner with a flexible pipe
- Film canisters and other projectiles!
- Small pieces of paper



Safety precautions

Ensure students and fragile objects that could be damaged are not in the line of fire.
Supervise operation by students.

Always carry out your own risk assessment for this demonstration.

Top 10 Flash Bang Demos

Number 7 Vacuum bazooka

Method

- Attach the end of flexible vacuum cleaner hose to the vacuum bazooka
- Turn the vacuum cleaner on and point the shortest end in the direction you'll be firing
- Put a piece of paper over this end
- Hold a projectile at the other end. If using an empty film canister make sure the bottom end goes in first
- Take aim, ensuring no students or fragile objects are in the firing line
- Let go of the projectile

The science bit

When the vacuum cleaner is turned on, the paper stays on the end of the tube due to the low pressure created by the removal of air, and causes a strong flow of air to come in from the back. When you let go of the film canister it is carried along by the air flow gaining speed and momentum as it moves down the tube. Once it reaches the front, its momentum will carry it past the connection, dislodging the paper and projecting it forward.

Demonstration tips and interesting facts

The more powerful your vacuum cleaner the further the projectiles will travel, some having reached 25 metres in our own tests.

This resembles a child's pop gun in reverse.

Other things to try

How far can the projectile travel?

How accurate can you be with the bazooka, - can you hit a target?

Does lengthening the tube make it more accurate?

How does the mass of the projectile affect its travel?

How does changing the angle of launching affect the distance travelled?

Who is the most accurate in the class?

Discuss what could happen if the vacuum cleaner was strong enough to take all the air out of the tube.

Instructions are in accordance with CLEAPSS guidelines and safety information.

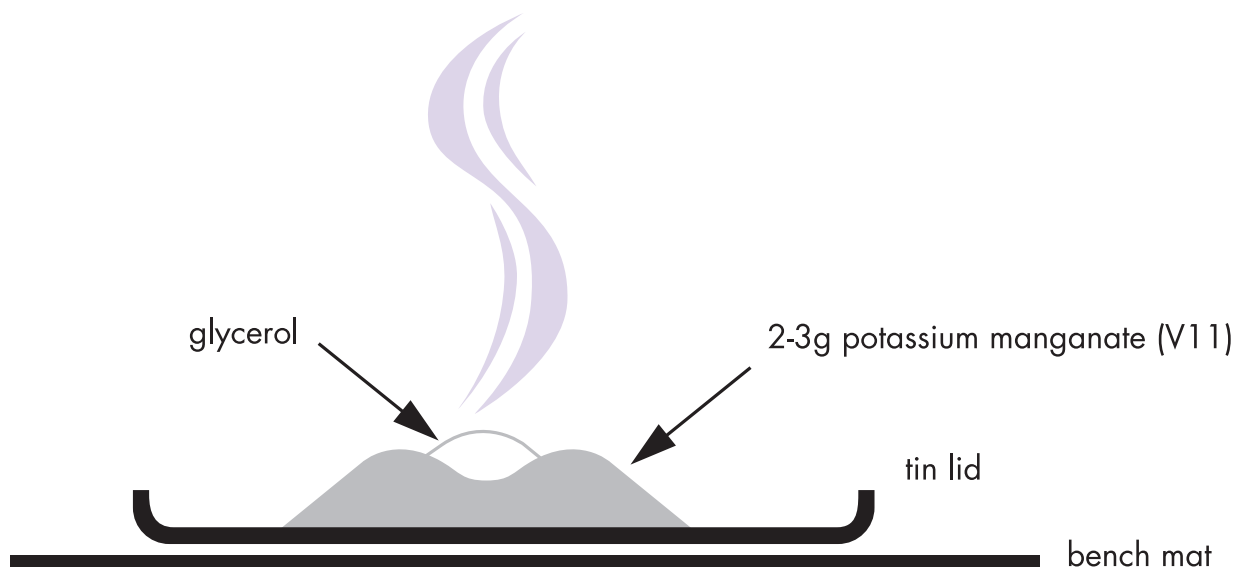
Top 10 Flash Bang Demos

Number 8 Lilac fire

A redox **reaction** with a flame delay that will **surprise** your students

Equipment

- 2-3g potassium manganate (V11)
- 1ml glycerol
- Pestle and mortar
- Tin lid
- Bench mat
- Syringe



Safety precautions

Always carry out on a tin lid and bench mat.
Potassium manganate (V11) is an oxidising agent (see hazard no. 81).
Demonstrator should wear safety goggles.

Always carry out your own risk assessment for this demonstration.



Top 10 Flash Bang Demos

Number 8 Lilac fire

Method

- Grind up the potassium manganate (V11) crystals using a pestle and mortar (this demonstration will not work if the crystals are too large, or if powdered potassium manganate (V11) is used)
- Pour the crushed potassium manganate (V11) into a small pile on a tin lid standing on a heat-proof mat
- Make a well in the middle of the pile and add the glycerol
- After approximately 20 seconds, steam is given off and a lilac flame produced, the colour characteristic of potassium salts

N.B The glycerol should be less than a year old otherwise this demonstration may not work

The science bit

Mixing the glycerol with the potassium manganate (V11) causes an exothermic reaction which oxidises the glycerol to form carbon dioxide and water (hence the steam) and is then itself reduced.

Demonstration tips and interesting facts

For a science 'trick' you could try placing the potassium manganate (V11) in the well formed in the top of a large, used candle. When adding the glycerol, it will look as though you're lighting the candle by pouring water on it!

This demo looks great against a white background or in a darkened room.

Instructions are in accordance with CLEAPSS guidelines and safety information.

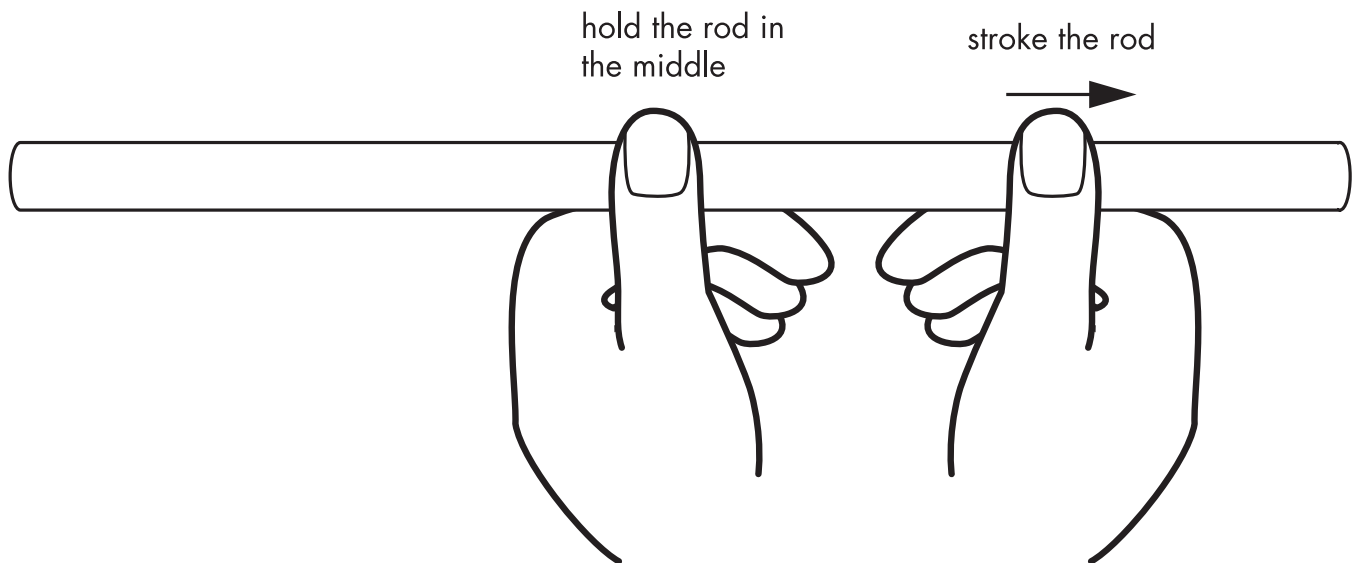
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Number 9 Singing rods

Prepare to cover your ears for the **piercing sound** of the singing rods

Equipment

- 1 metre aluminium rods (available from DIY outlets)
- Ground up rosin (from a music shop, used by violinists)



Safety precautions

None

Top 10 Flash Bang Demos

Number 9 Singing rods

Method

- To prepare for this demonstration you will need some rosin (this is available in block form so will need to be ground up into a powder beforehand)
- Hold the rod firmly in the middle with one hand
- Rub some rosin into the fingers of your other hand
- Firmly stroke the rod from the middle to the end and repeat as necessary until the rod begins to 'sing'

The science bit

The rod 'sings' due to a resonance - the build up of standing longitudinal waves. Repeated stroking causes vibrations within the metal rod to become stronger and stronger, creating the waves.

Demonstration tips and interesting facts

It may take some practice to get this to work!

The more you do this on the same rod, the easier it becomes due to a build-up of rosin.

Other things to try

Try using different length rods.

Hold the rod $\frac{3}{4}$ of the way down it's length, only stroking the last $\frac{1}{4}$ - does it sound different?

Once the rod starts 'singing' twirl it around.

Demonstrate the Doppler Effect. Hang the rod by a piece of string in its middle. Make the rod 'sing' and swing the rod like a pendulum - you will hear it change pitch as it swings.

To produce a transverse wave, hold the rod in the middle and strike it with a mallet at one end. You will hear a lower pitch that will die away.

Instructions are in accordance with CLEAPSS guidelines and safety information.

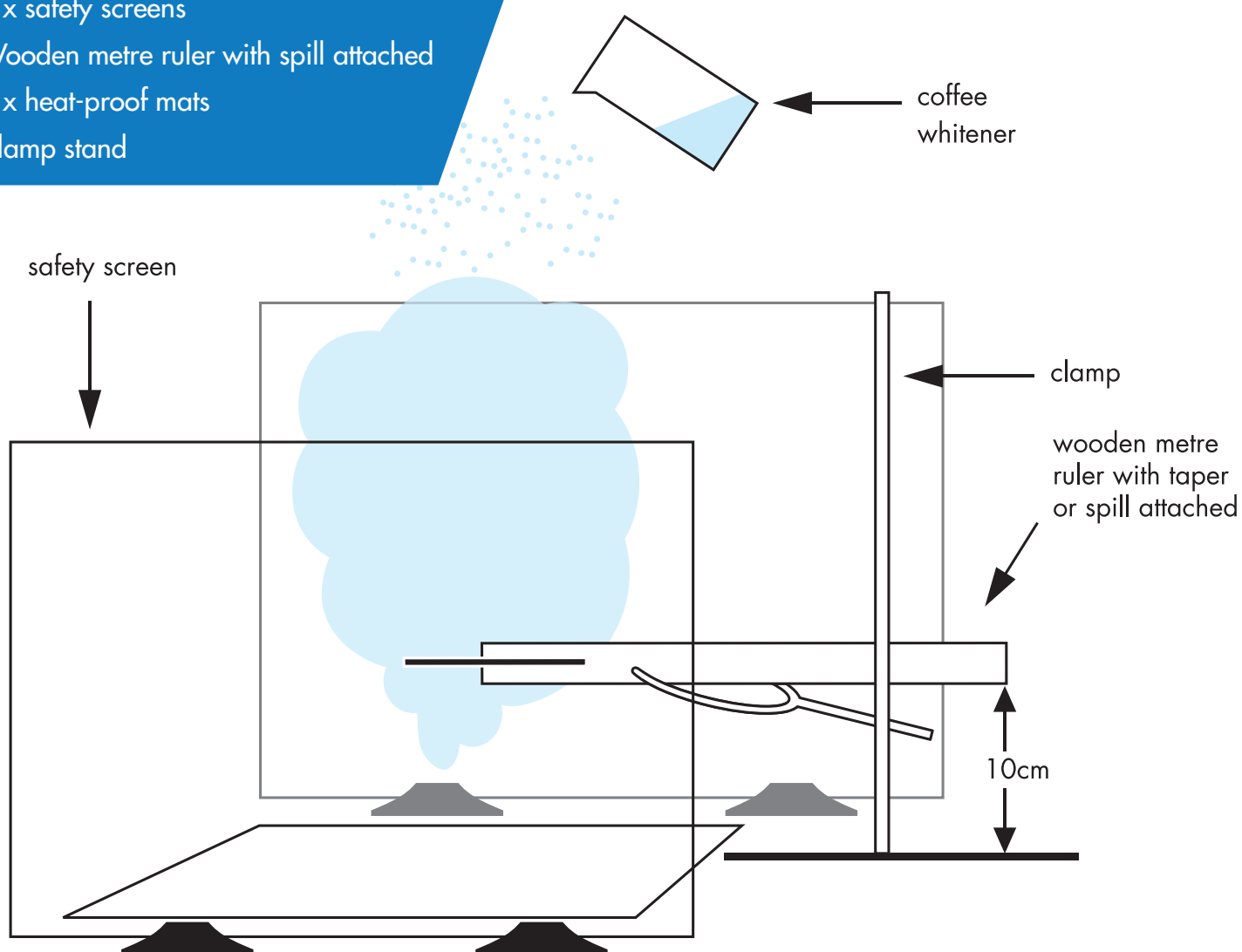
Top 10 Flash Bang Demos

Number 10 Powder flames

Demonstrate the release of **energy** from food in a dramatic way

Equipment

- 100ml beaker ¼ filled with coffee whitener (supermarket own brand works well)
- 2 x safety screens
- Wooden metre ruler with spill attached
- 4 x heat-proof mats
- Clamp stand



Safety precautions

Safety goggles should be worn.
The flames are quite large and need to be controlled using safety screens.
Only use a small amount of whitener and take care when pouring.

Always carry out your own risk assessment for this demonstration.



TOP 10 Flash Bang Demos

Number 10 Powder flames

Method

- Set up apparatus as shown in the diagram
- Place four large heat-proof mats on the floor
- Spill should be 10 cm above the ground and directly above the centre of the mats
- Place safety screens to either side of the ruler
- Light the spill
- Gently shake the coffee whitener over the lit spill

The science bit

This demonstration can be used to show the effect of particle size on flammability, and the amount of energy released from food during respiration. The fine particles of organic powder undergo rapid combustion when shaken over the spill due to the high surface area exposed to oxygen in the atmosphere.

Demonstration tips and interesting facts

To demonstrate the effect of particle size on flammability, you can illustrate to your students before beginning this demonstration that a lump of powder cannot easily be ignited.

Gunpowder factories were built with one weak wall or a weak roof. This was so an explosion would only destroy part of the building.

Although the release of energy inside a human body by respiration is much slower, the same amount of energy would be released.

Other things to try

Demonstrate that non-organic powders (e.g. chalk dust) will not produce the same effect.

Instructions are in accordance with CLEAPSS guidelines and safety information.