MODULE: *Chemical Change*

Episode 2: Fireworks

Activity Sheet 2.1 Firework safety

Brief:

You are a Fire Officer and have been asked by your Chief Fire Officer to prepare an information poster for teachers and parents to use with children advising them about fireworks. The poster will need to cover details about:

- what materials fireworks contain.
- the basic chemistry about how they work.
- how they can be used safely.
- the importance of following the fire safety code when using fireworks.

You need to decide what information you think is most important and what you will use when designing and making your group's poster. You should try to make your poster attractive to look at and easy to read and understand. The poster will be checked by the Chief Fire Officer (your teacher) and then displayed for other groups to look at and comment on.

You are also required to produce five questions to test people's understanding of your poster. You will need to produce answers to your questions.

Part 1: In your groups carefully read the following information about fireworks.

Fireworks

Fireworks were invented in China over 1000 years ago.

There are three kinds of fireworks: sparklers, firecrackers, aerial fireworks.

All fireworks contain a fuel that reacts with oxygen in a burning or oxidation reaction.

Chemical energy stored in the fuel is released in the form of heat, light, sound and kinetic (movement) energy.

How does a sparkler work?

There are three ingredients present in a sparkler:

- A fuel – a metal such as magnesium, aluminium, iron or steel.
- An oxidiser – a supply of oxygen from e.g. Potassium Nitrate.
- A binder (able to burn) – binds the chemicals together, such as wet sugar, starch or glue.

What happens when the sparkler is lit?

The fuel burns in oxygen from the oxidiser (and the air) and releases heat.

Powder particles of the fuel ignite (catch fire and produce bright sparks).

magnesium + oxygen → magnesium oxide

How does a firecracker work?

Firecrackers are the original fireworks and basically consist of gunpowder (oxidiser and potassium nitrate) wrapped in paper, with a fuse. Like all fireworks they have:

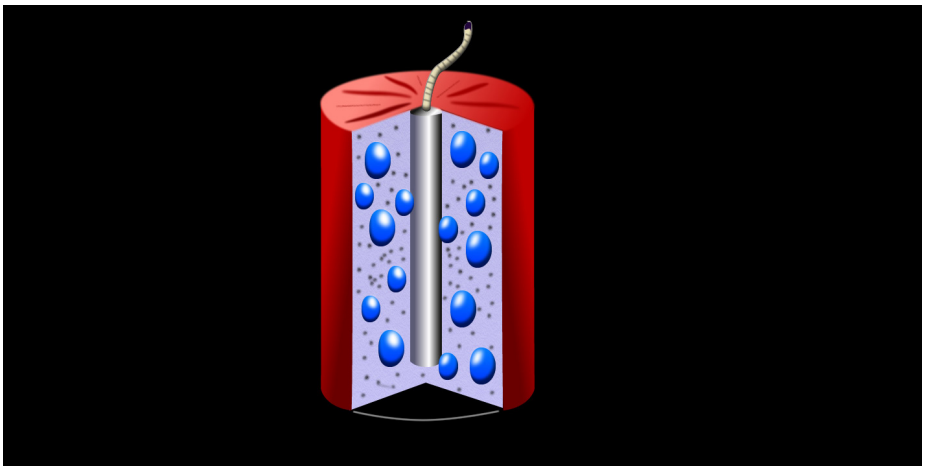
- A fuel – carbon (or sugar which contains carbon) and sulphur.
- An oxidiser – a supply of oxygen from potassium nitrate.

The firecracker explodes and makes a loud noise when:

- The fuse starts to burn and supplies heat to the gunpowder.
- The fuel ignites and the firecracker explodes

carbon + oxygen	→	carbon dioxide
sulphur + oxygen	→	sulphur dioxide

How does an aerial (Rocket) firework work?



A simple aerial firework consists of a paper tube filled with stars (a sparkler-like chemical) surrounded by black powder (gunpowder):

- The fuse is lit and burns into the tube and ignites the bursting charge and the tube explodes.
- The explosion ignites the stars which then burn with a bright shower of sparks.

In order to produce different bursts of colour different metal salts are put into fireworks. For example: copper salts – blue; magnesium salts – white; sodium salts – gold; lithium salts – red

Part 2

- Look at the last page of this resource. These are information cards for Fire Officers about fireworks and firework safety. Cut out the cards.
- Spread the information cards on your table and decide in your group how you will use these in your poster. You could paste them directly to your poster with other pictures or drawings and to include other information that is suitable.
- You should discuss which cards contain the most important information and give reasons why you have made those choices. Use this information and additional information you think is important in your poster.
- When you have finished, show your poster to the Chief Fire Officer and then be prepared to present and justify your poster content to the Chief Fire Officer and the class.

Part 3: Mind map activity

As a final activity produce a mind map poster, a little like the diagram below, to summarise all you have learnt in this module on chemical change.

- Chemical and physical changes
    - an explanation of each of these different types of change
    - examples of each change
    - justification for classifying each example as a chemical or physical change

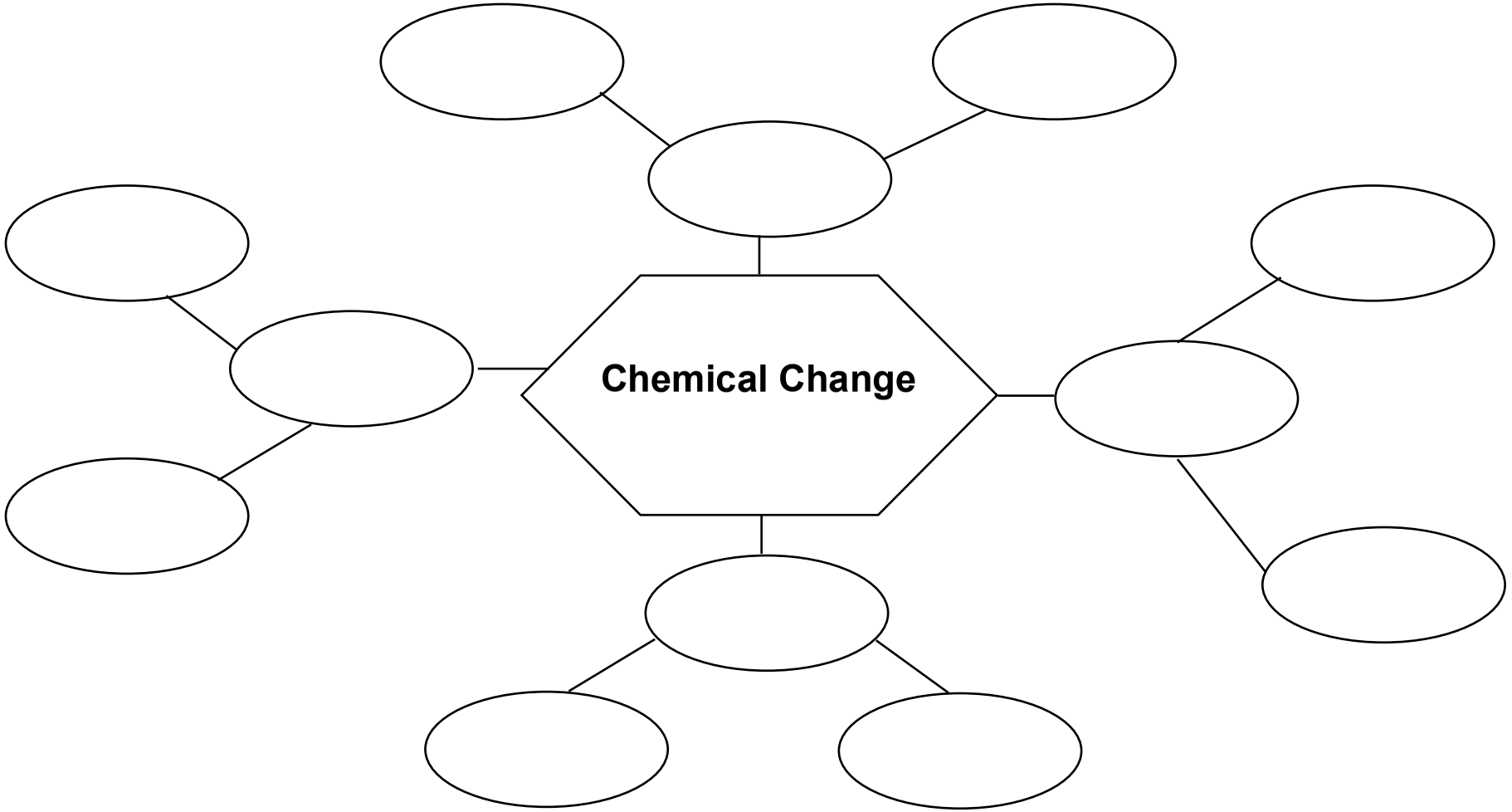
- Explanation of what endothermic and exothermic reactions are
    - examples of endothermic and exothermic reactions
    - explanation of why they are endothermic or exothermic reactions

- Glow sticks
    - what they are used for
    - explanation of how they work
    - what factors affect the reaction and how they affect the reaction

- Hot-Can
    - what they are used for
    - explanation of how they work
    - what factors affect the reaction and how they affect the reaction
    - other varieties of can and how they work

- Fireworks and the different types
    - how firework chemistry relates to burning, oxidation and exothermic reactions
    - explanation of how they produce explosions and different colours
    - firework safety and its importance and the fire safety triangle

Example:



All fireworks contain a Fuel that reacts with Oxygen in a burning or oxidation reaction

Chemical energy stored in the fuel is released as heat, light, sound and kinetic energy

The fuel in sparklers is powdered metal such as magnesium, aluminium, iron or steel

The oxidiser in sparklers supplies the oxygen (along with some from the air) and is usually a chemical called potassium nitrate (KNO^3)

The reactions in fireworks, which give out energy, are known as exothermic reactions. Many other chemical reactions are also exothermic reactions

When the fuels carbon and sulphur burn in firecrackers they produce carbon dioxide and sulphur dioxide gases

You should always follow the instructions on each firework

Light fireworks at arm's length with a taper and stand well back

Never go near a firework that has been lit – even if it does not go off, it could still explode!!

An aerial firework or rocket is a paper tube filled with stars (sparkler-like chemicals) surrounded by gunpowder

The fire triangle safety code says to put out a fire either remove the fuel, the heat or the oxygen

Always supervise children around fireworks

Never put fireworks in your pocket

Different metal salts put into fireworks produce different colours e.g.
Lithium salts- red
Copper salts- blue
Magnesium salts- white
Sodium salts- gold

To put out a fire such as a bonfire follow the normal fire safety triangle code BUT because a firework has its own source of oxygen (from the oxidiser) it is harder to put it out

Light sparklers one at a time and wear gloves

Be very careful – it takes very little to set off the gunpowder in a firework – just a spark or the glow from a taper!

Gunpowder burns very fast and gives off a jet of hot gas which is used to thrust the firework into the air

Remember

Fuel + oxygen + heat

=

Fire

You can smother a firework to make it safe on the ground with sand or soil