



What is *Chemical* Energy



1. In pairs

Can you think of any examples of chemical energy?

2. Watch the Australian video clip carefully:

<http://www.csiro.au/scope/clips/e27c01.htm>

3. Now answer these questions from the clip.

When you burn a match:

What fuel is used? _____

What element is needed for the fuel to burn? _____. It is found in _____

Complete the following

Fuel + Oxygen \longrightarrow _____ + _____ +
_____ + ENERGY

What forms does the energy take? _____ and _____

What is the key difference between a match and a firework? _____

How are different colours produced? _____

4. Activity: Coloured flames

You will need:

Large paper clips

Water

A bunsen burner

Table salt (Sodium Chloride, NaCl)

Cream of Tartar or Tartaric Acid (potassium hydrogen tartrate, $\text{KC}_4\text{H}_5\text{O}_6$)

Boric Acid also called Boracic acid ($\text{B}(\text{OH})_3$)



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What to do:

1. Straighten the paper clip.
2. Make a small pile of table salt on the plate.
3. Dip one end of the paper clip into the water, then into the salt. The crystals should stick to the end.
4. Draw a table to record your observations.

5. Holding the paper clip at the other end, place the salt crystals into the flame.
Record your observations
6. Using a separate paper clip for each chemical – Repeat steps 2–5 with the other chemicals.
7. Draw a conclusion from your observations.



Fireworks use different _____ to produce different colours.



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5. What's happening? Read this carefully

You should have found that the different chemicals produce different colours in the flame.

The colours are caused by the elements in the salts. When the atoms are heated enough, they start to produce flashes of colour. The exact colours they make depend on the atom. The colours you are seeing are mostly due to the metal atoms.

Up until a few centuries ago, fireworks produced their colours through incandescence. This is when an object is heated up so much that it starts to glow. If a piece of iron is heated enough, it will glow red, then orange, yellow and white. In old fireworks, they used small pieces of iron that would heat up when the firework exploded, so they glowed. The Sun, stars and light-bulbs also produce light from incandescence.

Modern fireworks produced their colours using another effect, called luminescence. Inside an atom, there is a nucleus in the middle with electrons orbiting around it. Luminescence is caused by the electrons changing their orbits. If an atom is heated enough, one of the electrons orbiting around the nucleus can absorb some of the heat energy and move into a different orbit. After a little while, the electron will move back to its original orbit. When it does, it emits its extra energy as a flash of light.

Different types of atoms will luminesce at different temperatures. When electrons change orbits, they always release the same amount of energy, so they always produce the same colours. When you heated up the chemicals, the Sodium in the table salt produced yellow light, Potassium in the Cream of Tartare produced purple and the Boron in the Boracic Acid produced green.

What does incandescence mean? _____

What does luminescence mean? _____

Explain how you can predict the colour of a firework _____

6. What can you use this knowledge for? – Applications:

- A basic firework that explodes in the air contains explosives in the middle, surrounded by little balls of flammable powder, called “stars”. When it explodes, the stars catch fire and are blasted out to produce the fireworks we see in the air. The colours of the fireworks comes from chemicals mixed into the stars luminescing. Some chemicals used to colour fireworks include:



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- Strontium Chloride for red
 - Calcium Chloride for orange.
 - Copper Chloride for blue.
 - Barium Chloride for green
 - Sodium Chloride for yellow
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- In some fireworks, the stars have layers containing different chemicals. As they burn inwards, the colour they produce changes. This is how they make fireworks that change colour in mid-air.
 - Different atoms produce different colours when they luminesce. This information can be used to work out what an unknown chemical is made of. This technique is called spectroscopy. It even lets astronomers analyse the chemicals in glowing clouds of gas in space.

7. Watch the US video clip <http://people.howstuffworks.com/fireworks.htm>

Did you notice anything wrong? _____

Outline key safety procedures that the guy should have taken.

Describe the stages of a basic firework. _____

Explain how an aerial firework works _____

What is a sparkler made of? _____

List the energy changes that take place when a firework is lit – from start to finish.

Draw a flow diagram to illustrate this clearly.