1 Stored energy in fuels

KEY QUESTIONS

- What are fuels?
- What is required to burn fuels?
- How can we safely burn fuels?
- How can we prevent fires and what must we do if there is a fire?

1.1 What are fuels?

In Gr. 4, we learnt that there are many different types of energy. This year we are going to learn about stored energy and how we can use the stored energy to do something useful.

New Words

- fuel

QUESTIONS

What do you understand about the term fuel? Discuss this word with your partner and write down your own definition below.

Learner dependent answer (a material such as coal, gas, or oil that is burned to produce energy)

There are a few different definitions for fuel. There are three main categories that you can use to investigate fuels.

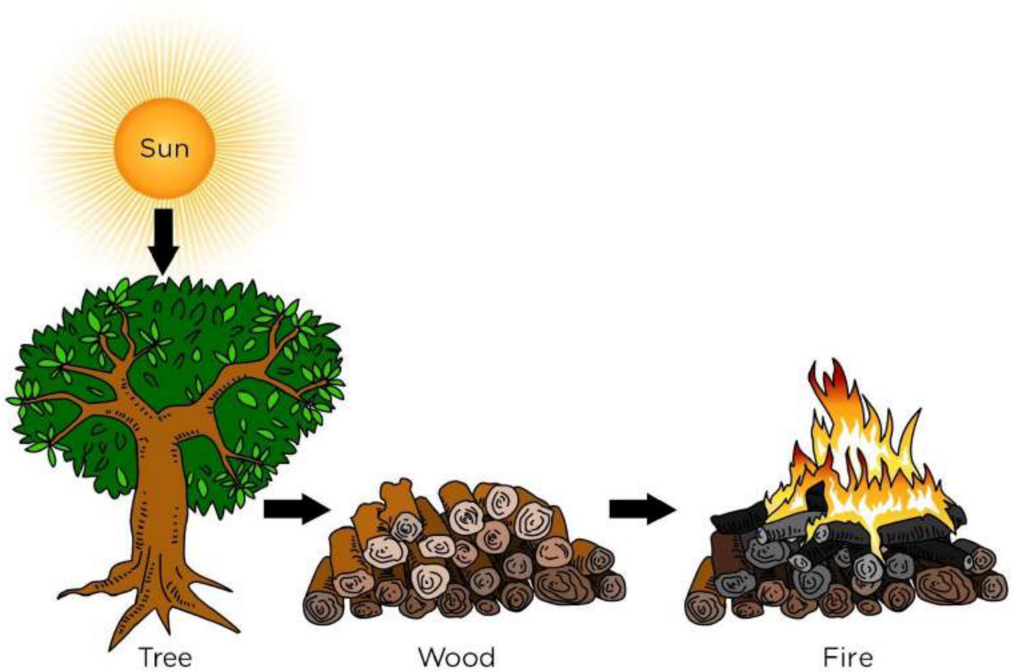
Some fuels can be burnt to create heat and light

Wood is often collected and burnt to give us heat and light. On a cold evening, it is wonderful to sit around a fire to tell stories and warm yourself with friends.

This man has made a fire to provide heat and light. [1]

Cooking meat on a fire made from wood in Khayelitsha. [2]

Wood comes from plants, specifically trees. Plants use light energy from the Sun, as well as carbon dioxide and water to grow. Plants take the energy and store it in their leaves, roots and all parts of the plant. Wood also contains this energy stored by plants. Burning wood allows us to change this stored energy into light and heat which is useful to us.



Energy from the Sun is stored in the tree's wood which is released as light and heat when we burn the wood.

VISIT

Formation of fossil fuels (video)

goo.gl/y041H

Coal is a type of fossil fuel that is also burnt to provide us with heat that we can use. The heat from coal can be used to cook our food and warm our houses.

Hot coals burning

VISIT
How fossil fuels are made
goo.gl/rxiVG

Fossil fuels like coal were made from prehistoric plants. The plants took up energy from the Sun and stored it in their bodies. Millions of years ago, the Earth was mostly covered by water. The plants that died sank to the bottom of the water. Over millions of years, the layers of plants were covered by layers of sand and compressed by the weight of the sand. The plant material was buried deeper and deeper under the ground where it is much hotter than on the surface of the Earth. Over millions of years, the plant remains changed into fossil fuels.

These fuels get their name, "fossil fuels", because they are made from plants and animals that lived a very long time ago.

Natural gas and oil are also examples of fossil fuels. Scientists have realised that tiny sea organisms also died, sank to the the bottom of the ocean, and were buried under the sand. Over millions of years, many layers of dead sea animals got buried like this. Over millions of years, the dead sea animals changed into oil and natural gas.

Wax in a candle is burnt to provide light. By burning the candle, the stored energy in the wax is released as light and heat energy.

Candle wax is an everyday fuel that we use to give us light.

A paraffin lamp [3]

Paraffin is also a fuel that contains stored energy. Paraffin is burnt in paraffin lamps and paraffin stoves to provide us with useful energy in the form of light and heat.

Gas is another fuel that can be burnt to release stored energy in the form of heat and light. We can use gas heaters to keep warm, and gas stoves to cook food and boil water. Natural gas is odourless and colourless, and it is also known as 'clean gas' because, unlike other fossil fuels, it doesn't produce harmful byproducts when it burns.

Food is fuel for the body

Humans and animals need energy to live. We get our energy from the food that we eat. Do you remember learning about food chains in the beginning of the year in Life and Living?

QUESTIONS

Choose one of the foods that you will eat for lunch today and draw a food chain including this food and ending with you.

Any food chain starting with the Sun and ending with a person (the learner). Perhaps it is a piece of fruit, then it will just be a 3 link food chain. If it is a meat product, then it would be a four link food chain.

Remind learners about food chains and how the direction of the arrows shows the transfer of energy from the Sun and then from one organism to the next.

Food contains stored energy that our bodies can change into useful energy that we need when we run, jump, breathe, learn and do everything else that we do.

So we can say that food is the fuel for our bodies! I must need a lot of fuel for my body as I love being active!

The energy value of food is often shown on the packaging of foods that we buy. The energy of food is measured either in calories (Cal) or in joules (J). A snack such as a packet of chips gives you thousands of joules of energy. Therefore, we rather talk about kilojoules (kJ) of energy when talking about the energy in food.

Spend a moment going over the link between units of measurements and the use of "kilo" as this is often a huge problem with learners in the higher grades. For example, write some of these on the board, 1000 grams (g) = 1 kilogram (kg), 1000 metres (m) = 1 kilometre (km), and then write 1000 joules (j) = ... and ask learners for the answer.

Have a look at the photo of the side of a mealie meal packet below. The side of the packet contains a lot of information about what the mealie meal contains. The very top line tells us that 100 g of mealie meal will supply your body with 1368 kJ of energy.

The nutritional information on a mealie meal packet

The energy value of a food tells us how much energy that food is worth to our bodies as fuel. An average adult man needs about 2500 kcal or 10 000 kJ per day. Children and adults that are not very active need less energy. People that are very active need more energy. These numbers are just to give us an idea of the amount of energy your body needs as fuel everyday.

It is important to eat a balanced diet. In the next activity we are going to look at how much energy different food gives us. In Gr. 6 we will learn a lot more about nutrition and what you should eat to be healthy!

ACTIVITY: Energy from food

About two weeks before you get to this activity, ask the learners to start bringing in packages from food that they eat, e.g. cereal boxes, butter wrappers, egg boxes, sweet wrappers, biscuit boxes, chip packets, rice packets, bread packets etc. The bigger the variety of packages the better. Make sure the learners understand that you need to be able to read the information in the table on the packet. Have a couple of examples with you to show the learners what they are looking for. NB: Not all foods will give kJ per 100 g. Ask learners to attempt to do some of the conversions themselves.

MATERIALS:

- various packaging for foods collected from home

INSTRUCTIONS:

1. Work in pairs.
2. There is a collection of packages from different types of foods in your classroom.
3. Look carefully at the energy information given on the packets and use this information to complete the table.
4. It is important to record the number and the unit in your table.

Food item	**Energy per 100g**

QUESTIONS:

1. Which food item contains the most amount of energy per 100g?
2. Which food item contains the least amount of energy per 100g?

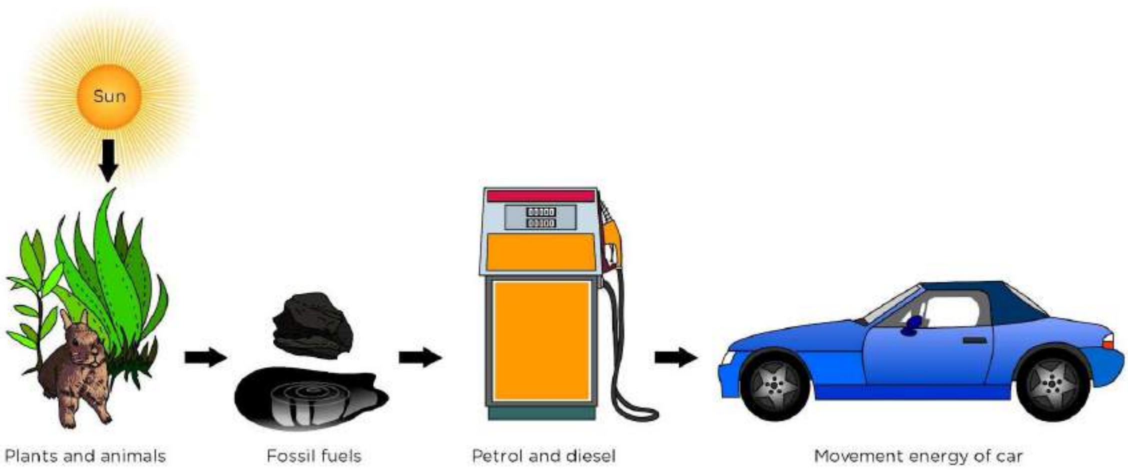
Some fuels are energy sources for engines and power station

Fuels can also be used to give us other forms of useful energy.

Petrol or **diesel** is used in cars and trucks to make them go. The stored energy in the fuel is changed into movement energy of the car or truck.

Putting petrol into a car at a petrol station

Petrol and diesel are made from fossil fuels. Can you see that even energy for cars and generating electricity comes from the Sun?



Energy from the Sun is stored in the plants and animals which eat the plants. Their remains turned into fossil fuels over millions of years which are then mined and used to make petrol and diesel to fuel cars.

Coal is not only burnt in our homes for cooking and keeping us warm. It can also be used to make electricity. A power station is a large factory where the coal is burnt in large amounts to produce electricity.

A power station [4]

We can also carry out an investigation to find out how much energy is stored in fuels.

INVESTIGATION: How much energy can we get from different fuels?

The teacher must make the apparatus as per the instructions in the method. This investigation must be performed by the teacher or under very careful teacher supervision due to the fire hazard. If possible, watch the video in the Visit box to get an idea of the experiment. If you cannot perform the experiment in your class, then possibly play the video for learners. This investigations makes use of simple equipment such as tin cans and corks. But, if you have access to a science laboratory, then you can use a metal retort stand, test tube and bunsen burner instead. The idea of this investigation is to show that you do not need fancy science apparatus to perform an experiment.

AIM: To determine which fuel contains the most energy

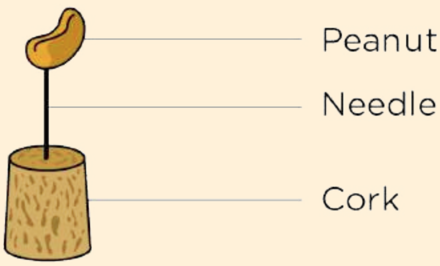
MATERIALS AND APPARATUS:

- a cork
- a needle
- peanuts (other fuels such as a piece of wood, candle wax or piece of biscuit)
- a large metal can (e.g. coffee tin)
- a small metal can (e.g. soup can) with paper label removed
- a can opener
- a hammer
- a large nail
- a metal spike longer than the diameter of large can
- 150 ml of water
- a thermometer
- a lighter

The idea of this investigation is to examine the amount of energy given off by a peanut. **NB:** Learners might struggle with linking a burning object, with energy given off, which then heats water, which then gives a reading on a thermometer. Take time to explain how a burning peanut can result in a different reading on a thermometer, and that we are actually looking at the energy given off and not the reading on the thermometer. The thermometer reading is an indicator that more energy is released.The experiment can be taken further to compare different fuels. You can also use a piece of wood, piece of candle wax, piece of biscuit (approximately the same weight of each fuel). It is important to burn the same weight of each fuel so that you can directly compare the amount of energy given off per gram of weight.

Method:

1. Carefully push the eye of the needle into the smaller end of the cork. The gently push the pointed end of the needle into a peanut. If the peanut breaks use another peanut.



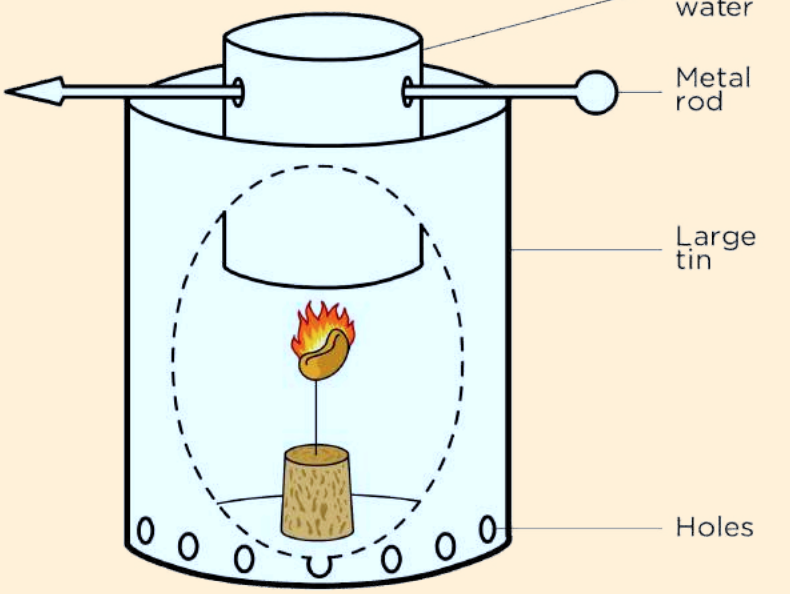
Set up your peanut and cork like this.

2. Carefully remove both ends of the large can. Watch out for sharp edges.
3. Use the hammer and nail to make holes all around the bottom of the large can. These are air holes.
4. Use the small can and punch two holes near the top of the can exactly opposite each other.
5. Slide the metal spike through the two holes in the small can.
6. Pour 150 ml of water into the small can.
7. Use the thermometer to measure the temperature of the water and record it in the results table.
8. Put the cork and peanut on a surface that cannot burn. Use the lighter to light the peanut. The peanut can be difficult to light so keep trying. It will eventually start burning.
9. As soon as the peanut is burning, carefully place the large can over the peanut. Balance the small can inside the big can as shown in the diagram. The small can must be a short distance above the peanut.

VISIT

Burning a peanut (video)

goo.gl/JoXw6



Set up your apparatus like this.

10. Let the peanut heat the small can with the water until the peanut stops burning. Stir the water and measure the temperature of the water and record it in the results table.
11. Repeat the experiment with two different fuels. Your teacher will decide which fuels to test. Fill in the results table for the other fuels tested. Remember to use quantities of the other fuels which are similar in size to the peanut, and always to start with a can of cold water.

RESULTS:

	Fuel 1: Peanut	**Fuel 2: ________**	**Fuel 3: ________**
Temperature of water before heating (°C)			
Temperature of water after heating (°C)			
Change in temperature (°C)			

CONCLUSION:

Write a conclusion for your investigation.

The energy stored in the peanut was changed into heat energy which we used to warm the water.

At this point, ask questions like if the peanut had stored a greater amount of energy would the final temperature of the water be greater or smaller. Lead the class to discuss which substance contained the most amount of energy. Also ensure the learners understand that to make a fair comparison about the amount of stored energy in each substance, that you would have had to have the same mass of fuel for each experiment. In addition, you could use a metal bottle top and fill with paraffin or other liquid fuel to compare stored energy.

QUESTIONS:

1. Which fuel contained the largest amount of energy, and how did you determine this?
   The fuel containing the most amount of energy would have burnt for the longest and therefore caused the greatest change in the temperature of the water.
2. Where did the energy in the peanut originally come from?
   The energy comes from the Sun.

3. Discuss what happened to the energy stored in the nut, or other fuels you used.
   As the nut was set on fire, the stored energy was released as heat and light.
4. What was the input energy needed to make the peanut (and other fuels) burn?
   heat energy
5. What was the output energy obtained from the fuel?
   heat and light energy
6. Discuss how you could compare the amount of energy stored in peanuts to the amount of energy stored in a cashew nut.
   The experiment (peanut or cashew nut) that produces the biggest increase in temperature has used the fuel with the most stored energy.
   Repeat the experiment with a peanut and then a cashew nut of the same mass. Learners can go into the details of how to set up and perform the experiment. Unless they have done it, they won't be able to predict which one has the most stored energy, but the following conclusion could be made:

In order to light the fuel, you had to put in a small amount of energy. The fuel however gave out a lot more energy than what was put in. The difference between the energy you put in and the energy the fuel gave out is how much energy was stored in the fuel.

The OUTPUT ENERGY obtained from a fuel is GREATER THAN the INPUT ENERGY needed to make the fuel burn.

1.2 Burning fuels

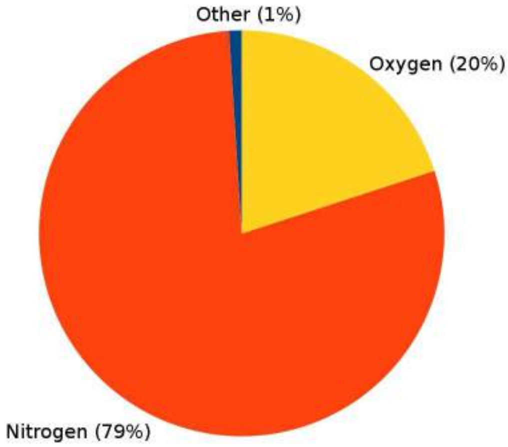
We have learnt that burning fuels provides us with energy that we can use. What does a fuel need to be able to burn?

It requires some energy to start burning fuel. Fuel needs oxygen to burn. Fuel usually gets oxygen from the air around it. There are other gases present in air as well, but they do not burn.

New Words

- oxygen
- combustion

The following pie chart illustrates how much of each type of gas is found in the air around us.



Pie chart of showing the percentage of gases in the air around us.

VISIT

The science of fireworks (video)

goo.gl/d4HJj

When something burns we say it is combusting. Another word for burning is combustion.

QUESTIONS

How much of the air around us consists of oxygen?

Oxygen makes up 21% of the air around us.

What happens to a flame when we take one of these things away, such as oxygen? When we take something away, we say we deprive it. Let's find out what happens when a flame is deprived of oxygen!

INVESTIGATION: What happens when a flame is deprived of oxygen?

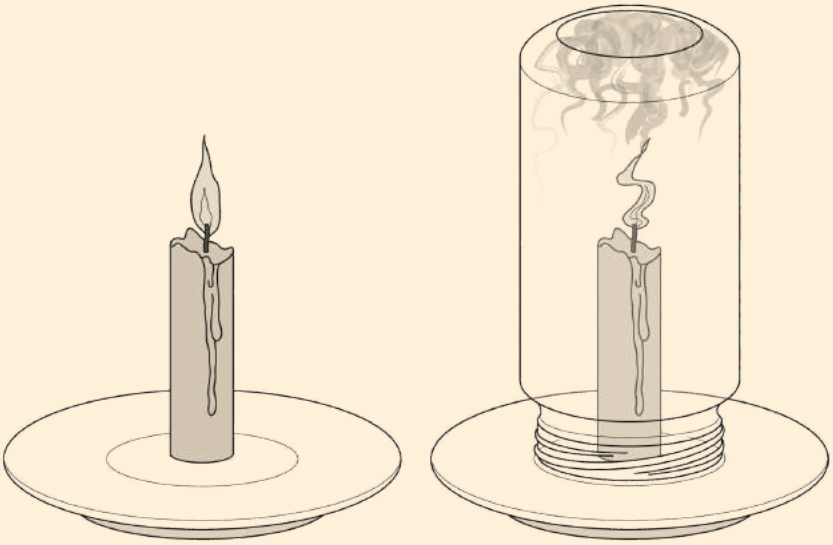
AIM: To find out how long a candle will burn for when given different amounts of oxygen.

MATERIALS AND APPARATUS:

- 1 candle
- 4 glass bottles (small, medium, large and extra large)
- matches
- 1 flat bottomed bowl

METHOD:

1. Light the candle.
2. Drip some wax in the middle of the bowl and 'mount' a candle in the wax.
3. Pour a small amount of water in the bowl around the candle for the glass jars to stand in.
4. When the candle is securely standing upright, light the candle with the matches.
5. Place the small bottle over the candle and time how long it takes until the candle goes out. Record the time taken in the results table.
6. Repeat the experiment with each of the different sized glass containers and record the time taken for the candle to go out.



Cover the candle as shown with each of the different sized bottles.

RESULTS AND OBSERVATIONS:

Size of glass jar	Time taken for candle to go out (s)
Small	
Medium	
Large	
Extra Large	

1. In which glass jar did the candle burn the longest?
   the extra large jar
2. In which glass jar did the candle burn out the fastest?
   the small jar

CONCLUSION:

Write a conclusion for the investigation.

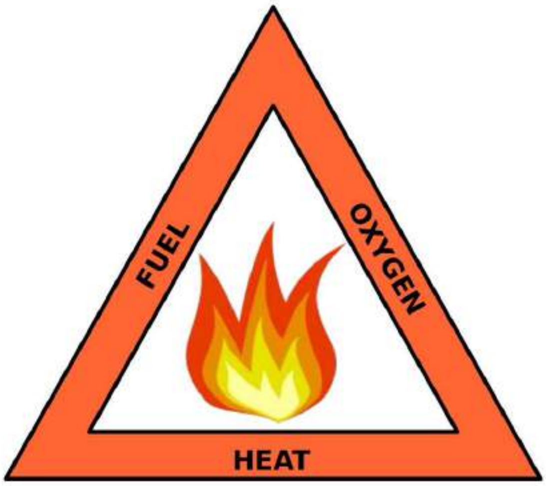
The more air the candle has available, the longer the candle can burn for.

QUESTIONS:

1. When lighting a candle, identify the heat source that provides the starting energy and the fuel supply.
   heat source is lit match, fuel is the wax
2. Why did the candle go out once you put the glass jar over the candle?
   The candle used up all the oxygen in the air. Burning cannot happen without oxygen so the candle went out.
3. Why do you think there is a difference in the time it took for the candle to go out?
   The small jar has less air and hence less oxygen than the bigger jars. The smaller the amount of oxygen, the quicker it gets used up and the quicker the candle goes out.
4. A candle that is allowed to burn freely in air will eventually burn down and go out. Why does the candle stop burning in this situation?
   The fuel has run out.

In this experiment we learnt that if you take away the fuel or the oxygen, the flame will stop burning.

For combustion to be possible, three things are required; a heat source, fuel, and oxygen. Without one of the three, combustion will not happen. You can remember this using the Fire Triangle (in the following picture). All three sides of the triangle are required for combustion.



The combustion triangle

1.3 Fire safety

Invite someone from the local fire department to come and talk to the children in your school. Ask them to bring their equipment and talk to them about fire safety. The fire department is normally very willing to visit schools and they are the experts. If the fire department is not available, a community member can also be asked to talk to the learners.

VISIT

Burning substances in air and pure oxygen (video)

goo.gl/sEV5g

New Words

- threat
- extinguish

We have spoken a lot about fire and burning in this chapter so far. Fire is a major source of heat energy for many people whether it for keeping warm, cooking food or for some other purpose. Although fire is very useful it is also very dangerous! Great care is needed when using fire. Fire is a threat in our communities.

DID YOU KNOW?

Some plants even need fire to survive! An example is Fynbos. This is a group of plant species found only in South Africa. The seeds of Fynbos plants need smoke and heat to germinate.

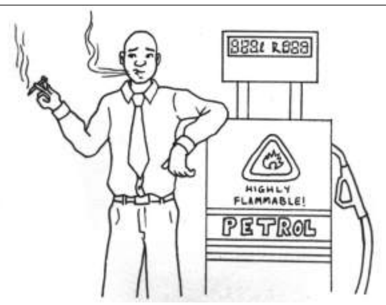
There are a few safety rules that everybody should know:

1. Never play with matches and lighters. Make sure that matches and lighters are kept out of reach of young children who do not know how to use them properly.
2. In case of fire - stay away. If there is a fire in your home, do not hide, rather go outside as soon as possible.
3. Know the number of the local fire department and phone in case of emergency.
4. Have an escape plan for your home and practice it with your family. Have a meeting place outside so that you will know everyone is safe in the event of a fire.

ACTIVITY: Dangerous situations involving fire.

INSTRUCTIONS:

1. Below are four different scenes.
2. Each one involves fire and is potentially dangerous.
3. Write a description next to each picture about why it is dangerous.

Situation	**Why is it dangerous?**
	
	

Fire alarms are extremely important to warn people in buildings that a fire has started.

You should have some fire extinguishers in your school. See if you can locate them.

A great additional activity is to demonstrate the use of a fire extinguisher and then ask the learners to explain why it puts out the fire. Does the fire extinguisher blow out the fire? Does it remove oxygen from the burning material? Does it remove heat from the fire? Does it prevent oxygen from getting to the fire? Lots of interesting questions can arise here that could lead to a valuable discussion. No mention need/should be made of carbon dioxide unless the idea has already been raised before this.

ACTIVITY: Talking about fire in our communities

1. Work in groups of four.
2. Talk about your experience of fire in your neighbourhood. List some good and some bad experiences in the table below.

Good experiences of fire	Bad experiences of fire

3. What causes of fire can you identify in your community?
4. How could you prevent each of the causes of fire you have been discussing?

The answers to these questions are unique to the community in which you live. Discuss the answers each group has come up with with the class. Suggest that each group makes a poster about fire safety after the class discussion.

Sometimes fires break out and it is important for us to know what to do in the event of a fire.

ACTIVITY: Acting out what to do in case of a fire!

INSTRUCTIONS:

1. In groups of 5, plan and act out a play for your class to teach them what to do in case of a fire.
2. Make sure that your play provides important information about:
   a) how to escape from a burning building;
   b) not to open a door in a building that is burning;
   c) what to do if your clothes are on fire; and
   d) what to do if your friend is stuck in a burning building.

The following actions should be shown in the plays:

- To escape from a building, fall and crawl.
- When clothes are on fire, stop, drop and roll, or cover in a blanket or carpet.
- If a friend is in a building, learners should show that they NEVER go into the building themselves, but rather call for help.

Assess the learners' plays as a group according to how clearly the learners speak and demonstrate the actions to do with their bodies and by acting out.

Have you ever seen any fire posters in your school telling you what to do in case of a fire? Did this poster catch your attention and make you aware of the dangers that fire can hold in your school? Maybe your school does not have any fire posters. Let's create our own fire posters to put up in the school.

ACTIVITY: Creating a fire poster

MATERIALS:

- Pieces of paper and cardboard.
- Coloured pens and pencils.
- Old magazines
- Scissors
- Glue

INSTRUCTIONS:

1. Design a poster telling everyone in your school what to do if

there is a fire.

2. Include some pictures to show the steps to follow. You can draw these pictures or cut some out of old magazines or newspapers.
3. Some points to think about when making your poster:
    - Does your school have an alarm bell?
    - If so, what is the signal?
    - Is there a safe place that a large amount of people can gather?
    - How will you make sure no one is left inside the buildings?
    - Is it safer to use the lift or the stairs when there is a fire?
    - What extra measures can you take to stop the fire? (Clue: Remember fire needs oxygen to burn so what can you do to your classrooms to help stop the fire and reduce the supply of oxygen?)

DID YOU KNOW?

Smoke inhalation (breathing in the harmful smoke) from a fire kills more people in household or domestic fires than the actual fire does.

Extra precautions are to close windows and doors.

KEY CONCEPTS

- Energy is stored in fuels.
- Fuels are sources of useful energy.
- Fuels are burnt to be able to use their energy as heat and light.
- Fire can be dangerous.

REVISION:

1. List three types of fuel that you use in your community.
   food, coal, any fuel that the learners have experienced
2. What is needed for combustion to take place?
   heat, fuel and oxygen
3. Your dad is cooking with hot oil on the stove. The oil catches fire. Suggest a way to put out the fire and explain why it will work.
   Put the lid on the pot. This will cut off the oxygen needed to burn and the fire will go out. Do not use water to put out an oil fire.
4. An enthusiastic science learner decides to perform an experiment to find out how long different quantities of firelighters will last. Each firelighter was cut into equal size blocks. The experiment was performed under adult supervision, and the following results were obtained:

Number of firelighters	Time of burn (min)
2	6,0
4	11,5
6	18,6
8	23,8
12	37,0
16	48,0

   a) Plot a graph of number of firelighters on the horizontal (x) axis and the time of burn on the vertical (y) axis.
   b) Draw a line of best fit on your graph.

   Line must NOT join the points. Must be a line drawn with a ruler that is as close to the data points as possible. There should be as many data points above the line as below.

5. Describe the relationship between the time of burn and the number of firelighters.
   The greater the number of firelighters, the greater the burn time.

6. Use your graph to find out how long ten firelighters would burn for.
   30 min

7. Your mom leaves the iron on and it is next to a window with a curtain blowing in the wind. Explain to her why this is dangerous and what she should rather do.
   The curtain could blow against the hot iron and catch fire and burn the house down. The wind blowing in from the window would also help to spread the fire. She should rather turn the iron off when not using it and close the window so the curtain does not blow against the iron.

I really enjoyed learning about fuels! Let's find out more about energy and electricity.

2 Energy and electricity

KEY QUESTIONS

- What do cells and batteries do?
- What is an electric circuit?
- Where does energy come from in a power station?
- How does electricity get from a power station to where it is needed?
- How can we use electricity safely?

2.1 Cells and batteries

Batteries come in all shapes and sizes. Batteries are needed for many different purposes. Most torches, radios, calculators, cell phones, some toys and even cars, pacemakers and hearing aids need batteries to work.

Typical batteries

New Words

- cell
- battery
- circuit
- pacemaker

Batteries are useful because they store chemical energy. When the battery is connected in an electrical appliance and the appliance is switched on, the stored energy in the battery is transferred to the appliance in the form of electrical energy to make it work.

ACTIVITY: Investigating the source of electricity in a torch.

MATERIALS :

- a working torch
- an old, broken torch

INSTRUCTIONS:

1. Turn your torch on and off. Can you see the bulb light up?
2. Turn your torch off. Open it up and take the batteries out.
3. Now turn it back on.

QUESTIONS:

1. Does the bulb light up when there are no batteries in the torch?
   No
2. What does this tell you about the need for batteries to make your torch work?
   You need batteries for the light bulb to light up. This is because the batteries are the source of electrical energy.
3. Do you remember learning about transfer of energy in Gr 4? When the torch lights up, what is the chemical energy in the battery transferred to?
   Chemical energy in the batteries is transferred to electrical energy. Electrical energy is then converted to light energy in the bulb.
4. Bring an old torch to school that can be taken apart. Look carefully at all the parts that make up a torch and make a list of what you find. Each part of the torch is needed for the torch to work properly.
   batteries, light globe, wires, switch, casing, glass or plastic front

An electric circuit is a system that consists of different parts. We call these parts the components of the circuit. For example, batteries, light bulbs and connecting wires are components that can make up a circuit. When these components are connected the right way, electricity will be transferred from one component to another. In this example, the electricity would be transferred from the batteries through the connecting wire to the bulb and back through the wire to the batteries to complete the circuit.

The chemical energy from the battery is transferred to electrical energy in the wires, then electrical energy is transferred into heat and light energy in the bulb.

ACTIVITY: Making a simple circuit

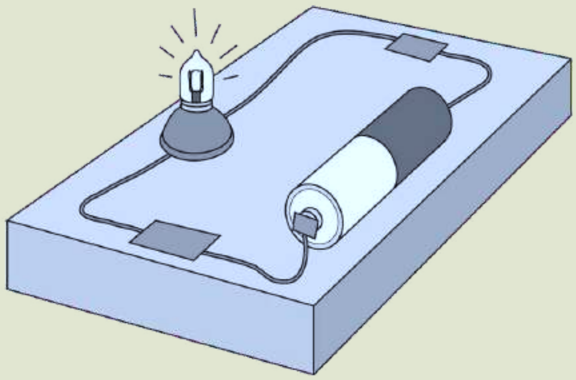
MATERIALS:

- 2 torch batteries
- 1 light bulb
- connecting wires

INSTRUCTIONS:

Part 1

1. Set up the circuit as shown in the following diagram.
2. Make sure all the wires are connected to form a closed loop.



A simple circuit

QUESTIONS:

1. What do you observe?
   The globe lights up.
2. What happens when you disconnect one end of one of the wires?
   The light goes out.
3. The one end of the battery is labelled positive and the other end is negative. Draw a diagram of the battery and label the ends as positive or negative.

Part 2

1. Set up a new circuit with 2 batteries and 1 globe.
2. Explain how you connected the batteries so the globe still light up.
   Batteries had to be connected end to end, with the positive side of one battery touching the negative side of the other battery.
3. Did the globe glow brighter or dimmer than in experiment 1, or did it glow the same?
   brighter
4. Explain your answer to question 2.
   Two batteries contain more stored energy than 1 battery, more stored energy changes to more light energy
5. Describe an electric circuit.
   An electric circuit is a pathway that allows electricity to flow or a system that allows electrical energy to move.

If you have access to the internet, there is a wonderful site that allows you to build circuits and do experiments. Go to `goo.gl/jrGJ3` and see if you can build some circuits. Experiment to see how to make the globes burn brighter and dimmer.

Batteries are actually made up of smaller parts, known as cells, that store chemical energy. Two or more cells connected end to end are called a battery. We will mostly refer to them as batteries, but keep in mind that 'cell' is the scientific term for what most people call a battery in everyday life. One cell stores a small amount of energy. If we need to store a lot of energy we use a battery.

A car needs a lot of energy to start its engine. One cell does not have enough stored energy. Therefore, a car battery has six cells that are connected end to end inside the battery case. In this case, there is six times more energy stored in the battery than in a single cell. This gives the car enough energy to start the engine.

A car battery contains 6 cells.

Mmm... so a torch needs two batteries to light up. I wonder how many batteries are needed to light up our house?!

Good question Jojo! Let's find out in the next section.

2.2 Mains electricity

New Words

- transmission lines
- pylons

A battery has stored energy which can provide electrical energy. However, our homes, schools, shops, and factories cannot run on batteries. We use electricity for many different things every day. The main source of electrical energy is from power stations. We call this 'mains electricity'.

A power station

Power stations need a source of energy

Power stations use different ways to generate electricity. A power station needs a source of energy. In South Africa, most of our power stations burn coal to use the energy stored in coal to generate electricity.

VISIT

Electricity generation (video)

goo.gl/32irY

QUESTIONS

Coal is not the only source of energy for power stations, there are also other types of power stations. Find out what these are and write down what source of energy they each use.

Types of power stations include hydroelectric (water), geothermal (steam), and nuclear power stations (nuclear).

Electricity is transferred in a huge circuit to our homes

From a power station, electricity is transferred through transmission lines held up by pylons. The transmission lines are part of the circuit that connects the power stations to where we need to use the electricity.

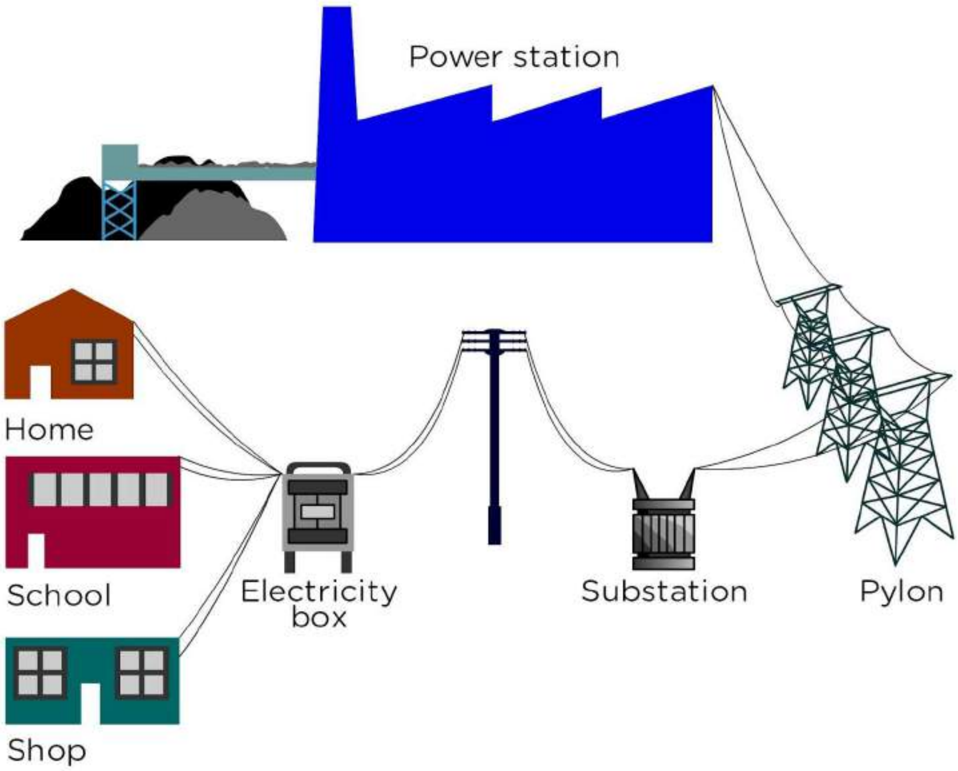
Do you remember learning about the structures of pylons in Gr. 4 in Matter and Materials? Remember they are made from triangular shapes and struts to make them strong and stable!

Huge pylons carrying the transmission lines across the country

Making electricity from coal (video) goo.gl/Hzu5V and goo.gl/scUhI

The transmission lines carry large amounts of electricity to substations in cities and towns.

From a substation, electricity is carried in smaller amounts to an electricity box for our home. From the electricity box, electricity travels through wires to the plug points and light fittings in our homes.



Transfer of energy from power stations to our homes, schools and shops

QUESTIONS

The above diagram shows how electricity is transferred from the power station to your home. Continue the diagram (use the space below) to draw the path of electricity once it is in your home and goes through the wires, wall socket and plugs to get to an appliance, such as the TV.

This is to assess the learner's ability to draw a flow diagram and translate words into pictures and text.

2.3 Safety and electricity

We use electricity every day. Electricity can be dangerous, so it is important that we use it safely. Electricity can give you an electric shock. An electric shock can hurt you badly or even kill you.

High voltage is very dangerous. Look out for warning signs like these!

VISIT

Interactive site about electricity

goo.gl/mrFiy

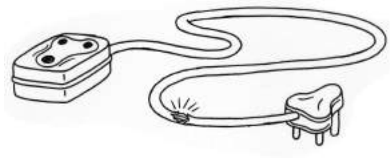
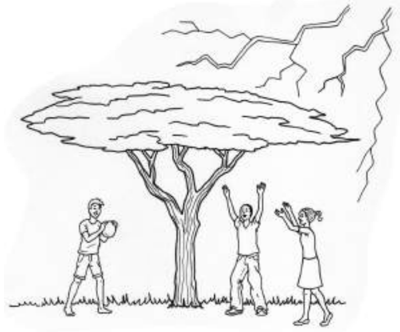
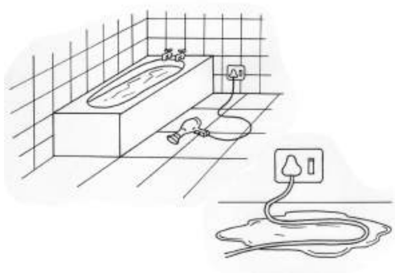
Electricity can cause fires and injuries, even death. Here are some rules for using electricity safely:

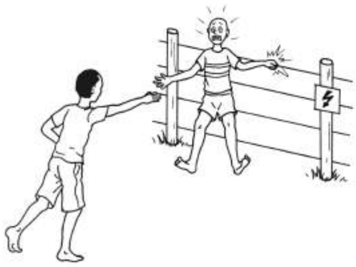
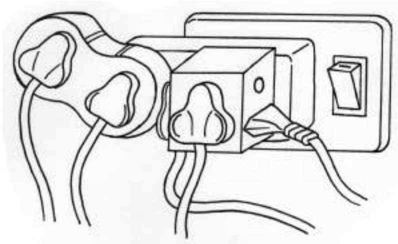
1. Do not put anything into an outlet except a plug.
2. Do not pull on the cord to unplug an appliance, hold the plug and pull.
3. Dry your hands before you plug in or unplug a cord.
4. If a plug is broken or a cord is cut or worn, do not use it.
5. Do not plug too many cords into one outlet.
6. Keep appliances away from water. Do not use a hair dryer if there is water nearby.
7. If there is an electrical storm (with lightning), turn off and disconnect electrical appliances, like the TV and computer.
8. Never touch any power lines.
9. Some power lines are buried underground. If you are digging and find a wire, do not touch it.
10. Do not fly a kite or climb a tree near a power line.

ACTIVITY: 10 Safety tips for electricity

INSTRUCTIONS:

1. Look at the pictures.
2. Each picture shows an INCORRECT use of electricity or electrical appliance.
3. Study the pictures and write a "Safety tip" for the situation in each picture.
4. The first example has been done for you.

Picture	Safety tip
	Never use an appliance that has a broken cord or has some of the metal wire showing through the cord casing.
	Do not play outside when there is thunder and lightning. If this powerful natural electricity strikes close to you, it will try to get to the ground through you!
	Never play near to or on electric fences or power lines. These have live electricity running through them so you can get a shock without even touching them!
	Never use electrical appliances outdoors in wet weather or if you are wet. Water conducts electricity well, so you WILL get a shock if you are touching an appliance and water drips into the socket, cord or motor. Wear closed shoes with rubber soles when using electrical appliances. Never use electrical appliances barefoot.
	Never use electrical appliances in the bathroom. Remember, electricity can flow through water.

	Electricity can flow from one person to the next. NEVER try to pull someone who is being shocked away from the appliance. you will get shocked too! Use a non plastic/non metal object to separate them from the electrical source.
	Never put lots of appliances into one socket. Too much electricity flowing to one plug is dangerous. One multi-plug adapter is safe, but do not put adapters into each other. Rather use 2 different plug points.
	Never stick a metal knife into a toaster while it is on. First turn the toaster off and unplug it and use a wooden or plastic knife. Beware, electricity can flow through metals.

KEY CONCEPTS

- Energy can be stored in cells and batteries.
- The cells or batteries are a source of electrical energy for an electric circuit.
- An electric circuit is a system that transfers electrical energy to where it is needed.
- A power station needs a source of energy.
- Electricity from the power station is transferred in a circuit to our homes.
- Electricity can be dangerous and needs to be used safely.