

Electrical Safety Teaching Resource



Contents

Contents and list of activities	2
Foreword	4
Values in the curriculum framework	5
Overarching learning outcomes	6
Linkage of steps to the overarching learning outcomes	7
Generalisations and content area	8
Junior Primary section	9
Teacher's notes	10
Comic Book Activities	
Characters	12
Learn the rules	13
Socket and the gang puppets	14
Ordering	15
General Activities	
Electricity	16
Different people – different uses	17
Pathways	18
Watchit	19
Powerlines	20
Danger above	21
Powerlines are down	22
Trees and Powerlines do not mix	23
Fallen powerlines	24
Electricity saves and protects	25
Trespassers will be prosecuted	26
Life without electricity	27
Danger	28
Electric blankets	29
Power points	30
Cord dangers	31
Bathroom dangers	32
Electricity crossword	33
Always be careful	34
Lightning	35
Middle Primary section	
Teacher's notes	37
Comic Book Activities	
Design a poster	39
Your view	40

General Activities

Electrical dangers	41
Look up, look down and live	45
A blast from the past	46
What is important?	47
Electricity and school	48
Power plugs	49
Power plug dangers	50
Cord or cordless	51
A dangerous combination	52
Water and electricity	53
Consequences of the action	54
On the spot reporting	55
What to do	56
Six safety rules to remember	57
Using electricity	58
Reporting the action	60
Finding out for yourself	61
Word sleuth	62
Electrical fun	63

Upper Primary section

Teacher's notes	65
-----------------	----

Comic Book Activities

Make a safety statement	68
-------------------------	----

General Activities

What happened?	69
Dangerous situations	70
Water and electricity do not mix	71
An electrical emergency	72
Is your home safe?	73
Electricity saves lives	76
An electrical safety survey	77
PVC or not PVC	78
Extension cords	79
Out and about – teachers' notes	80
Dangers associated with Powerlines	82
Remember!	84
Dial 1100 before you dig	85
Make up a television commercial	86
Electrical safety signs	87
Electrical safety officer	88
Find out for yourself	89
It's all Greek to me	90
Positive and negative	91
Some great inventors	92
Glossary	94
Vocabulary activity	99

Foreword

Watchit and play safe

This teaching resource is designed to complement and supplement the Shock Proof in-school electrical safety education program for primary school students.

The tales of Socket and the gang

The comic book chronicles the ability of Socket and the gang to recognise DANGERS AND HAZARDS associated with electricity and reinforces the following six key messages:

- Leave a ball on the roof until an adult can fetch it;
- Remember, it's safety first with fallen powerlines;
- Fly kites in wide open spaces. It's safer and much more fun;
- When a plug is broken, switch it off at once;
- A heater in the bathroom could get you into serious trouble; and
- Keep away from overhead powerlines and substations.

The activities

The learning activities are divided into three sections – Junior, Middle and Upper Primary. Each is then further divided into “comic specific” and “general activities”.

Please note, that while the sections have been broadly age characterised it is quite conceivable that activities designated for a particular level may be interchangeable with upper or lower year levels. Teachers are invited to use their discretion in selecting activities that are most appropriate to the needs of their students.

The “comic specific” worksheets have been designed as followup activities directly related to the content and concepts covered in the Shock Proof electrical safety education program in-school visits.

The “general activities” extend on these concepts and encompass a diverse range of activities related to the theme of “electrical safety”. Activities include the historical development of electricity, the ways that we use electricity and how to be safe around it.

Students who use the Shock Proof material will come to appreciate the importance of electrical safety and become aware of the methods of safeguarding themselves, their friends and families from potential dangers.

Values in the Curriculum Framework

1. A pursuit of knowledge and a commitment to achievement of potential.
2. Self- acceptance and respect of self.
3. Respect and concern for others and their rights.
4. Social and civic responsibility.
5. Environmental responsibility.

The integration of these values in the use of this resource will enhance the learning opportunities within school communities.

Overarching Learning Outcomes

1. Students use language to understand, develop and communicate ideas and information and interact with others.
2. Students select, integrate and apply numerical and spatial concepts and techniques.
3. Students recognise when and what information is needed, locate and obtain it from a range of sources and evaluate, use and share it with others.
4. Students select, use and adapt technologies.
5. Students describe and reason about patterns, structures and relationships in order to understand, interpret, justify and make predictions.
6. Students visualise consequences, think laterally, recognise opportunity and potential and are prepared to test options.
7. Students understand and appreciate the physical, biological and technological world and the knowledge, skills and values to make decisions in relation to it.
8. Students understand their cultural, geographic and historical contexts and have the knowledge, skills and values necessary for active participation in life in Australia.
9. Students interact with people and cultures other than their own and are equipped to contribute to the global community.
10. Students participate in creative activity of their own and understand and engage with the artistic, cultural and intellectual value of others.
11. Students value and implement practices that promote personal growth and well being.
12. Students are self-motivated and confident in their approach to learning and are able to work individually and collaboratively.
13. Students recognise that everyone has the right to feel valued and be safe, and in this regard understand their rights and obligations and behave responsibly.

Linkage of Steps to Overarching Learning Outcomes

Outcomes	Lower	Middle	Upper
1. USING LANGUAGE Students use language to understand, develop and communicate ideas and information and interact with them.	X	X	X
2. NUMBER & SPACE Students select, integrate and apply numerical and spatial concepts and techniques.	X	X	
3. FINDING OUT Students recognise when and what information is needed, locate and obtain it from a range of sources, and evaluate, use and share it with others.	X	X	X
4. USING TOOLS Students select, use and adapt technologies.	X	X	X
5. PATTERNS AND RELATIONSHIPS Students describe and reason about patterns, structures and relationships in order to understand, interpret, justify and make predictions.	X	X	
6. PROBLEM SOLVING Students visualise consequences, think laterally, recognise opportunity and potential and are prepared to test options.	X	X	X
7. UNDERSTANDING THE WORLD Students understand and appreciate the physical, biological and technological world and have the knowledge and skills to make decisions in relation to it.	X	X	X
8. OUR CULTURE Students understand their cultural, geographic and historical contexts and have the knowledge, skills and values necessary for active participation in life in Australia.	X	X	
9. OTHER CULTURES Students interact with people and cultures other than their own and are equipped to contribute to the global community.			
10. CREATIVITY Students participate in creative activity of their own and understand and engage with the artistic, cultural and intellectual work of others.	X	X	X
11. WELL BEING Students value and implement practices that promote personal growth and well-being.	X	X	X
12. WORKING ALONE AND WITH OTHERS' Students are self-motivated and confident in their approach to learning and are able to work individually and collaboratively.	X	X	X
13. FEELING SAFE AND VALUED Students recognise that everyone has the right to feel valued and be safe and in this regard, understand their rights and obligations and behave responsibly.	X	X	X

Generalisations	Content Area
1. People have benefited from continuous technological advancements in electricity.	Important historical contributions need to be recognised. Technological advancements show developments in: <ul style="list-style-type: none"> • Types of appliances now available; • Improved lifestyles; and • Leisure time activities.
2. People rely on an efficient supply of electricity.	Electricity is an important part of everyday life. Many people form part of the electrical service industry. Due to our dependence on electrical services, many people in society will be affected by power failures due to storms, vandals or short circuits.
3. People use electricity in many different ways to function effectively in society.	People try to take short cuts by do-it-yourself house wiring or electrical repairs that are not approved. Everyone in the community uses electricity in one form or another.
4. People need to be aware of the potential dangers that electricity can present.	Through safe experimentation, students can appreciate the properties of electricity. Electricity seeks a path to earth and the human body can provide this path. Different voltage affects the degree of danger, hence substations of high voltage must be emphasised as out of bounds. Students need to be able to identify electrical power sources, electrical appliances and safe usage practices.
5. The potential dangers of electricity can be avoided by following simple rules.	Correct power point procedure needs to be demonstrated and practised by students. Correct safety steps in the event of an electrical shock need to be taught. Students need to know electric blanket safety procedures.
6. Water is a good conductor of electricity and decreases the body's resistance by allowing the current to pass through it.	Water and electricity have the potential to be lethal when combined. The severity of a shock will depend on the amount of time exposed to the electrical leakage to earth and the voltage. Students need to be aware of the dangers of having portable appliances in bathrooms.

JUNIOR PRIMARY



Junior primary teacher's notes

1 Water and electricity

All materials conduct electricity in varying degrees. Materials classified as “insulators” conduct electricity in such small quantities it cannot normally be detected. On the other hand, materials classified as “conductors” conduct electricity readily in large amounts. GLASS IS AN INSULATOR – METAL IS A CONDUCTOR.

Water is also a good conductor of electricity. Water decreases the body's resistance allowing a much higher current to pass through it. The effect of electricity is dependent on the length of time that the body is exposed to it. The higher the current the less time that we can survive.

People who are wet from taking a bath or shower or who are standing in wet areas such as the laundry must be very careful. We must keep water and electricity apart.

2 Overhead powerlines

In Western Australia electricity is transmitted and distributed to customers along powerlines that carry up to 330,000 volts. The powerlines strung between power poles in your street can carry a number of different voltages. The powerlines hanging closest to the ground carry 415/240 volts that goes into your home. Above these could be powerlines carrying 11,000, 22,000 or 33,000 volts.

- i. If someone touches a powerline with something that conducts electricity such as an aluminium swimming pool cleaner, fishing rod or a sailing boat mast, the electricity will pass through that conductor and through the person holding it.
- ii. Throwing items at powerlines can be very dangerous. Not only could the Powerlines be broken, the item thrown could become entangled and hang down low enough for someone to touch it and receive an electric shock. Fallen powerlines will cause power failures that could affect thousands of homes and put people's lives in danger. Just because powerlines on the ground are not “sparking” does not mean that they are not alive and dangerous.
- iii. A kite that comes in contact with a powerline may not cause the person holding the string to be electrocuted. However, trying to dislodge it from the powerline may cause the powerline to dislodge from the insulator and/or break and fall to the ground.

3 Pathways

A person receives an electric shock when they come in contact with electricity from a faulty appliance or bare wire. Electricity will travel through the body because it acts as a good conductor. Electricity will always travel to ground and seeks out the shortest path to earth. It takes about 1,000 milliamps (1 Amp) of current to run a 100 watt light bulb. Here are the effects that you can expect from just a fraction of that current for a few seconds.

Amount of current	Effect on the body
1 milliamp	can just be felt.
5 to 9 milliamps	cannot let go.
20 milliamps and above	increasing pain and may be fatal.

The figures above illustrate that a small amount of current for a few seconds can be fatal. It is the current that kills or injures. However, the voltage that pushes the current through the body also has an important effect.

When someone is exposed to household voltages he or she may suffer a muscle spasm and may be locked-on to the electrical source until the circuit is turned off, or until the person is dragged clear by the weight of his or her body falling clear. Contact with low voltage is the cause of many electrical fatalities in the home.

4 Electric blankets

Electric blankets are not recommended for children under 12.

It is important to note that the heating elements contained inside an electric blanket are not totally flexible. Therefore, the blanket should never be folded or crumpled and all wrinkles should be smoothed out. "Hot Spots" will occur when the element has been damaged or it is deteriorating with age.

It is also very important that you never place or heap clothes or heavy articles onto an electric blanket when it is turned on as this will cause overheating.

Refer to Middle Primary Teachers' Notes for the following headings:

5 Conductors/insulators. 7 Power points.

6 Substations. 8 Frayed cords.

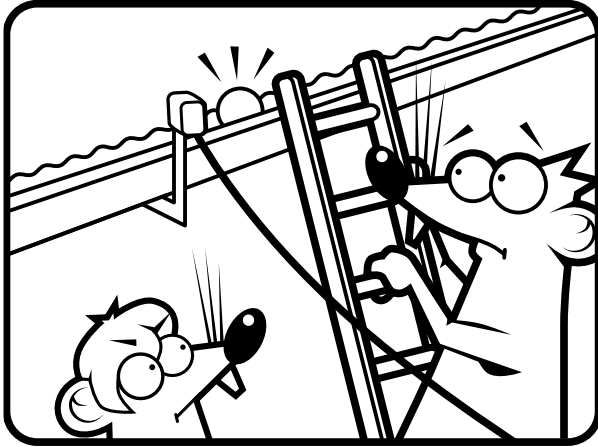
Refer to Upper Primary Teachers' Notes for the following headings:

9 Electric shocks. 11 Polyvinyl chloride (PVC).

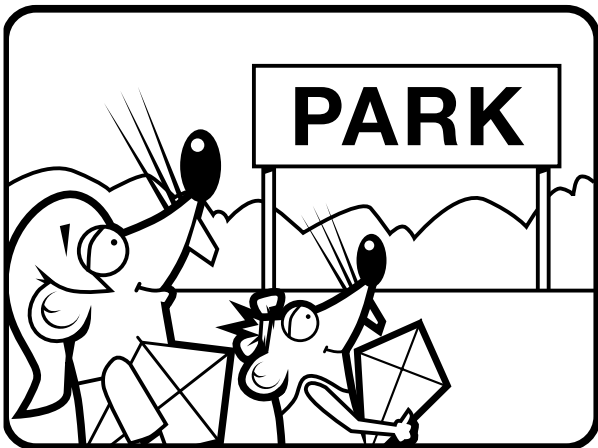
10 Safety switches.

Characters

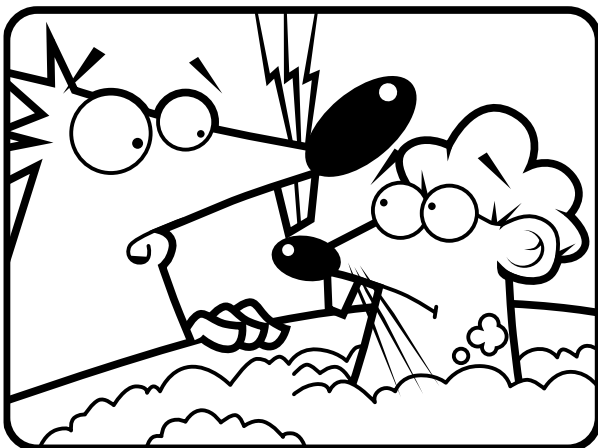
The following pictures are taken from "The tales of Socket and the gang" comic book. Write a sentence to explain what each character is doing.



Voltaire is



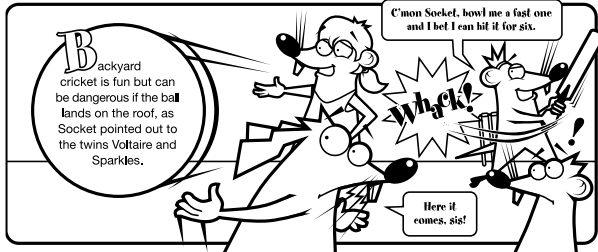
Electra and Sparkles are



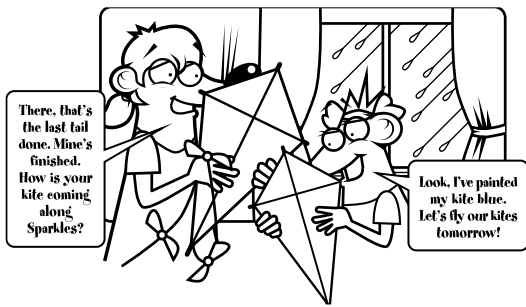
Socket is

Learn the rules

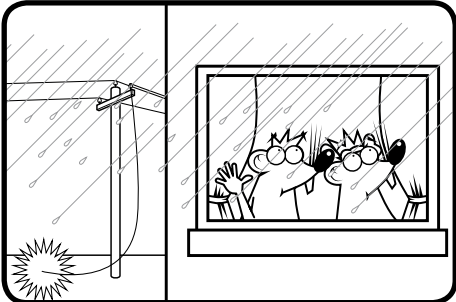
In the comic book we learnt many things about what we should do to be safe around electricity. Write in the RULES that match the pictures.



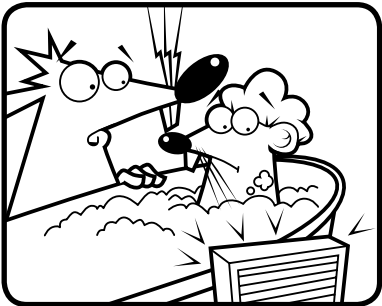
1 _____



2 _____



3 _____



4 _____

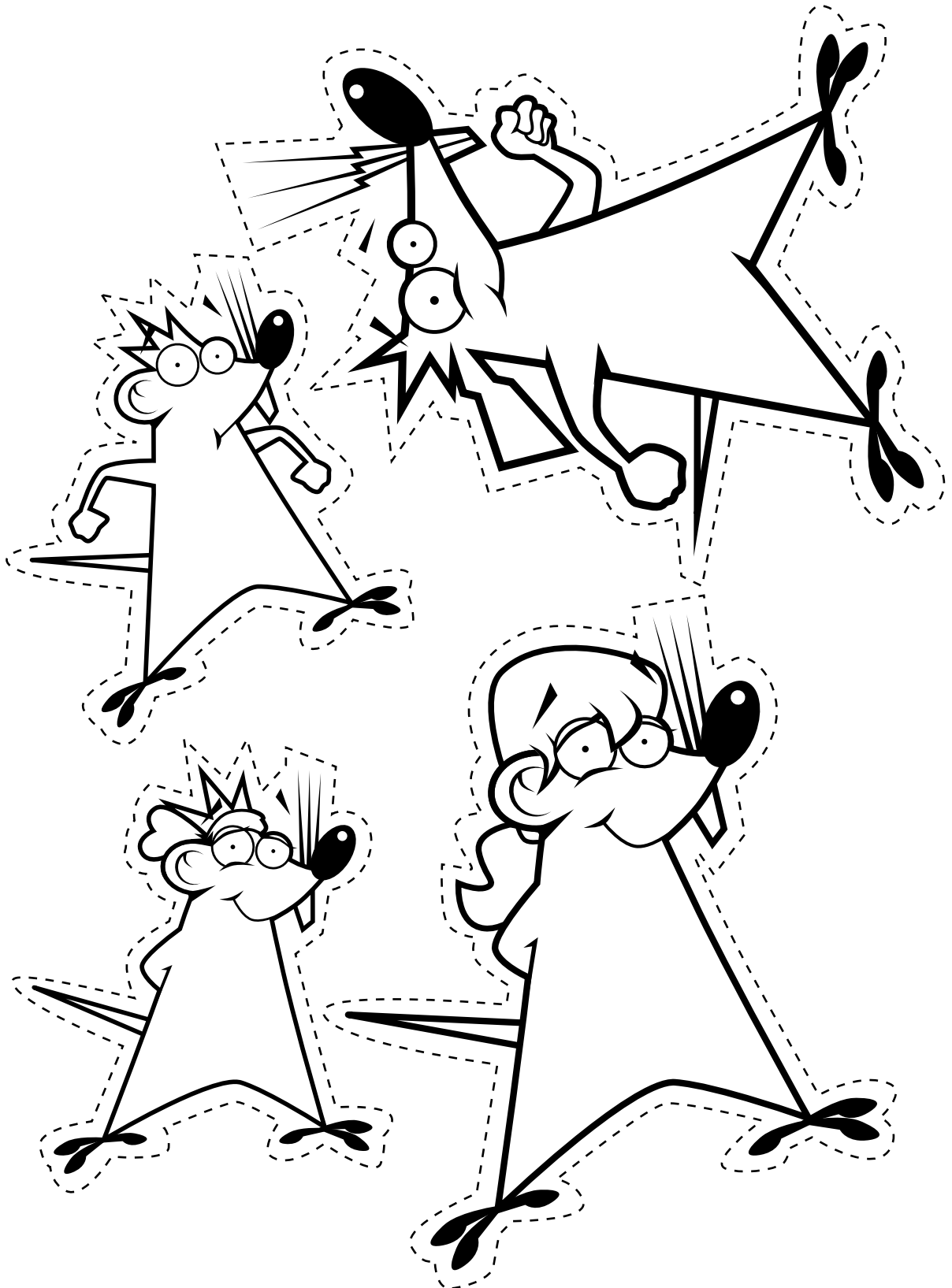
RULES

A heater in the bathroom could get you into serious trouble.	Fly kites in wide open spaces. It's safer and much more fun.
Remember, it's safety first with fallen Powerlines.	Leave a ball on the roof until an adult can fetch it.

Socket and the gang puppets

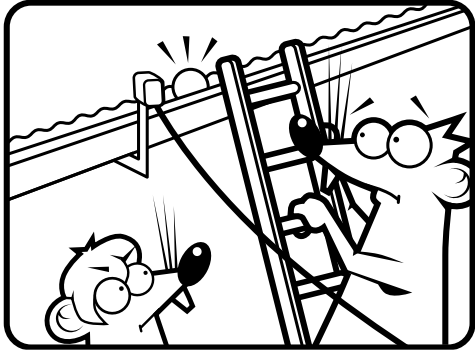
Colour the characters from the comic shown below. Cut them out and glue them onto cardboard. Then stick them onto paddle-pop sticks to make your puppets.

Use the puppets to act out a scene from the comic.

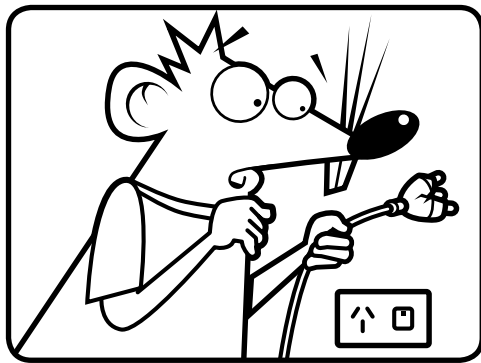


Ordering

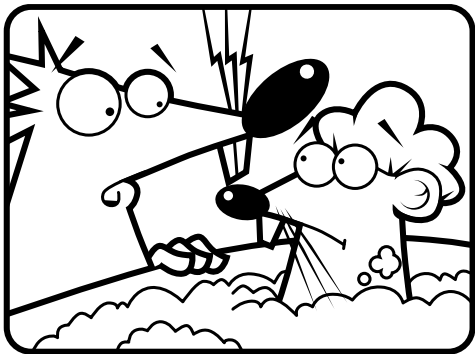
Below are four scenes showing events that occurred in the comic book. Can you remember and list them? Describe what is happening in 1 to 4.



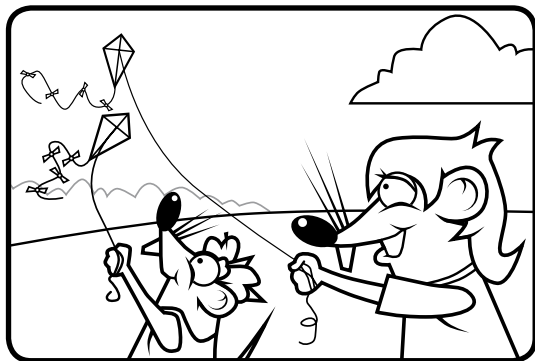
1 _____



2 _____



3 _____

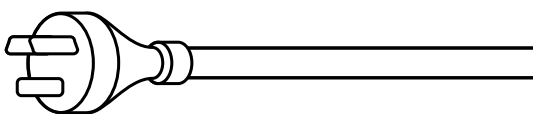
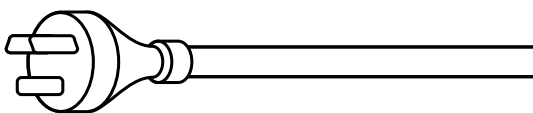
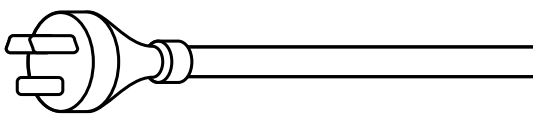
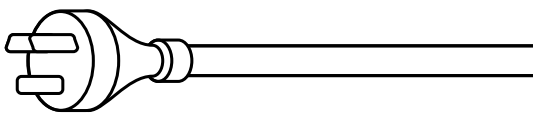
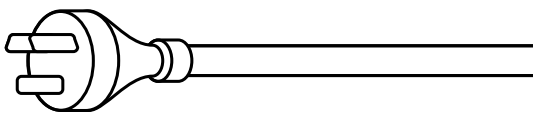
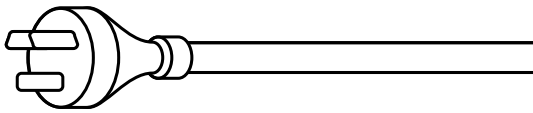


4 _____

Electricity

There are many different appliances that we use everyday that help make our lives easier.

At the end of each cord draw something that you use that runs on electricity and makes living easier.



Which of the appliances that you have drawn do you think is the most important?

Why?

Different people – different uses

We all use electricity in one form or another. Different people use it for different things.



Draw yourself using electricity in some way.

Write a sentence to go with the picture.

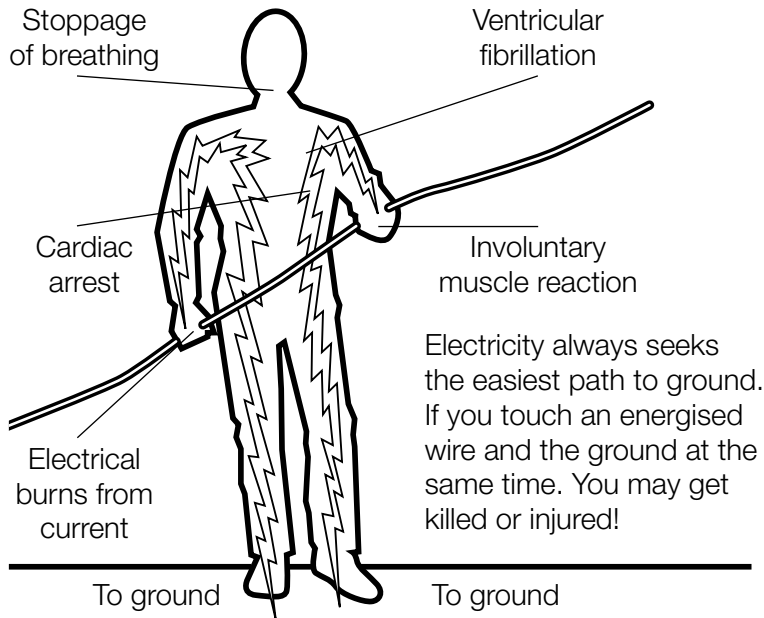


Draw someone else in your family using electricity in another way.

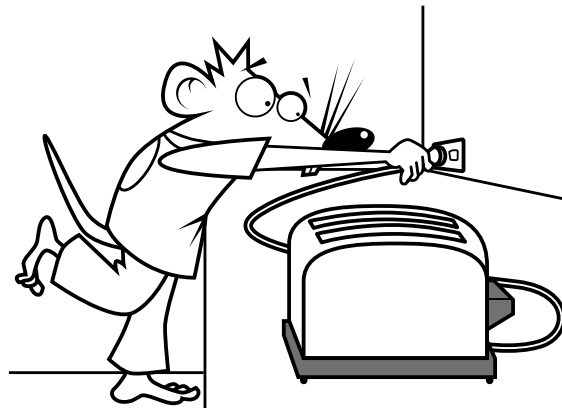
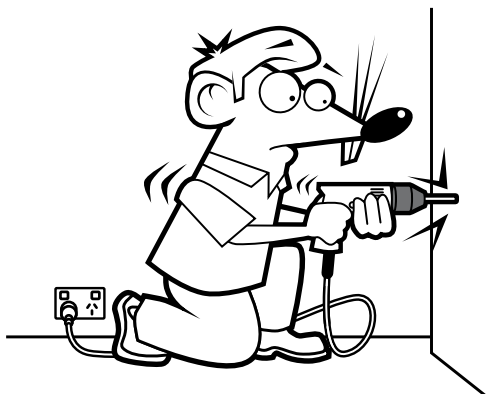
Write a sentence to go with the picture.

Pathways

Electricity always tries to find a path to earth. The human body can provide this path.

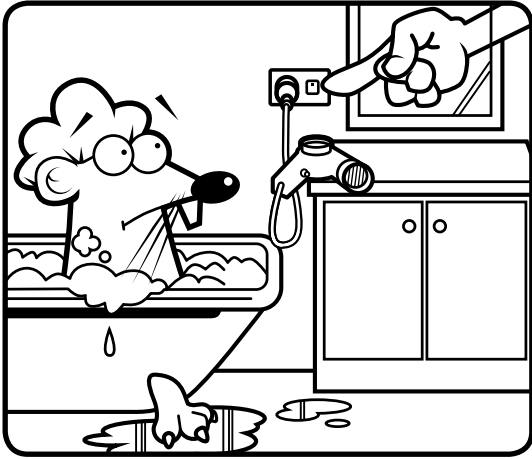


On the pictures below, show where you think the pathway from the power source to earth would be.



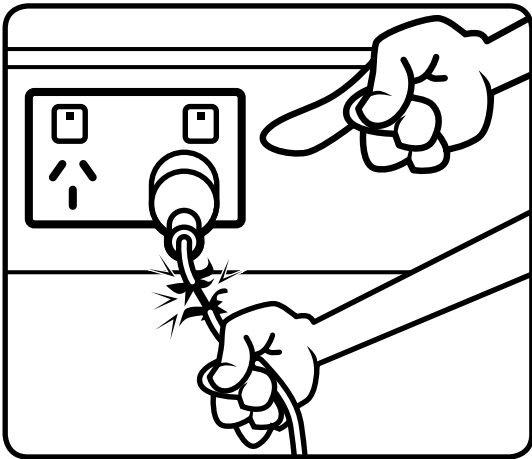
Watchit

Socket has found two dangers in each of the pictures below. List the dangers you can see next to each picture.



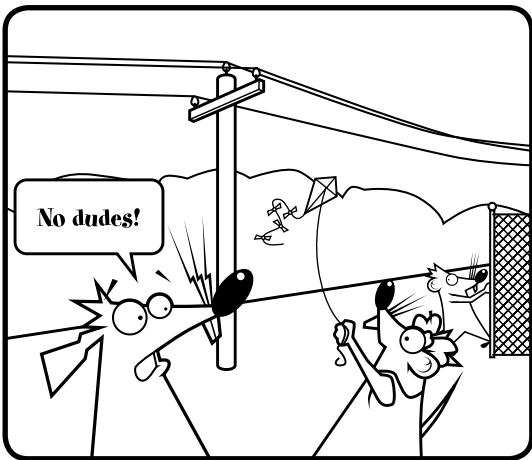
1 _____

2 _____



1 _____

2 _____

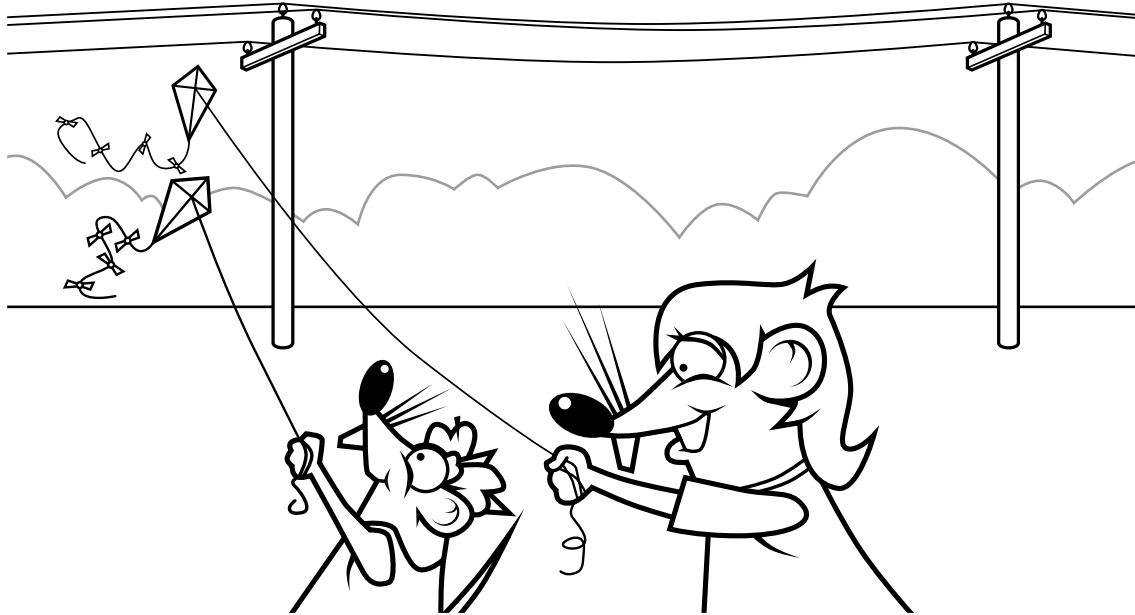


1 _____

2 _____

Powerlines

Kites are great fun to play with however, they can be dangerous if used in the wrong place.

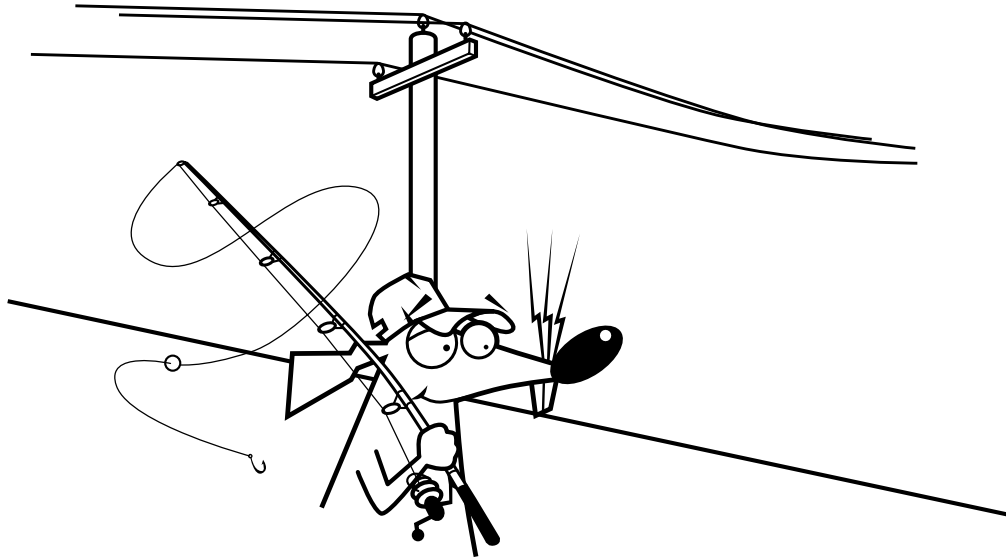


What do you think could happen here?

Draw a picture of where Electra and Sparkles should be playing with their kite.

Danger Above

Socket and the gang have decided to go fishing down at the creek. They are going to use Socket's new long fishing rod that he got for his birthday. They have not noticed the overhead powerlines.



What do you think could happen next?

What could you tell Socket and the gang to do?

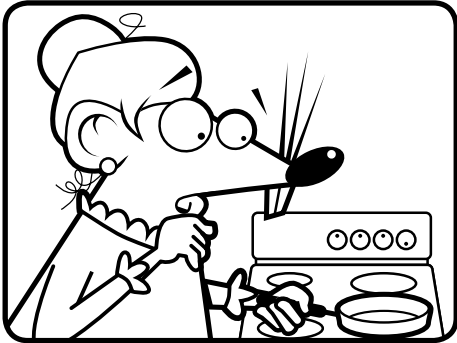
“Look _____ and _____”

Draw Socket and the gang carrying the fishing rod the correct way so that it will not hit the powerlines.

Powerlines are down

When the powerlines are broken because of a traffic accident or severe weather conditions, the power may go off.

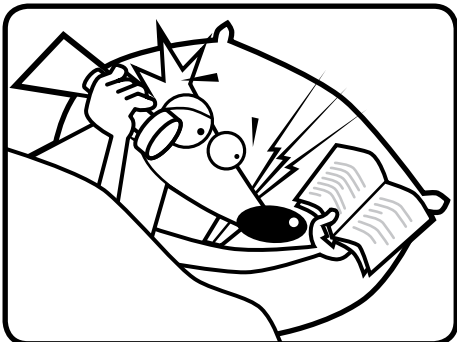
Look at the pictures that show what happened when the power went off in Socket's neighbourhood. Write down what you think is happening and how the characters are feeling about not having any power.



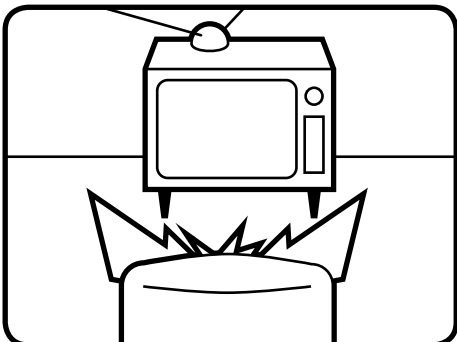
1 _____



2 _____



3 _____



4 _____

Trees and powerlines do not mix



Electricity saves and protects

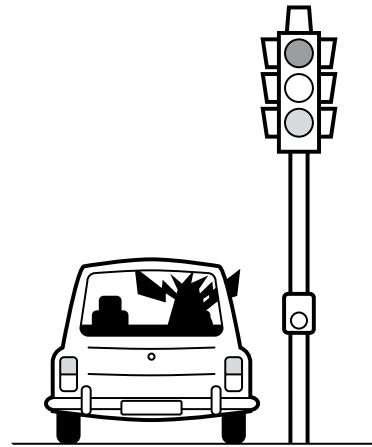
The car on the road in the picture are controlled by

t _____ | _____

The traffic lights work because of e _____

If we did not have traffic lights the c _____

Electricity saves and protects us in many different ways in our community. Draw another way that you can see electricity used around your community/suburb.

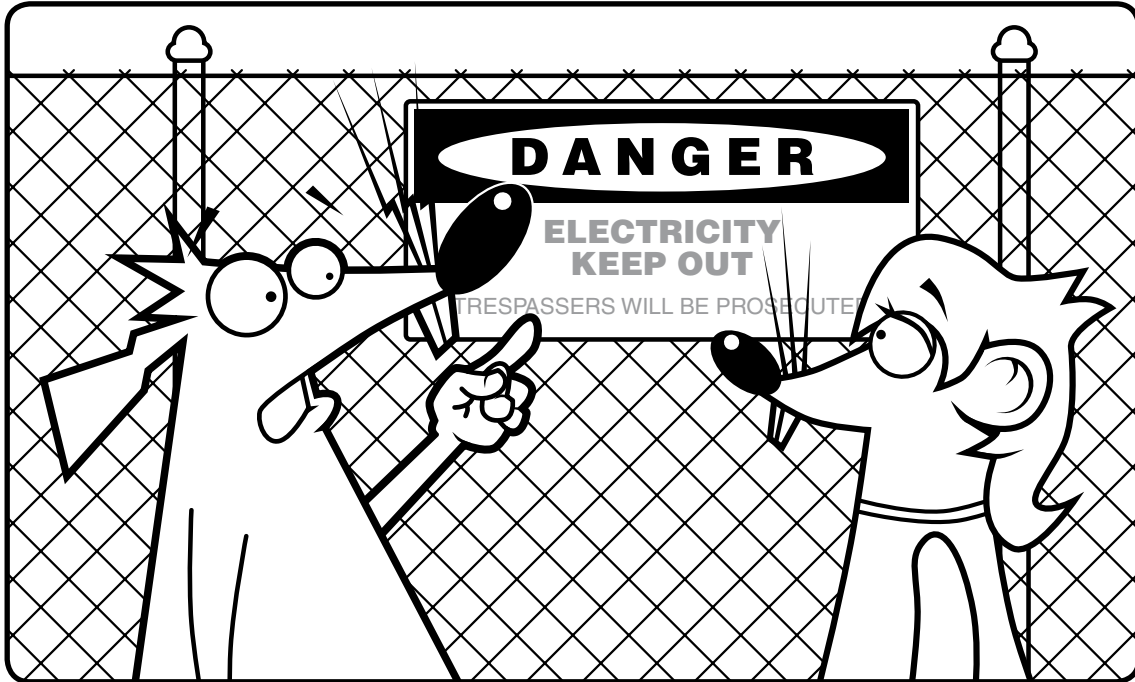


If we did not have this

Trespassers will be prosecuted

There are many different types of signs that we can see around our neighbourhoods. Many of them make us aware of dangers and help to keep us safe.

Discuss with other members of your class where you have seen a sign like this.



What does this sign mean?

What are trespassers?

What do you think might happen if you were prosecuted?

Why would someone put up a sign like this?

Life without electricity

If you had lived 200 years ago life would have been very different. You certainly would not have had electricity in your home.

Make a list of some of the things that would have been difficult to do around your home 200 years ago if you did not have electricity.

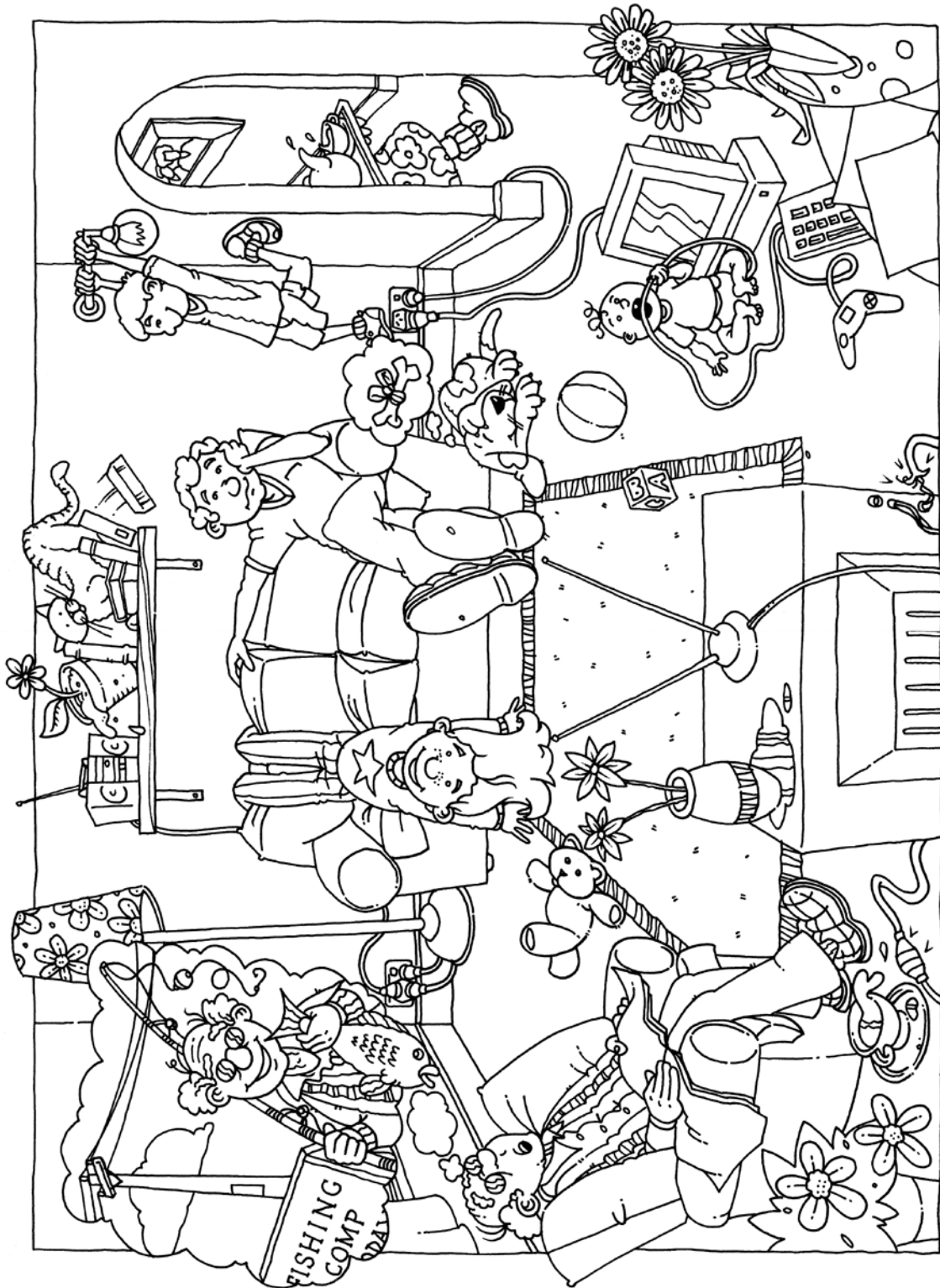
- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____

What do you think would have been the most difficult activity to get used to doing 200 years ago? Why?



Danger

It might look as though the people in this picture are safe, but they are not. There are ten different ways they might get an electric shock. Can you find them all?
Colour in the drawing and circle all the dangers.



Electric blankets

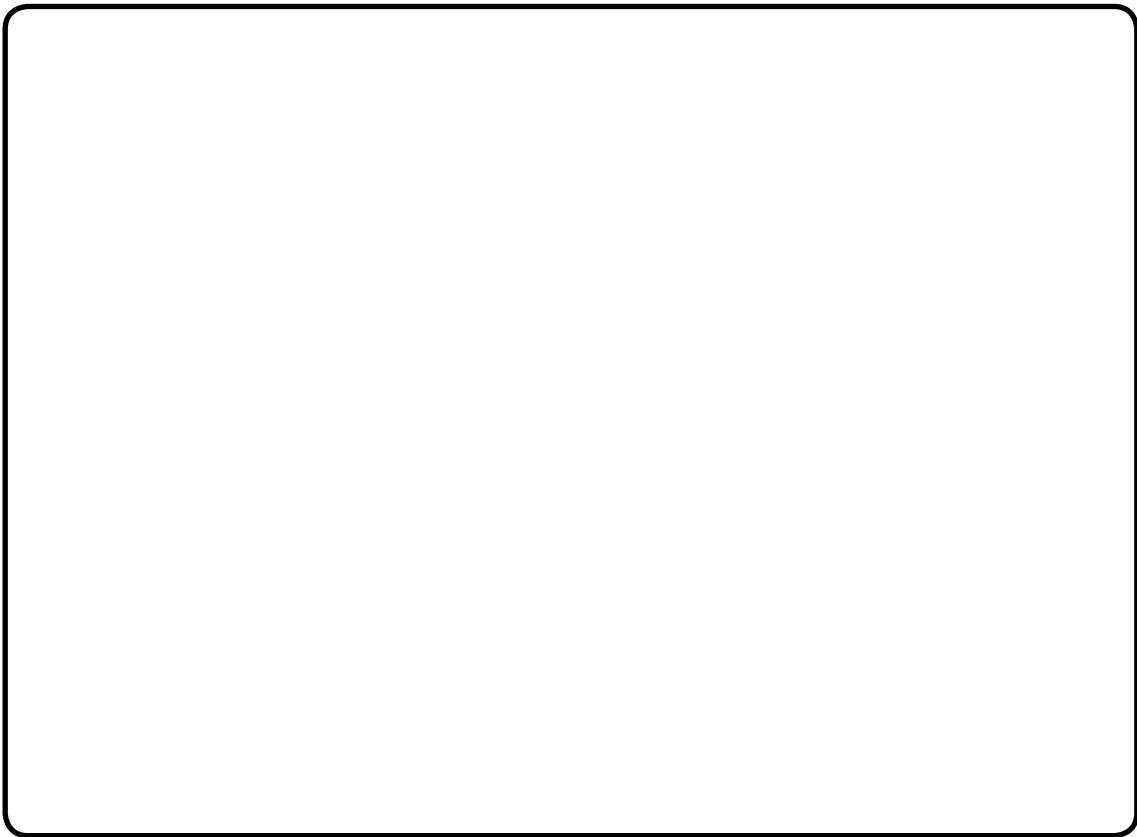
Electric blankets are very useful to have on cold nights, but they can be dangerous if used incorrectly.

The following is a list of rules that should be followed when using an electric blanket:

1. Children under 12 should not use an electric blanket.
2. Check the blanket carefully after storage for creases, folds or signs of damage, such as hot spots.
3. Switch off the electric blanket before you get into bed.
4. Do not heap things onto the bed as you will create a hot area.

What accidents can happen if you do not follow the rules?

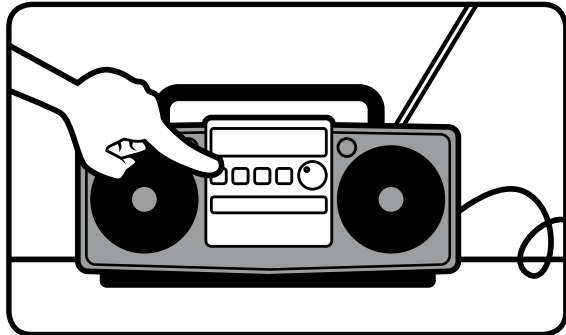
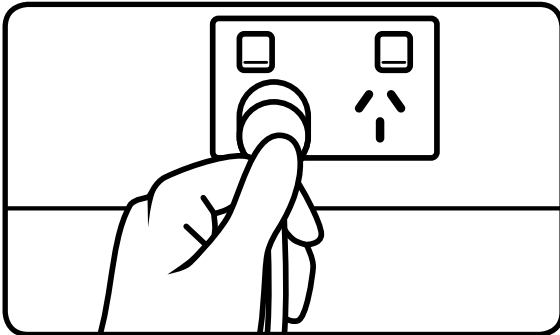
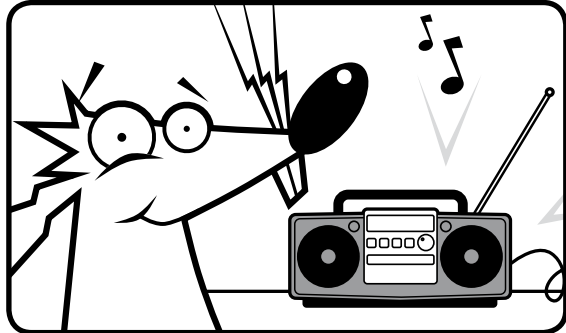
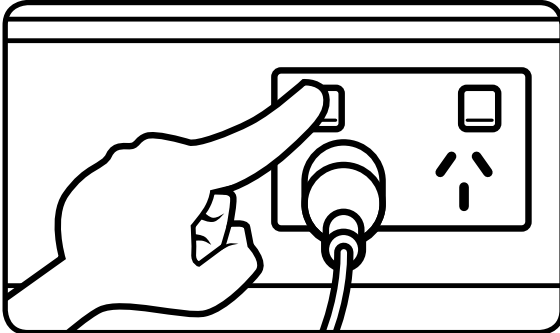
Draw yourself following one of the rules.



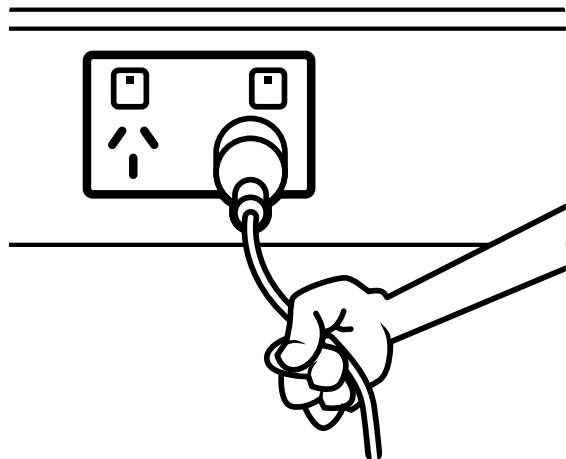
Power points

It is very important that everyone knows how to switch off a power point correctly.

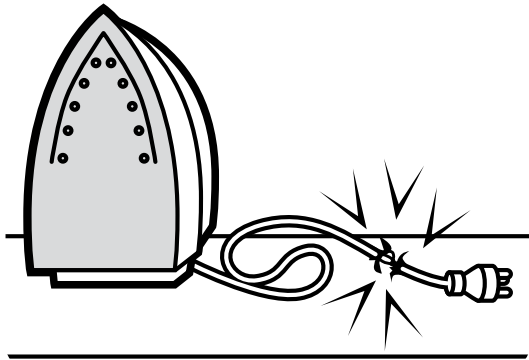
Look at these pictures. Put the numbers 1 to 4 in the boxes to show the correct order that is to be followed when disconnecting an electrical appliance.



Look at the picture opposite and write down what the person is doing wrong.



Cord dangers



What do you think is wrong with the iron?

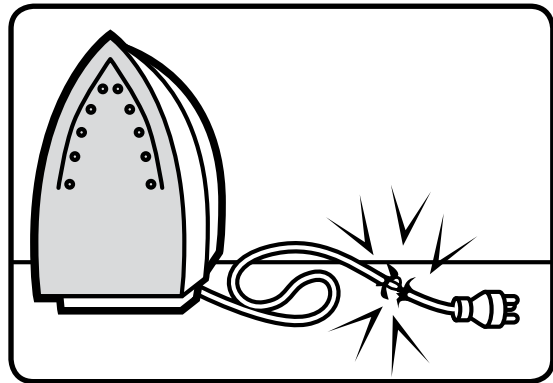
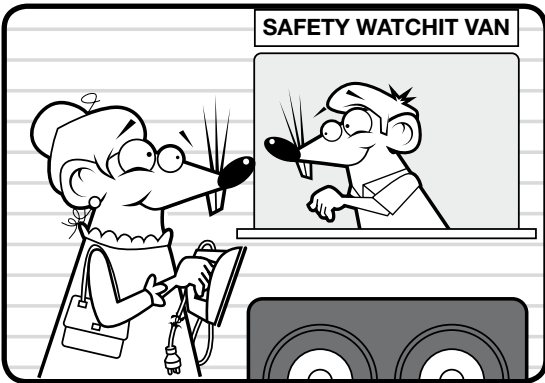
Why is it dangerous to use?

What will an adult need to do to make the iron safe?

Write what is happening in the two pictures below. Put a cross (X) next to the picture that is dangerous. Put a tick (✓) next to the picture that you think is safe.

1

2



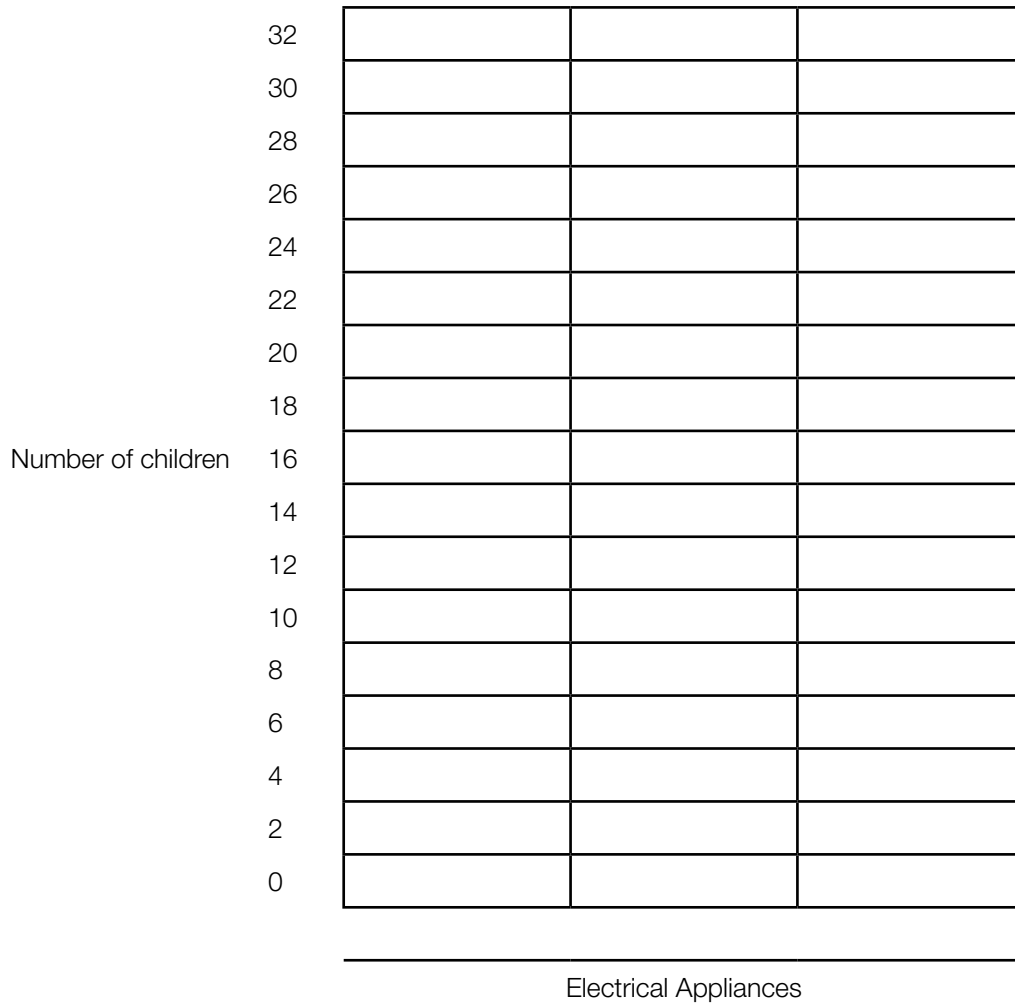
Bathroom dangers

Although it can be very dangerous to use certain electrical appliances in the bathroom lots of us use them every day.

List the electrical appliances that are sometimes used in bathrooms.

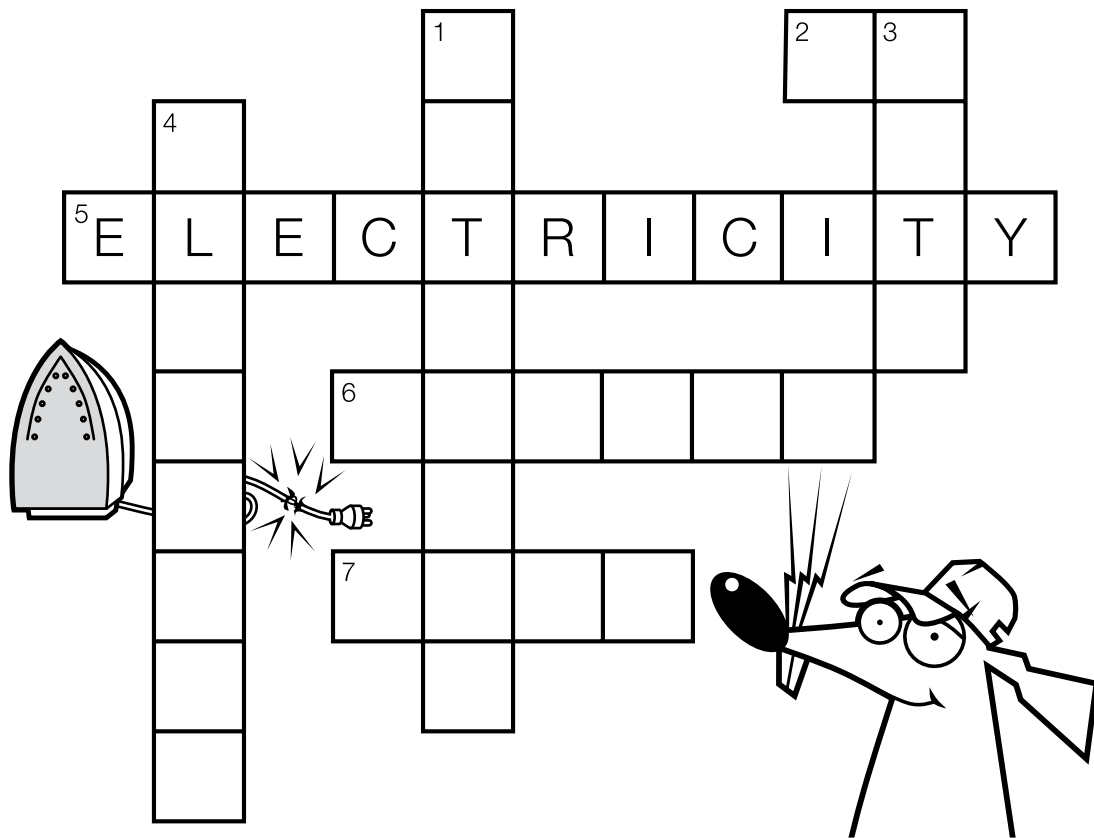
What is dangerous about using electrical appliances in the bathroom?

Carry out a class survey and record the electrical appliances that are used in their bathrooms. Colour the graph to show the top three appliances used.



Electricity crossword

Solve the clues to complete this electricity crossword.



ACROSS

2. Look _____ and live.
5. This helps us in our day-to-day lives.
6. You must never use _____ power cords.
7. Don't take the plug out of the power point by pulling the _____.

DOWN

1. The room that it is most dangerous to use portable electrical appliances in is the _____.
3. Electricity sometimes seeks a _____ to earth.
4. Children under twelve should not use electric _____.

Always be careful

Keep liquids like drinks away from electrical appliances like televisions, video cassette recorders, digital video devices and computers. They could spill and cause dangerous shocks and fires.

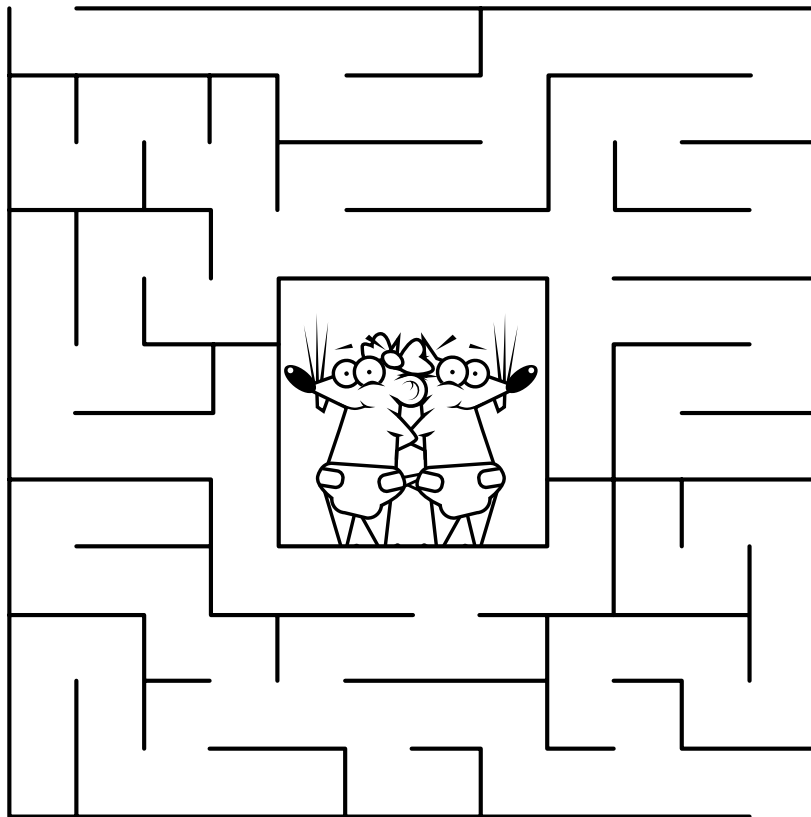
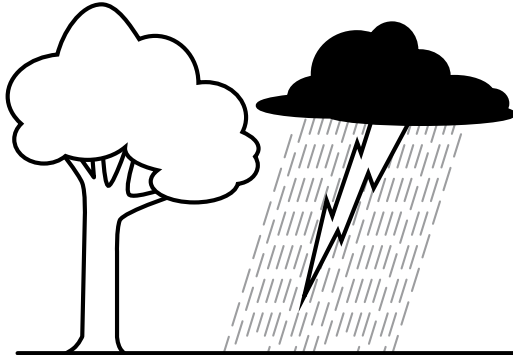
Colour in the picture and show where the danger is.



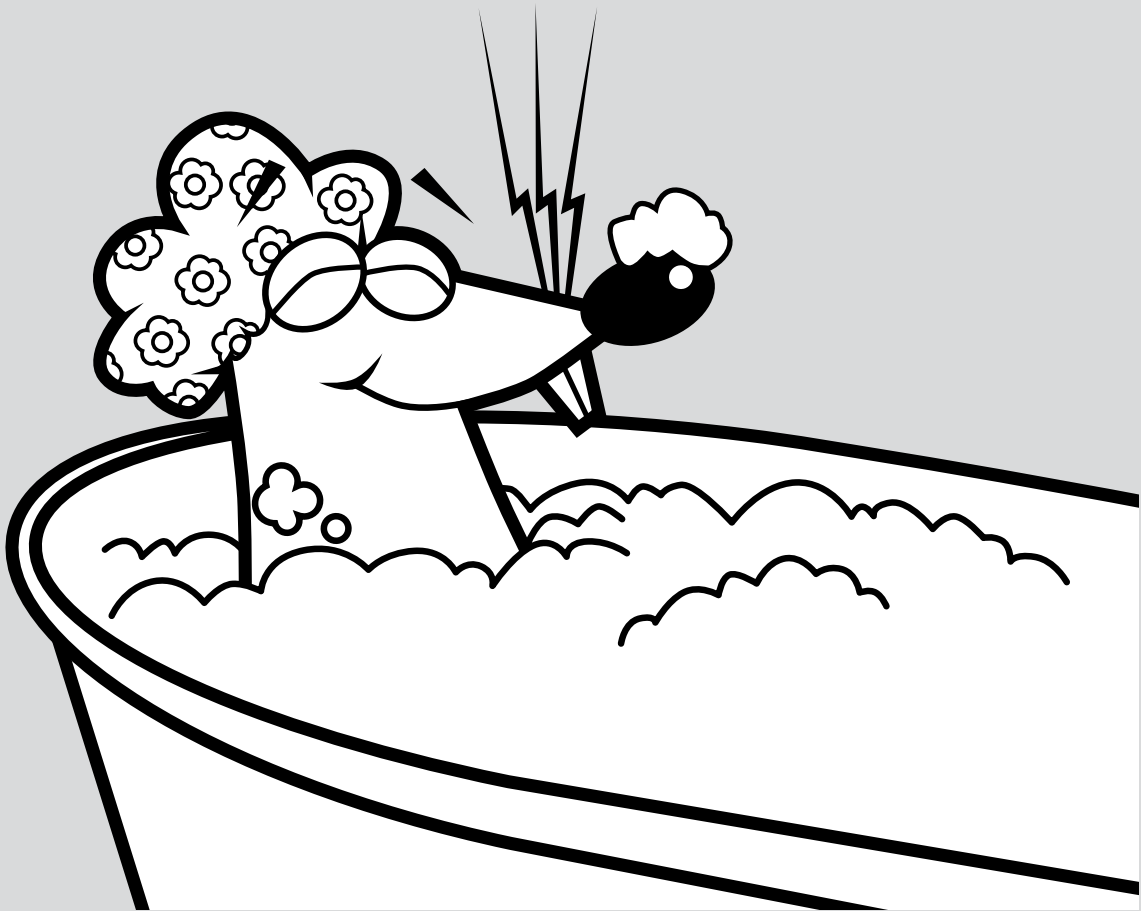
Lightning

When there is lightning, stay away from trees and get inside.

Help these children get to safety.



MIDDLE PRIMARY



Middle primary teacher's notes

5 Conductors and insulators

Conductors are materials that allow electricity to easily pass through them. Copper and aluminium are the two metals that are normally used for electrical wiring because they are good conductors. They are used for overhead Powerlines, underground power systems, residential and commercial property wiring, electrical appliances and cords.

Water is also a good conductor of electricity and that is why water and electricity is a dangerous combination.

Insulators are materials that will not readily allow electricity to pass through them. They are used to cover conductors to protect people and to separate “live” conductors from other conductors of electricity. Some examples are polyvinyl chloride (PVC) insulation on building wiring and ceramic insulators for overhead Powerlines.

6 Substations

These are enclosures with either brick or mesh fences. They contain transformers where the voltage is increased or decreased for distribution to residential and commercial customers. There are very high voltages inside substations and they are definitely a place to keep clear of.

7 Power points

The important rules to remember are:

- i. Switch off at the power point.
- ii. Withdraw the plug.
- iii. Never pull the plug out by the cord.

The two reasons for the above are:

- i. The switch has been specifically designed for switching the power on and off. Do not remove the plug without switching the power off. If the switch is not turned off, there is a possibility that you may receive an electrical shock from touching the live pins or a worn or damaged cord.
- ii. Pulling the plug out by the cord loosens the connections inside the plug. This could cause overheating, a short circuit or even a loose bare wire that could result in an electric shock.

Middle Primary teacher's notes (continued)

8 Frayed cords

Frayed cords can cause electric shocks and fires because they leave the wires uncovered and unprotected. Frayed cords may result in a leakage of current to earth.

If two or more of the wires are bared they may accidentally touch and create a spark, thereby creating a potential fire hazard.

Refer to Junior Primary teacher's notes for the following headings:

- | | | | |
|---|------------------------|---|--------------------|
| 1 | Water and electricity. | 3 | Pathways. |
| 2 | Overhead Powerlines. | 4 | Electric blankets. |

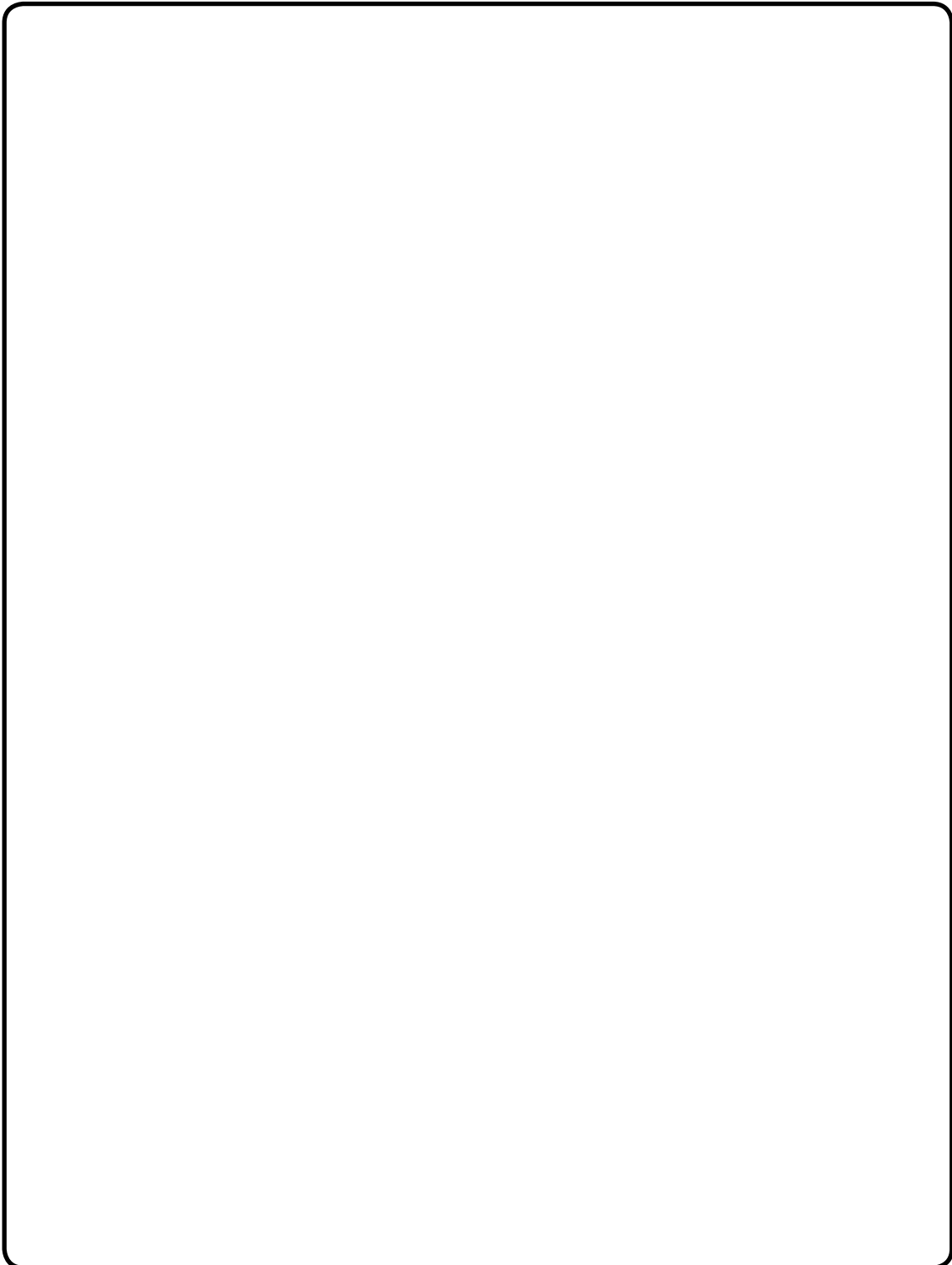
Refer to Upper Primary teacher's notes for the following headings:

- | | | | |
|----|------------------|----|---------------------------|
| 9 | Electric shocks. | 11 | Polyvinyl chloride (PVC). |
| 10 | Safety switches. | 12 | Double adaptors. |

Design a poster

You have been asked by the producers of “The tales of Socket and the gang” to create a poster to advertise the comic.

Remember to include the title, an exciting scene from the comic and a caption to describe what it is about. Also make sure that the poster is bright and appealing.



Your View

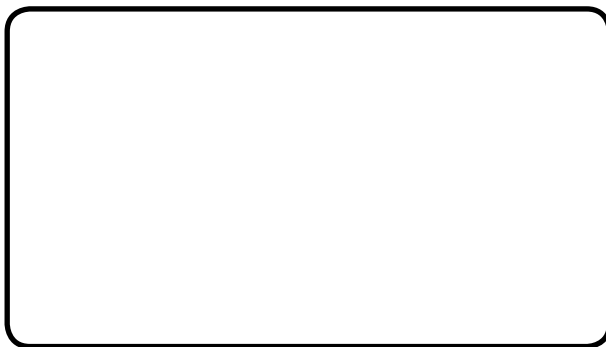
You have been asked to write a review of the comic book “The tales of Socket and the gang” for your school magazine. Read the comic carefully and complete the review form below.

Comic title

Main characters

In your opinion what “message” is being given in the comic?

How successful is the comic in getting its message across?



Create your own rating system and give the comic a rating. Compare your ideas with the rest of your class.

Electrical dangers 1

Why is this man in danger? Circle the correct answer:

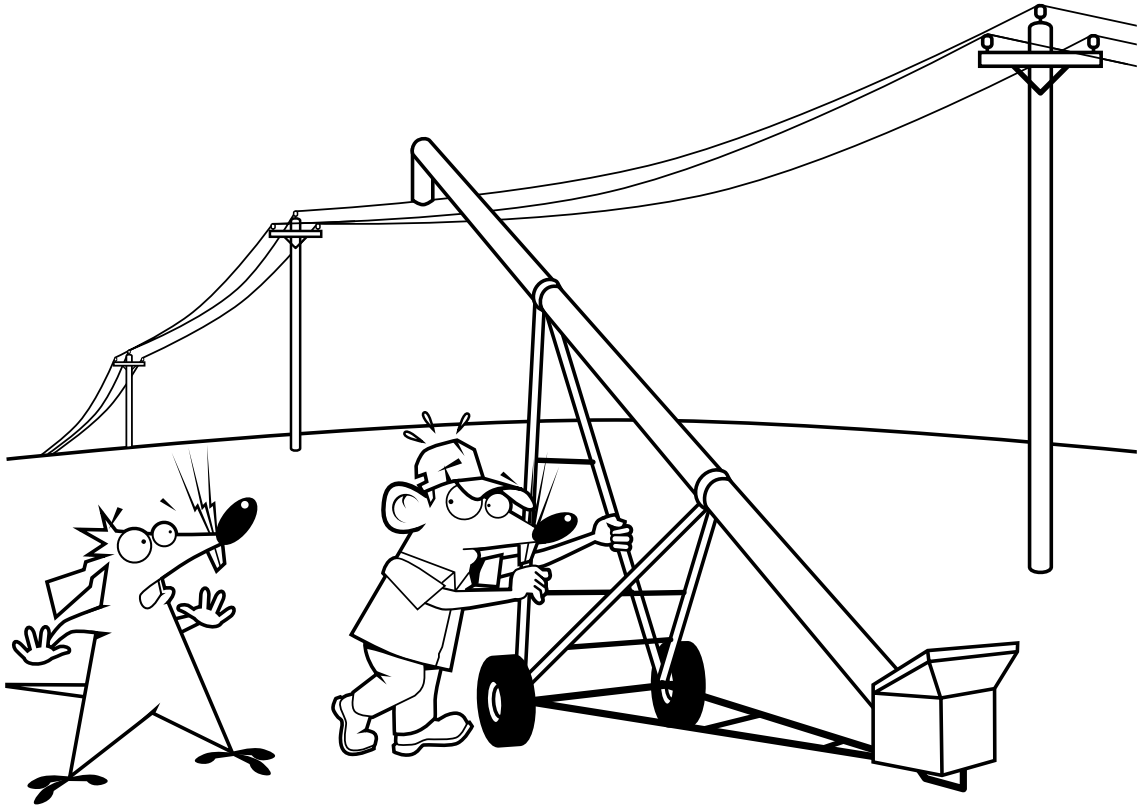
- 1 The ladder is too close to the house.
- 2 The man is wearing the wrong type of shoes.
- 3 He is climbing too close to the powerlines.



LOOK UP and LIVE!

Electrical dangers 2

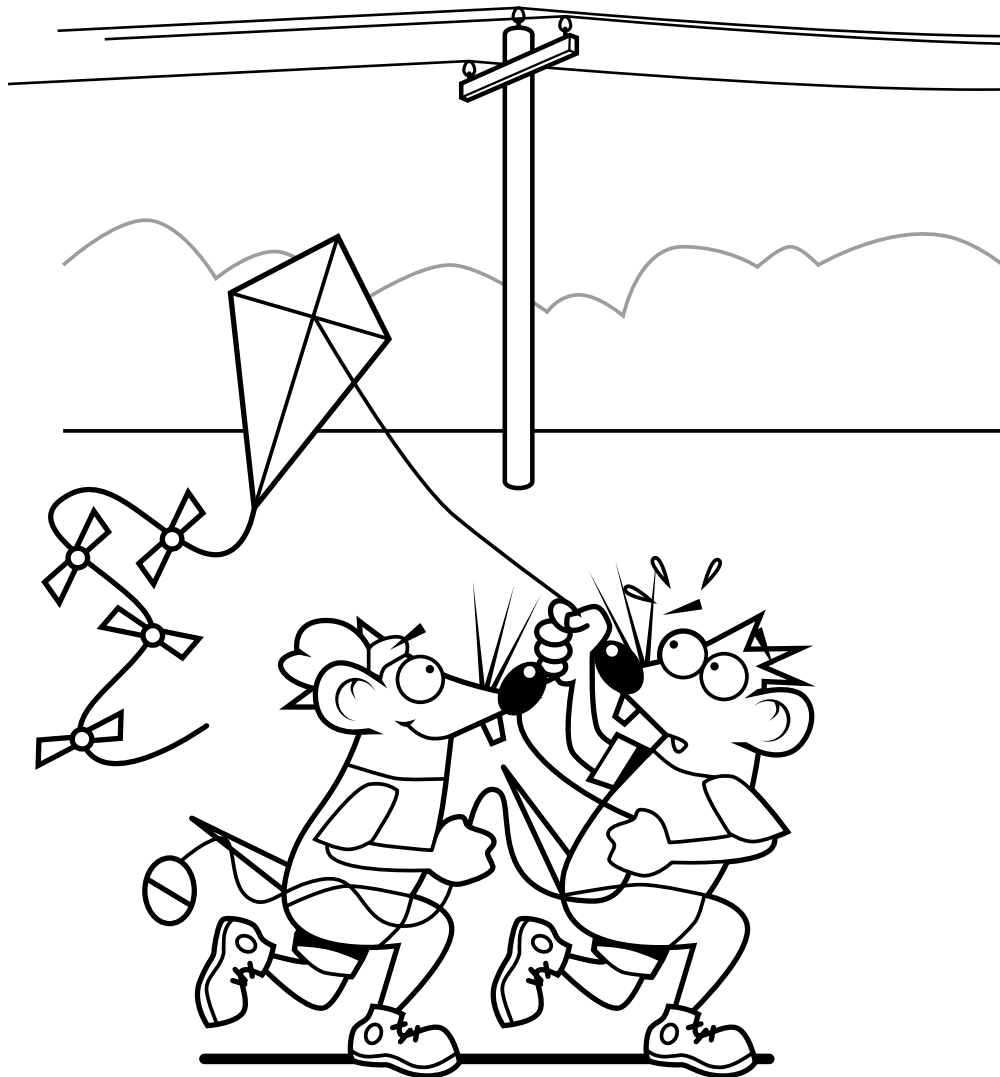
This worker is not obeying one of the safety rules. Do you know which one it is?



LOOK UP and LIVE!

Electrical dangers 3

The two children in the picture are going to fly their kite near the powerlines. In the comic "The tales of Socket and the gang" what does Electra say about this?



LOOK UP and LIVE!

Electrical dangers 4

Why is Socket handing Mr Smith a mobile phone? Circle the correct answer:

- 1 To call a neighbour to help plant the tree.
- 2 To call "Dial Before You Dig" on 1100 to locate buried Powerlines.
- 3 To call for pizza. He looks hungry.



LOOK DOWN and LIVE!

Look up, look down and live!

Remember:

- Overhead powerlines carry enough energy to turn almost anything into a conductor.
- The greater the voltage carried, the higher up the powerlines are, so stay away from them.
- Do not touch anything that is touching powerlines.
- When flying kites, choose an open space well away from overhead powerlines.
- If walking with long fishing rods, ladders or poles near overhead powerlines do not carry them upright.
- Before digging in the ground, "Dial Before You Dig" telephone 1100.
- If kites, tree branches or any object should get caught in overhead powerlines, do not attempt to retrieve it yourself. Call 13 13 51.

In "The tales of Socket and the gang" there are six safety messages.

Can you remember them?

1

2

3

4

5

6

A blast from the past

Imagine that you have just woken from a very, very long sleep. You learn that the year is 2007! You have been asleep for 200 years.

Many things have changed considerably since you were last awake. One thing that has affected everybody's day-to-day lives is electricity.

Write a journal of your first five days in the 21st century, attempting to explain some of the new inventions that you have seen. Write about whether you think that these inventions are good for people or not, and why?

The image shows a spiral-bound notebook page with five days of journaling space. Each day is labeled 'Day 1' through 'Day 5' and has three horizontal lines for writing. The spiral binding is on the left side.

Day 1

Day 2

Day 3

Day 4

Day 5

What is important?

Electricity saves and protects us all in many different ways.

Select five of the items listed below and number them in order of importance. Add any of your own if you wish.

<input type="checkbox"/>	traffic lights	<input type="checkbox"/>	iron lung	<input type="checkbox"/>	humidicrib
<input type="checkbox"/>	humidifier	<input type="checkbox"/>	telephone	<input type="checkbox"/>	alarms
<input type="checkbox"/>	smoke detector	<input type="checkbox"/>	street lights	<input type="checkbox"/>	television
<input type="checkbox"/>	electric heater	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____

Which do you think is the most important?

Why?

Organise the items listed above into groups that contain similar things. When you have listed the items, give each group a title, for example, hospital items.

Electricity and school

We use electricity all the time throughout our day-to-day lives. Just imagine what it would be like if we did not have electricity in our schools.

List some of the activities that we would be unable to do at school if we did not have electricity.

Of course, computers and photocopiers have become an important part of our school life. In the boxes below show how things would be done if you did not have electricity in your school.

Which do you think is the better way? With or without electricity. Why?

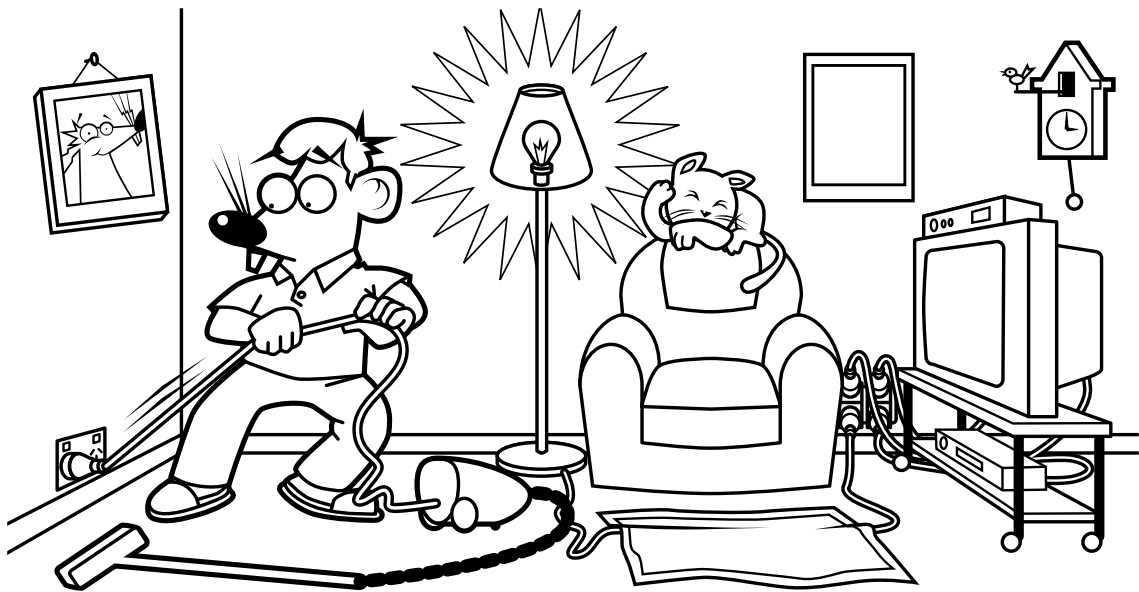
Power plugs

We have many electrical appliances in our homes that need to be plugged into a power point.

Discuss as a class the correct method of removing a plug from a power point. List all the steps for safe plug removal.

What accident could happen if these steps are not followed?

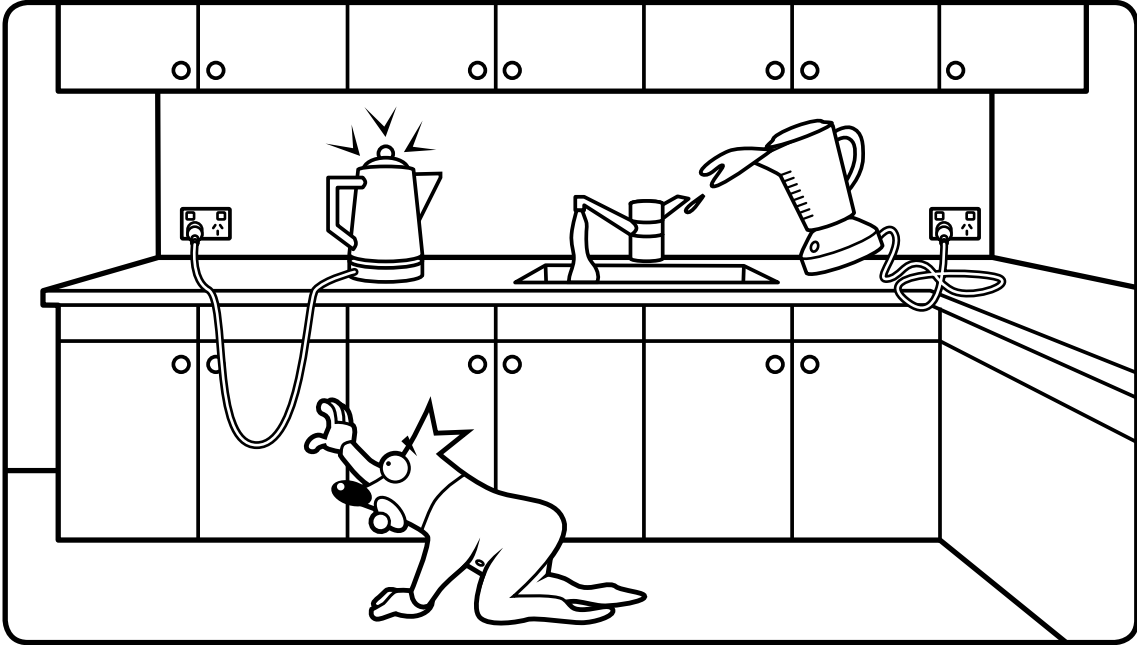
Can you help Socket find the four electrical dangers in the picture below? Underline the correct answers.



- Electrical cord under the mat.
- Crooked picture.
- Cat on the chair.
- Too many cords in the power point.
- Noisy cuckoo clock.
- Too many things that use electricity.
- Dad pulling the vacuum cord.
- Light bulb too bright.
- TV too heavy for the stand.

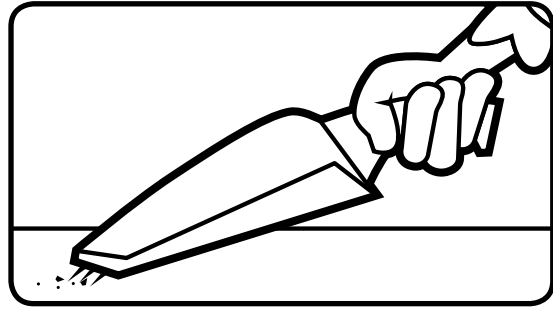
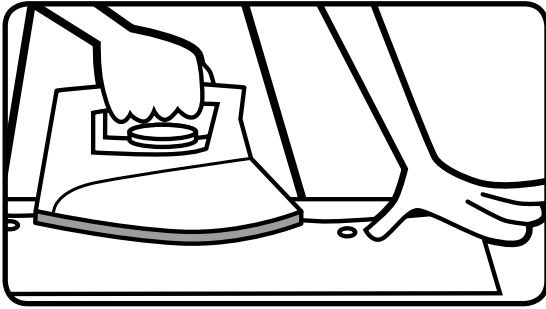
Power plug dangers

As a class, discuss the following two pictures and highlight the electrical dangers in each.



What should be changed in both these situations?

Cord or cordless?



Look through some spare magazines or newspapers that you have at home and cut out a picture of one appliance that is cordless. Paste it into the box below.

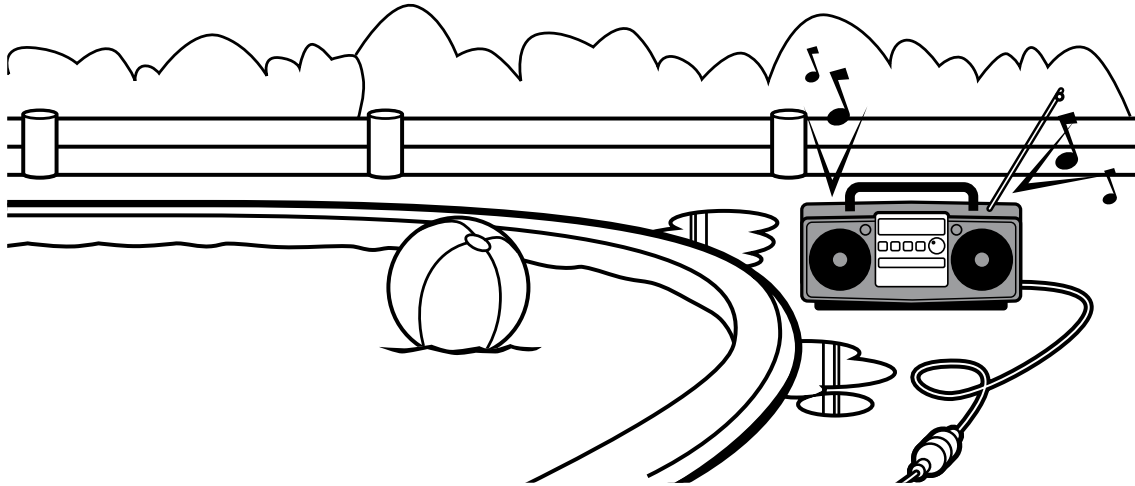
Where do these cordless appliances get their power?

What are some of the advantages/disadvantages of using cordless appliances?

A Dangerous combination

If you are wet or standing in water and you touch something electrical, you could easily get an electric shock. In your bathroom, kitchen and laundry and around swimming pools keep all electrical appliances away from the water.

What electrical danger can you find in the picture below?



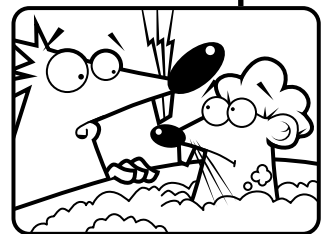
What happens when electricity and water meet?

In the boxes below draw two other dangerous situations involving water and electricity.

Water and electricity

Make up a slogan warning others about the danger of water when it comes into contact with electricity.

Place your slogan on a poster. Use different lettering and colours to make it bright and eye-catching. You may wish to paste in magazine pictures or lettering.



Discuss with your class where you could display your poster. For example, it could be around the home, school or at your local library.

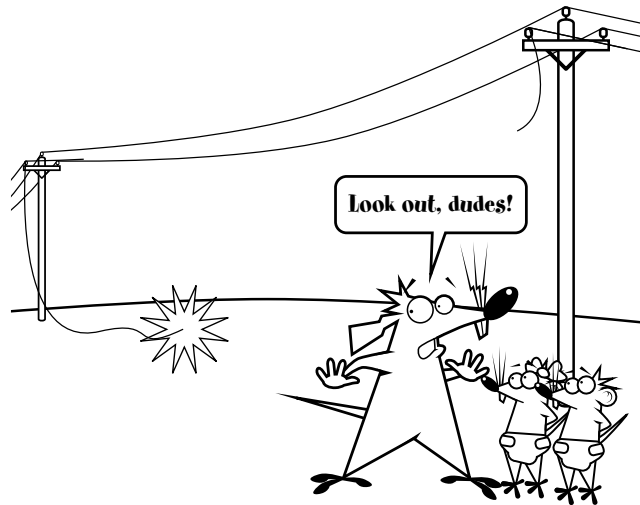
Consequences of the Action

Western Power looks after the power poles and powerlines so that we can all have electricity to use.

Unfortunately, there are times when some members of the community cause deliberate or thoughtless damage that will affect the supply of electricity.

Think about, and write down the consequences of the following:

A thief has broken a marker pole and removed the written plate indicating that there are underground powerlines nearby.



While throwing stones at powerlines a group of children accidentally make one line fall to the ground.

Someone kicks the plastic power point cover, causing it to crack.

Children are using an extension cord as a rope during a game and the end begins to come away from the plug.

Someone peels off the safety instructions from an electrical appliance.

On the spot reporting

Imagine that you are a member of a television crew sent to report on some fallen powerlines. Your job is to conduct an interview with the witness who followed the correct procedure in order of urgency. Write three of the questions you would ask. Find a partner to act as the witness write down their answers. Remember to get all of the facts. You may need to interview several people before you get the best answers.



Reporter question 1

Witness answer

Reporter question 2

Witness answer

Reporter question 3

Witness answer

What to do

While walking to a friend's house you pass by an electrical substation. The signs around the substation make it quite clear that trespassing on the property is illegal.



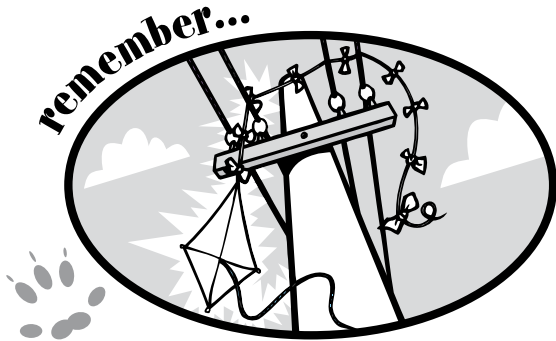
You see someone climbing over the fence to retrieve a football that has been kicked inside the substation.

What do you do?

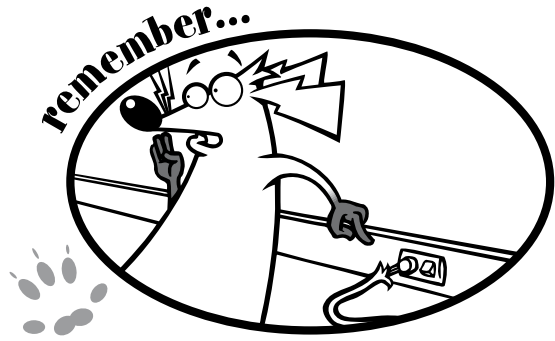
Which option would you choose? Why? You may wish to act out these situations before you make your final choice.

List the dangers of entering a substation.

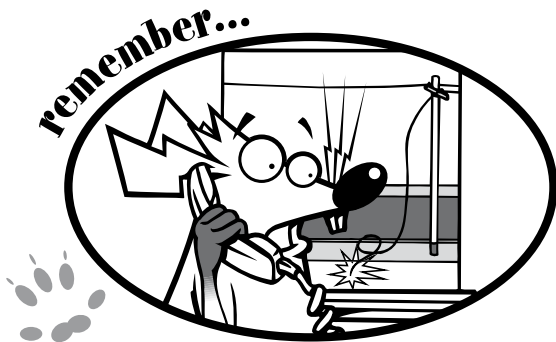
Six safety rules to remember



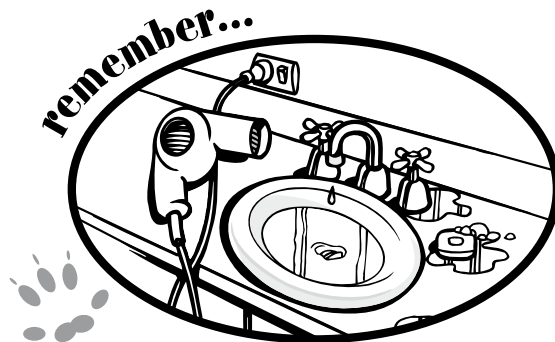
Be careful around electricity power poles and wires when you play!



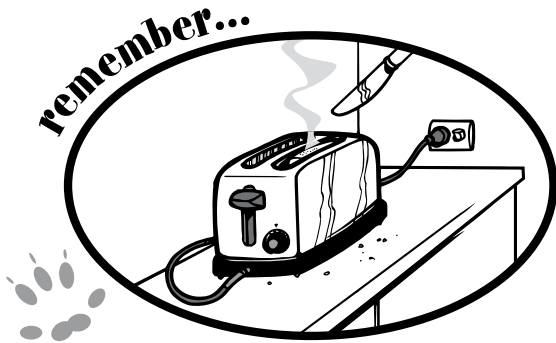
If you see a dangerous situation tell an adult!



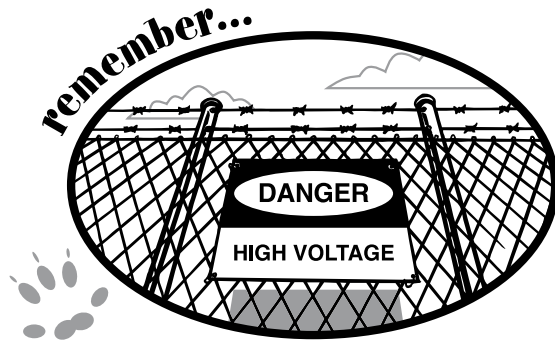
Know what to do in an electrical emergency!



Electricity and water do not mix!



Metal is a conductor of electricity and can be dangerous!



Stay away from electricity substations!

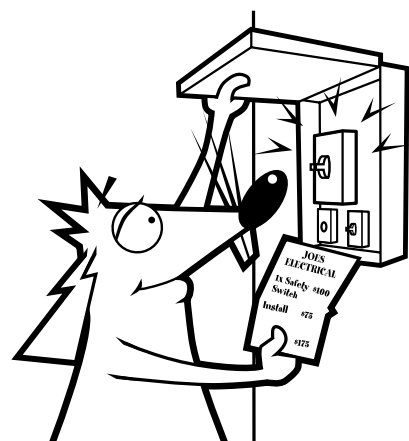
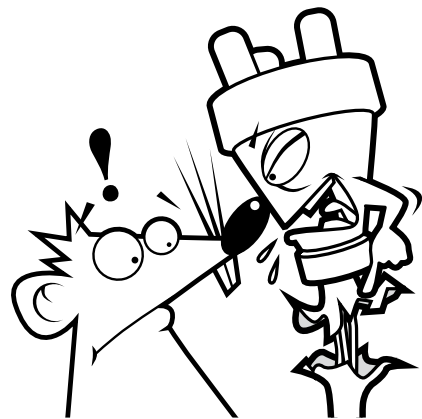
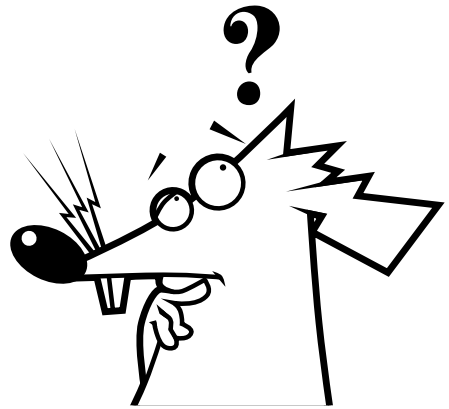
Can you think of any other safety rules that you should remember?

Using electricity

Quiz – Are you switched on to electrical safety?

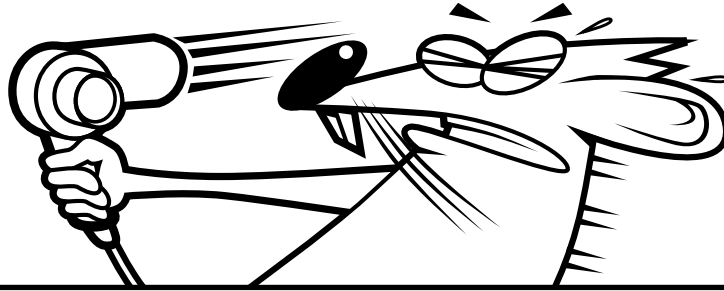
Read each statement carefully and decide if it is true or false. Write T or F in the box.

1. You should always dry your hands before touching appliances or switches.
2. In the bathroom it is very dangerous to leave a hair dryer turned off but still plugged in next to the basin.
3. If a cord is broken you should wrap electrical tape around it.
4. Grabbing the cord to pull out a plug can loosen the connections inside the plug.
5. Electricity will flow through your body.
6. It is OK to have bare feet when you are using an electrical appliance outside.
7. If an appliance or plug catches fire you should never use water to put it out.
8. You should always wear rubber-soled shoes when you use the washing machine.
9. A short circuit is the easiest path for electricity to follow.
10. Babies are too small to get hurt if they poke things in a power point.
11. It doesn't matter how many appliances you plug into one outlet.
12. You will be quite safe if you touch bare live wires with only one hand.



Using electricity (continued)

13. Only metal things will conduct electricity.
14. Regular maintenance of appliances can help prevent accidents.
15. If an appliance gives you a small shock discontinue use of the appliance and have it checked.
16. If linespeople and workers on substances can touch electrical wires then they must be safe for anyone to touch.



How many did you get right?

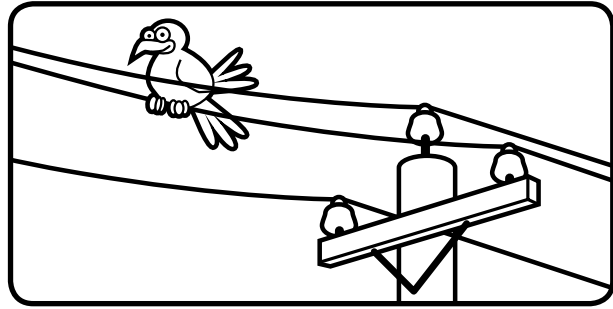
As a class discuss all the questions in the quiz and the reasons why they are true or false.

Finding out for yourself

Powerlines:

- Have you ever looked up at the powerlines and seen birds standing on the wires?
- Why don't they get electrocuted?

Look this up in an encyclopaedia or on the Internet to find the answer.

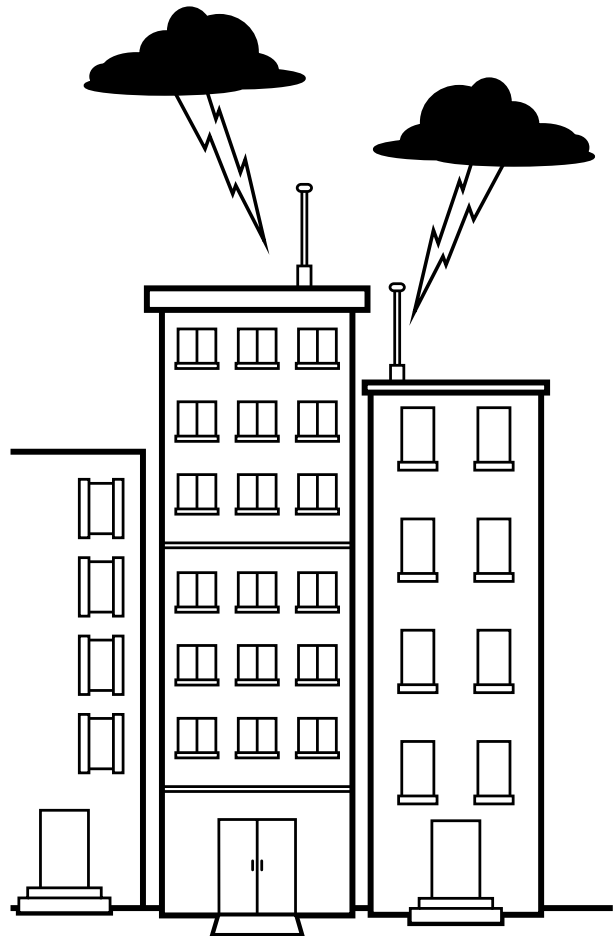


How does electricity get into our homes when we do not have overhead powerlines?

Lightning:

- Is lightning electricity?
- Why do buildings have lightning rods?
- What happens if a person is hit by lightning?

Look up "lightning" in an encyclopaedia or on the Internet and see if you can find the answers to the above questions.



Word sleuth

Can you solve the word sleuth below and find all the electrical words contained within it?



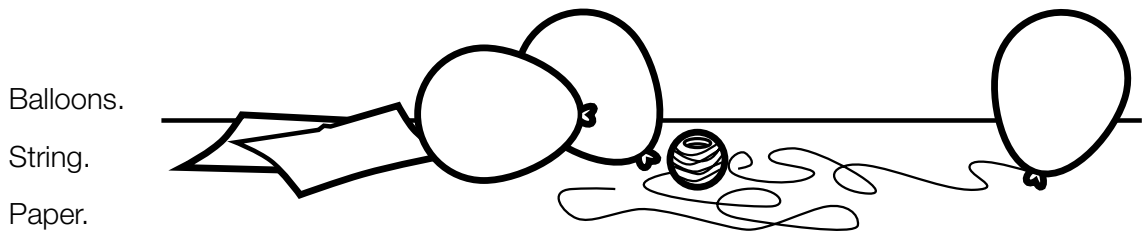
- | | | |
|------------|--------------|---------|
| repair | vandalism | path |
| power | power points | socket |
| plug | electrician | live |
| connection | powerlines | water |
| shock | electricity | blanket |
| cord | appliance | safety |
| wire | substation | switch |

E	L	E	C	T	R	I	C	I	T	Y	P
L	S	T	N	I	O	P	R	E	W	O	P
E	O	S	W	I	T	C	H	A	U	L	O
C	C	O	N	N	E	C	T	I	O	N	W
T	K	V	A	N	D	A	L	I	S	M	E
R	E	P	A	I	R	D	A	L	M	O	R
I	T	N	E	V	I	L	D	I	S	R	L
C	W	A	T	E	R	L	R	Y	A	B	I
I	E	A	L	R	P	P	O	W	E	R	N
A	P	P	L	I	A	N	C	E	I	G	E
N	G	H	U	W	T	N	K	C	O	H	S
K	U	A	N	D	H	Y	T	E	F	A	S
B	L	A	N	K	E	T	N	I	C	E	T
U	P	N	O	I	T	A	T	S	B	U	S

Electrical fun

Have you ever noticed how your hair crackles after it has been washed and you are either combing or brushing it? This is a form of electricity called static electricity.

Try the fun experiments below using the following simple equipment.



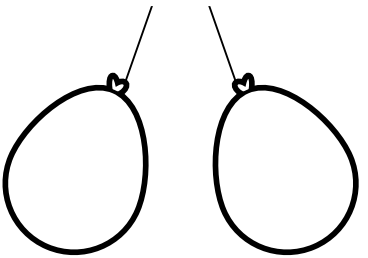
Blow up a balloon and tie the neck into a knot. Rub part of the balloon onto your clothes, or with a clean dry cloth. Place the balloon onto the wall or window.

What happens?

Why?

Join the balloons with a piece of string. Electrify the balloons by rubbing them and then hang them as shown in the picture.

What happens?



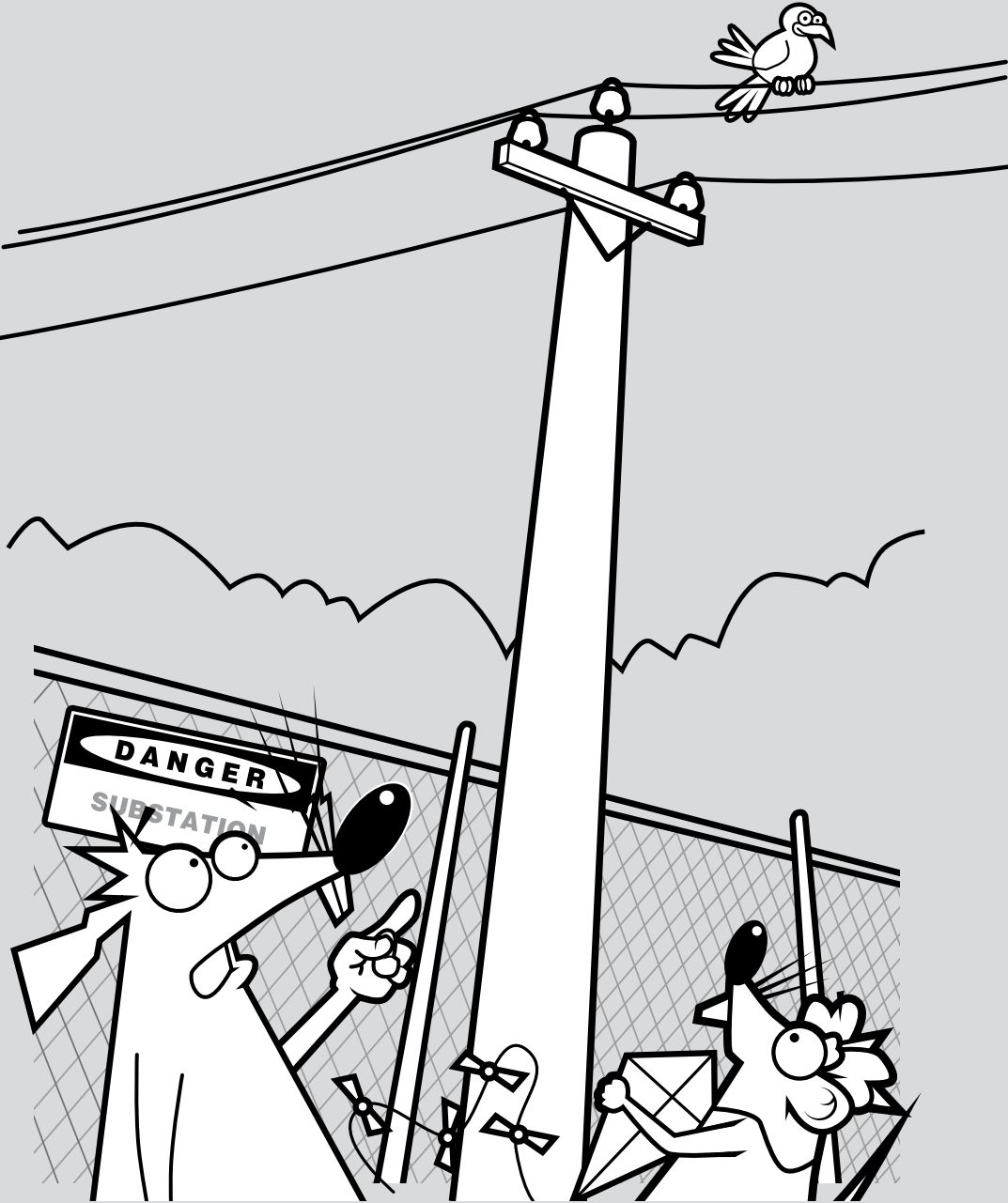
Why?

Now place a piece of paper in between the two balloons. After a while remove it.

What happens?

Why?

UPPER PRIMARY



Upper primary teacher's notes

9 Electric shock

When appliances, cords and extension leads are in good condition and used sensibly, electricity is completely safe. However, people are not always sensible.

Carelessness can cause leads to fray and then appliances and tools become faulty. These faults may cause electrocution.

When a person comes in contact with electricity he or she will receive an electric shock.

The severity of this shock depends upon:

- i. How much current is flowing through the body.
- ii. The path the electricity takes through the body.
- iii. The amount of time that the person is exposed.

The effects of electric shock on the body can be:

- i. Breathing can stop.
- ii. The heart can stop.
- iii. Burns to the skin.
- iv. Muscle spasm.
- v. Clinical shock.

There are three steps to be followed when dealing with an electrical accident in the home.

They are:

Step 1: Spot the hazard

- Spot the hazard and stay calm.

Step 2: Assess the risk

- Assess the risk but do not touch the victim.

Step 3: Make the changes

- Turn off the electricity at the switchboard if you are in a house or building.
- Phone 000 for emergency help.
- Call a neighbour for help.
- If the area has been cleared and it is safe, apply resuscitation first aid techniques if you know them.

Stay calm.

Why? Staying calm allows you to think clearly and act quickly whilst avoiding being hurt yourself. Staying calm allows you to be of maximum help to the victim. If you panic, you will not think clearly and take longer to be of any help. If you also get hurt, the situation will get worse for everyone.

Upper primary teacher's notes (continued)

Do not touch the injured person.

Why? Electricity can travel through water and people or animals, so don't step in any water near the victim or touch them until the electricity has been turned off.

Turn off the electricity at the switchboard.

Why? If possible turn off the electricity supply at the main switchboard. This will ensure that the current does not continue to pass through the victim. Remember, the amount of current that flows through the body will affect the severity of the electric shock. See Junior primary teacher's Note 3 – Pathways.

What if I cannot turn off the electricity?

Use a wooden broom handle or rolled up newspaper to knock the appliance or wires away from the victim. Remember, the shorter the time the current flows through a person the greater their chance of survival.

This technique should never be used to knock high voltage street wires out of someone's hand.

10 Safety switches

A safety switch is an electrical safety device specially designed to immediately switch the electricity OFF when electricity "leaks" to earth at a level harmful to a human. These devices offer a high level of personal protection from electric shock. Safety switches must not be confused with circuit breakers or fuses.

Circuit breakers and fuses provide equipment and /or installation protection and operate only in response to an electrical overload or short-circuit when high fault currents flow. They do not offer protection to humans.

A safety switch will significantly reduce the risk of electrocution. On a circuit protected by a safety switch, if a fault causes electricity to flow from active to earth through a person's body, the safety switch will automatically disconnect the electricity supply, avoiding the risk of death or serious injury.

11 Polyvinyl chloride

PVC (polyvinyl chloride) tape does not repair broken appliances. It is an insulator but it does not keep water from getting into the cord. Also, it does not protect the insulated wires in the cord against heat. Without the correct protection heat could melt the insulation and expose bare wires.

Remember, if the appliance has a frayed cord do not attempt to repair it yourself. Take it to a qualified electrician or the Synergy Energy Safety Watchit Van.

Upper primary teacher's notes (continued)

12 "Piggy-Back" – double adaptor arrangements

Double adaptors are designed to convert one power outlet to two, but no more than two.

Household power points are designed to safely deliver 10 amps if used correctly.

Increasing the number of outlets using double adaptors or a power board divides the current. So, if you wanted to run several appliances that draw only a small amount of current such as a stereo, TV or desk lamp, a power board or double adaptor should be used. However, be very careful when using appliances that heat up such as toasters and kettles, or have moving parts like drills. Heating or getting parts to move requires more energy, so these appliances draw considerably more current than computers and radios that do not have moving parts. Running more than one appliance from a standard power point could cause power boards and double adaptors to heat up creating a potential fire danger.

If you use a power board, it should have an overload cut out switch. This ensures that you do not overload the power board. The cut out switch will break the circuit and stop electricity flowing through the appliance.

Refer to the Junior primary teacher's notes for the following headings:

- | | | | |
|---|------------------------|---|--------------------|
| 1 | Water and electricity. | 3 | Pathways. |
| 2 | Overhead powerlines. | 4 | Electric blankets. |

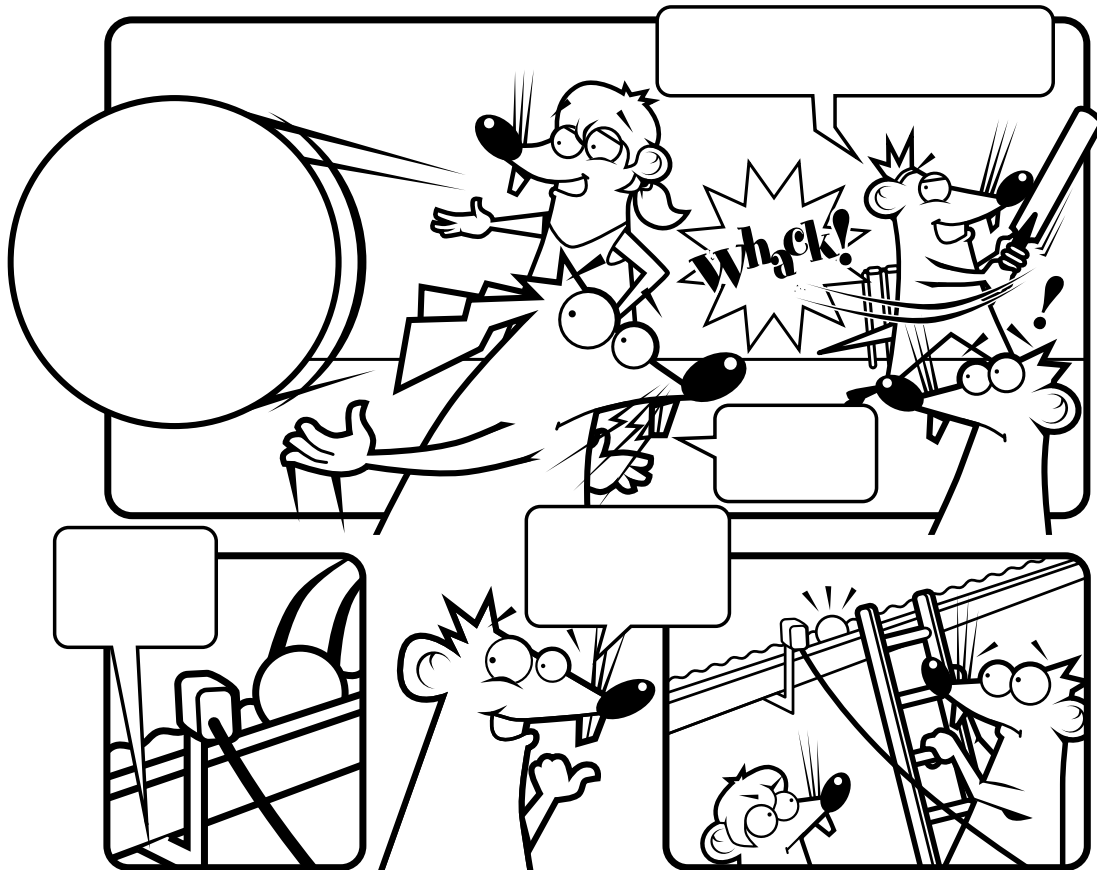
Refer to the Middle primary teacher's Notes for the following headings:

- | | | | |
|---|----------------------------|---|---------------|
| 5 | Conductors and insulators. | 7 | Power points. |
| 6 | Substations. | 8 | Frayed cords. |

Make a safety statement

Look very carefully at the comic book “The tales of Socket and the gang”. Comic strips are a group of cartoons that tell a story. They contain story elements such as the setting, plot and characters. They often use humour to draw attention to something bad or foolish. Ideas that are hard to understand through words on their own can be made into a good comic strip.

What story is the comic strip below telling?



Write down at least five different safety messages that you have learnt. Next to each message write down your ideas about how you could present it in a comic strip.

Safety message.

How to present it.

Pick one of the safety messages and write down the types of characters that will help you illustrate the story. Now draw a comic strip that tells your electrical safety message.

What happened?



When the corrugated sheeting flew into the Powerlines during a storm it caused the power to go out in your suburb.

Write down how you think the following situations will be affected by the loss of power.

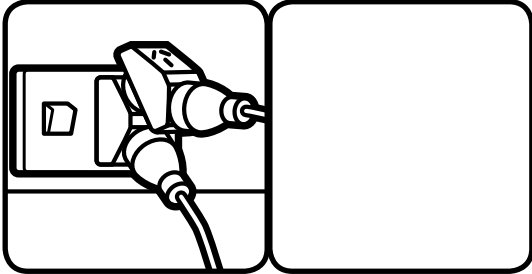
Shopping centre open for late night shopping.

Service station owner.

Mum trying to cook the family dinner.

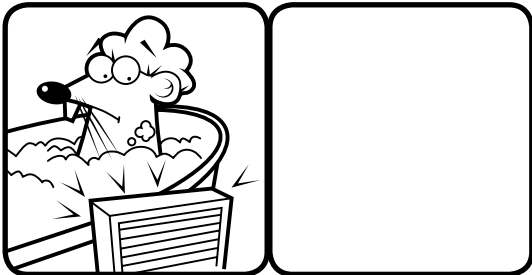
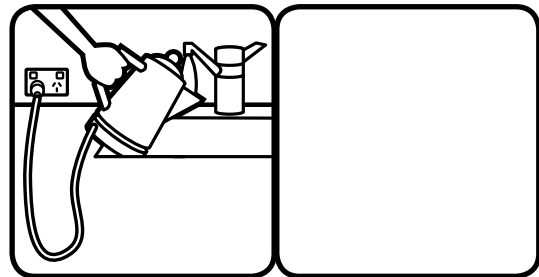
Dangerous situations

What are the dangers contained in these pictures? Write down what you think they are next to the box and then draw how the situation should be handled safely.



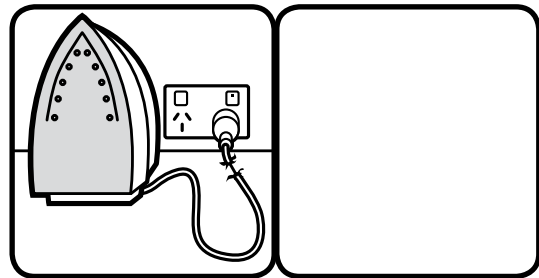
1 _____

2 _____



3 _____

4 _____



Which situation do you think is the most dangerous? Why?

Design a poster that can be used to warn people of this dangerous situation.

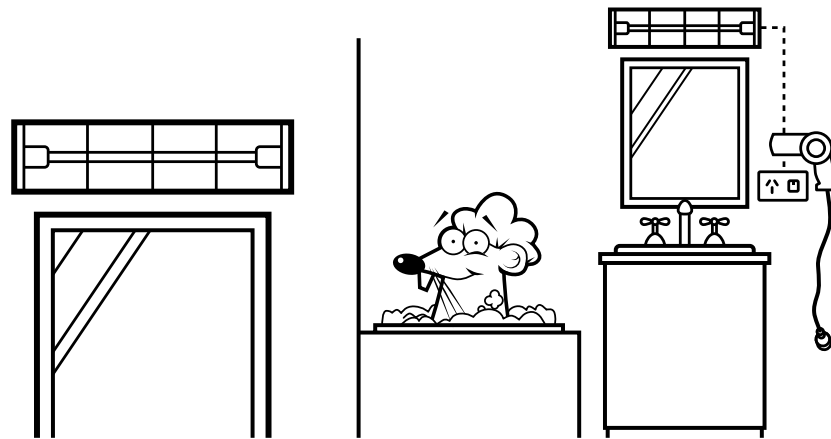
Water and electricity do not mix

You have been asked to finish developing three electrical safety posters about the dangers of water and electricity.

The artwork has already been completed. The first poster is about mixing electricity and water in the bathroom and uses picture 1. The second poster relates to electrical hazards in the laundry and the third poster is about electricity and water outside the home.

Design the safety messages for each poster.

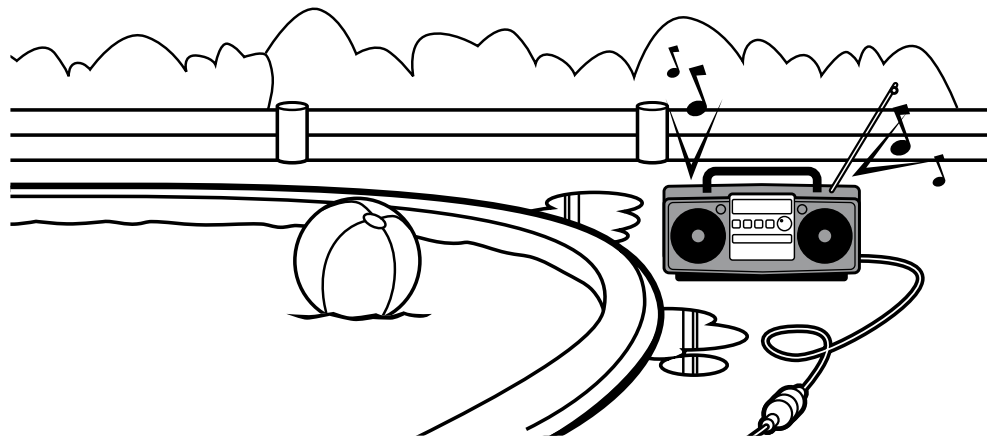
Poster 1



Poster 2



Poster 3

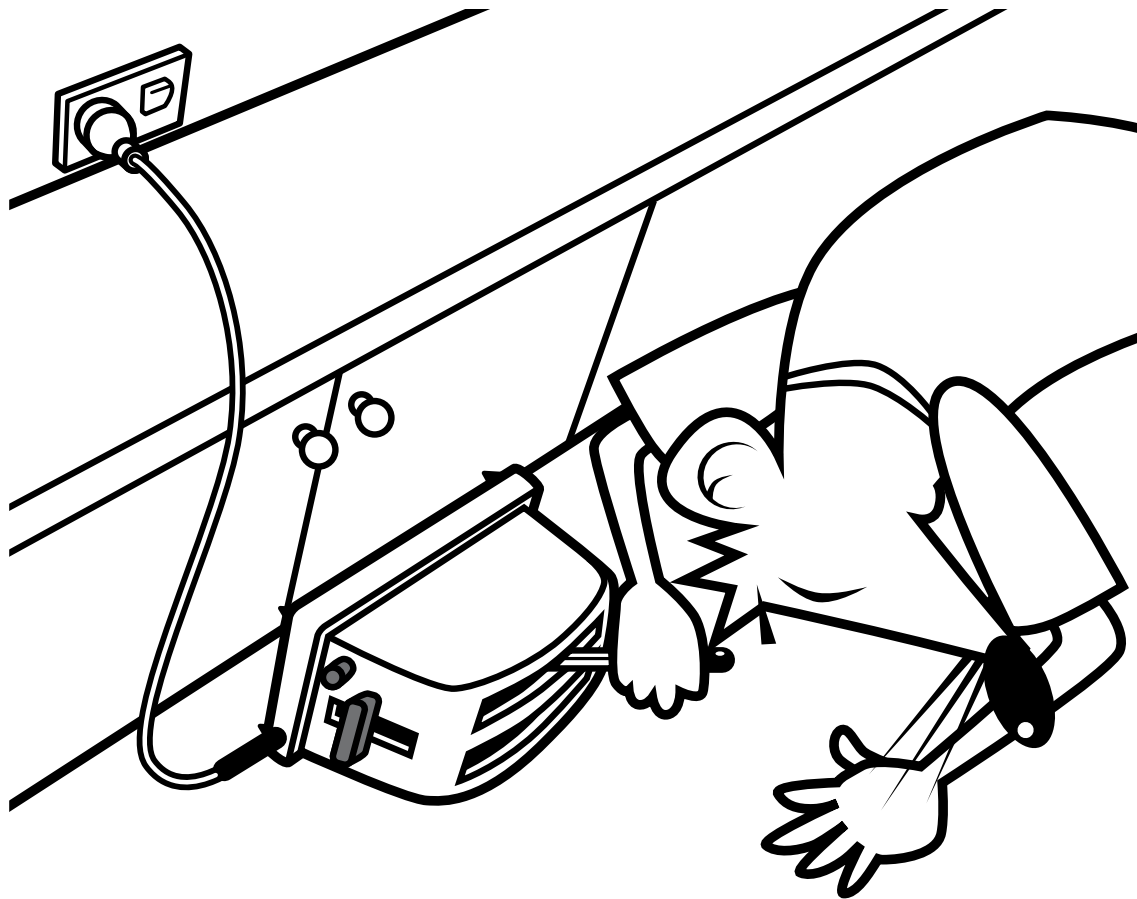


An electrical emergency

Imagine that you have just returned home to find a member of your family lying sprawled on the kitchen floor with their fingers around a metal knife that is sticking in the toaster. The toaster is still switched on at the wall socket.

Split the class into pairs. Each pair will then discuss among themselves what they should do in this situation. When all pairs have decided what should be done, act out a simulation in front of the rest of the class. Use whatever props are available. As a minimum you will require something that represents the wall socket, a toaster and a knife.

Once each pair has completed their simulation the rest of the class should comment on whether the actions were safe, and if not, explain the potential hazards. At the completion of this class activity all students should have a clear understanding of what to do if confronted with this type of situation.

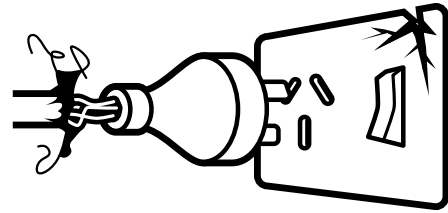


Is your home safe?

Safety first

When you carry out an electrical audit at home or at school, it should be done safely.

It would be helpful for you to carry out this activity with an adult or to discuss the audit before you go around and do it.



It is very important that this is a visual check only. Do not touch.

Do a safety check of your home

	NO	YES
1. Damaged or broken power points and light switches.	<input type="checkbox"/>	<input type="checkbox"/>
2. Frayed or damaged appliance cords.	<input type="checkbox"/>	<input type="checkbox"/>
3. Frayed or damaged extension cords.	<input type="checkbox"/>	<input type="checkbox"/>
4. Stacked double adaptors.	<input type="checkbox"/>	<input type="checkbox"/>
5. Unprotected power points in reach of small children. (If you have small children living in the house.)	<input type="checkbox"/>	<input type="checkbox"/>
6. Damage to appliances.	<input type="checkbox"/>	<input type="checkbox"/>

Bathrooms

7. Portable appliances still plugged in.	<input type="checkbox"/>	<input type="checkbox"/>
8. Heaters not wall-mounted.	<input type="checkbox"/>	<input type="checkbox"/>
9. Some or all electrical appliances, for example, a hairdryer kept in a place where it could get wet.	<input type="checkbox"/>	<input type="checkbox"/>

Kitchens

10. Small everyday appliances away from the sink.	<input type="checkbox"/>	<input type="checkbox"/>
---	--------------------------	--------------------------

Continued on next page...

Is your home safe? (continued)

Do a safety check of your home (continued)

NO **YES**

Bedrooms

11. Electric blankets creased in storage or on the bed.

12. Electric blankets left on when people go to bed.

Garage/Workshop

13. Damaged casings or frayed cords on power tools.

Outdoors

14. Extension cords to garden or pool appliances.

15. Tree branches close to powerlines.

16. If you have an underground power supply, is it clearly marked?

Conclusion:

1. Suggest how you would improve electrical safety in each situation you ticked 'YES'.

2. Suggest some ways in which you could improve electrical safety around your home, even if you have ticked 'NO' for each item in the audit.

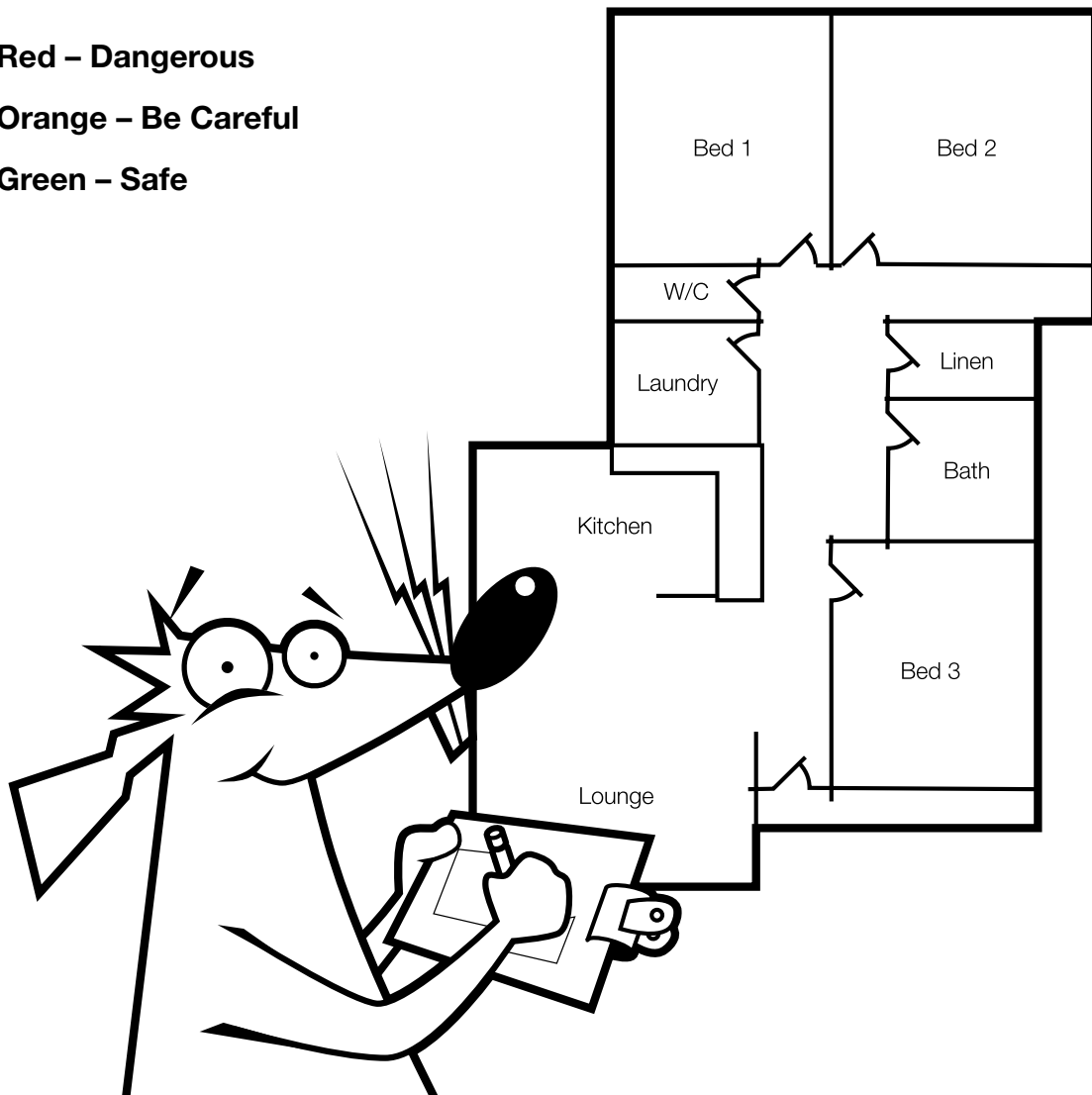
Is your home safe? (continued)

3. a) Draw a floor plan of your house or use the one given.
- b) Examine your survey of electrical safety around your home closely and then colour each room according to the degree of electrical safety.
- c) Label each room and use the colour key below to show the different degrees of safety.

Red – Dangerous

Orange – Be Careful

Green – Safe



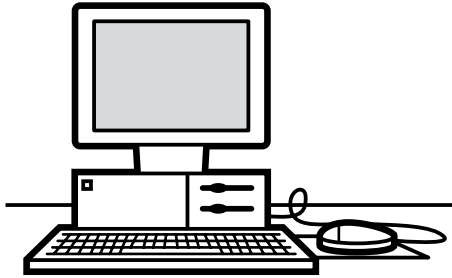
Is your home using electricity safely?

What could be done to make your home a safer place to live?

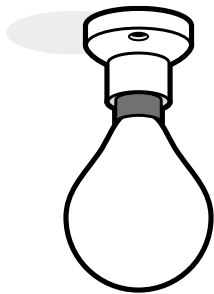
Electricity saves lives

Look carefully at the different electrical appliances that are illustrated below. Can you think of a situation in which that appliance could save a life?

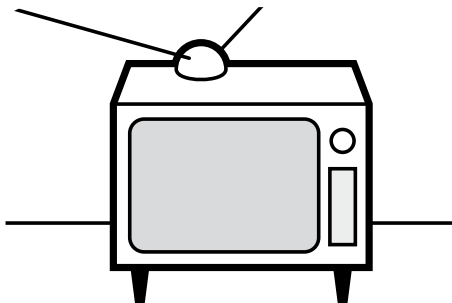
Write your answers next to the appropriate picture.



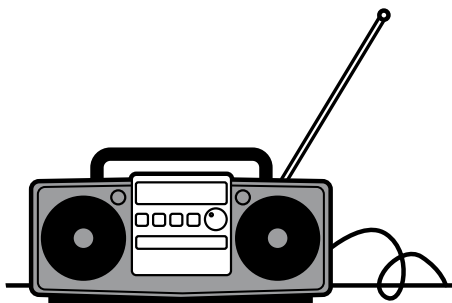
1 _____



2 _____



3 _____



4 _____

Which is the most important of the ones shown?

An electrical safety survey

A survey is a method of collecting information from a group of people. Television networks conduct surveys to find out who is watching their programs. Telephone companies conduct surveys to find out whether their customers are happy with their phone service.

In this survey you will interview other students, family members and neighbours about electrical safety. You will ask ten people the same set of questions so that you can compare their answers. Use the questions below as a starting point and then add two or three more questions of your own.

To start the interview, tell the person that you are conducting a survey about the best ways to prevent accidents from electrical hazards in the home and around the neighbourhood. Let the person know that the results of the survey will be used to help other students learn how to be safe when using electricity.

Write down each person's first name and age and then his or her answers to your questions.

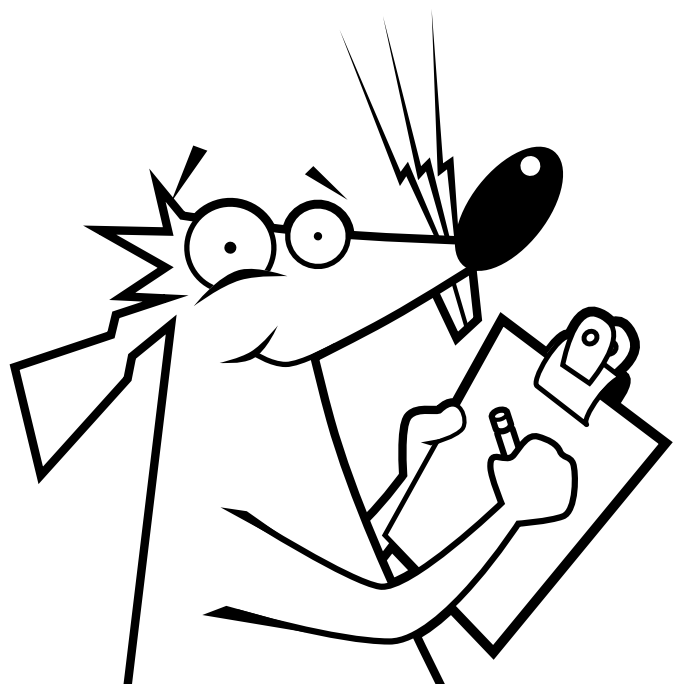
1. What is the best way to remove toast that is stuck in a toaster?
2. How many extension cords can you join together and still be safe?
3. What would you do if you came across someone who was receiving an electrical shock?
4. How are you going to repair the damaged cord on your electric kettle?
5. How many appliances can be plugged into a power point?

(Add your own questions)

6. _____

7. _____

8. _____



PVC or not PVC?

Find PVC in the dictionary. What do the abbreviations mean?

What do people normally use this type of tape for in regard to electricity?

Is it safe to do this? Why/why not?

Read the following possible things you could do if you found a frayed cord on an electrical appliance. Place, in order of urgency five things YOU should do if you find you have a frayed cord on an electrical appliance in your home. (Put crosses for the two things you should NOT do.)

a. Attempt to fix the cord with tape.

b. Take the appliance to an electrician.

c. Immediately turn the power off.

d. Ignore the frayed cord and keep on using it.

e. If the appliance is plugged in, pull the plug from the socket.

f. Label the appliance as unsafe, so no one else will use it.

g. Inform an adult of the danger.

Class Discussion

1. Consider which appliances appear to have frayed cords more frequently.
2. Discuss why this may be so and how it could be prevented.

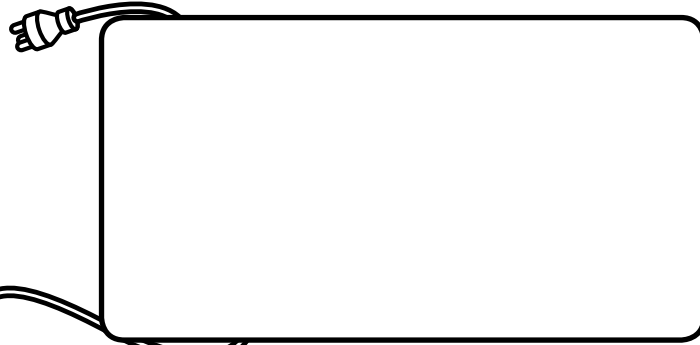
Extension cords

Extension cords are extremely useful if used correctly. They help make electricity much more accessible.

Below are four very important rules to keep in mind when using extension cords.

Design a cartoon to go with each rule. Ensure you illustrate the possible dangers.

1. Take care when using extension cords outdoors. Garden equipment and tools can damage them. Where possible, keep cords clear of the ground.



2. Extension cords on reels should be fully unwound before use to prevent overheating.

3. Buy extension cords which are already assembled. Home made ones cost more and are dangerous if incorrectly wired.



4. Extension cords are intended for temporary use and not do-it-yourself wiring. Replace by permanent wiring.

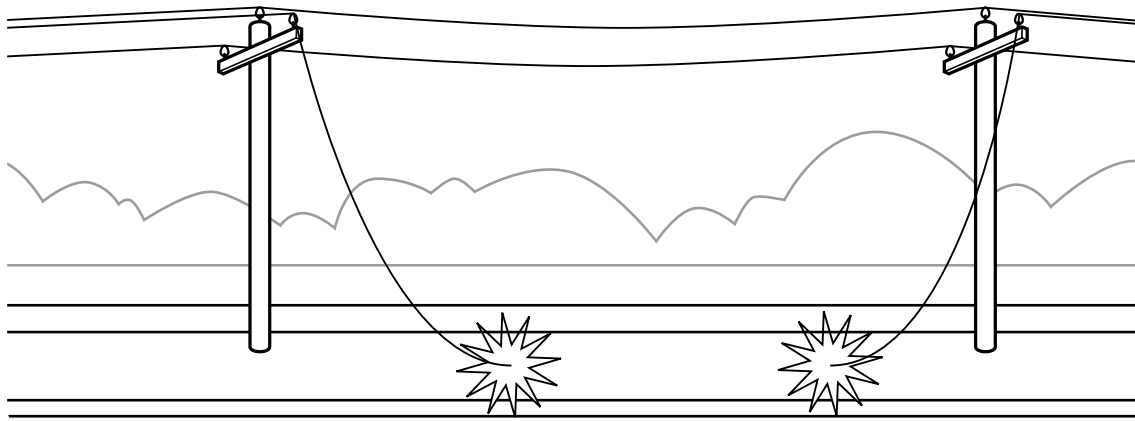


Out and about – teacher’s notes

Powerlines

Three golden rules:

1. **Look up and live!**
2. **Dial 1100 before you dig.**
3. **Stay clear of fallen wires.**



Why?

Powerlines are an essential part of supplying Western Australians with electricity. Usually they don't bother us because they are either up high or underground.

Overhead powerlines

The powerlines strung between the power poles in your street can carry a number of different voltages. The wires hanging closest to the ground carry 415/240 volts which goes into your home. The wires above these could be 11,000, 22,000 or 33,000 volts. The higher the wires are the greater the voltage they are carrying. Have you ever seen those tall steel towers carrying electricity from the power station across the countryside? They carry 330,000, 220,000, 132,000 or 66,000 volts.

Electricity being transmitted at these high voltages carries enough power to turn almost any material into a conductor of electricity. Many people forget about overhead powerlines when flying kites, carrying long fishing rods, manoeuvring sailing boats with tall masts and using other tall equipment. Unfortunately this can be a fatal or near fatal mistake.

What most people don't realise is that electricity can 'jump'. The higher the voltage and the humidity of the surrounding air, the further electricity will jump. Electricity has been known to jump up to six metres.

Out and about – teacher’s notes (continued)

Interfering with powerlines

Powerlines carry high voltages. Interfering with them can:

- Kill or badly injure those interfering with the powerlines;
- Cause a power surge in someone’s home that could kill or seriously injure people or damage electrical appliances;
- Kill or seriously injure people who may accidentally come in contact with the damaged powerlines;
- Stop someone’s life support system in his or her home;
- Cause traffic lights to go out and cause road accidents;
- Cause unnecessary disruptions to power supplies; and
- Result in business having to shut down their operations because the power is off.

Underground power cables

Many people now live in suburbs where the powerlines have been placed underground. In these areas it is vital that people are aware of where these cables run so that when they are digging they do not accidentally damage them. Between every second house is a green plastic electricity pillar (dome) and if these are damaged live wires may become exposed.

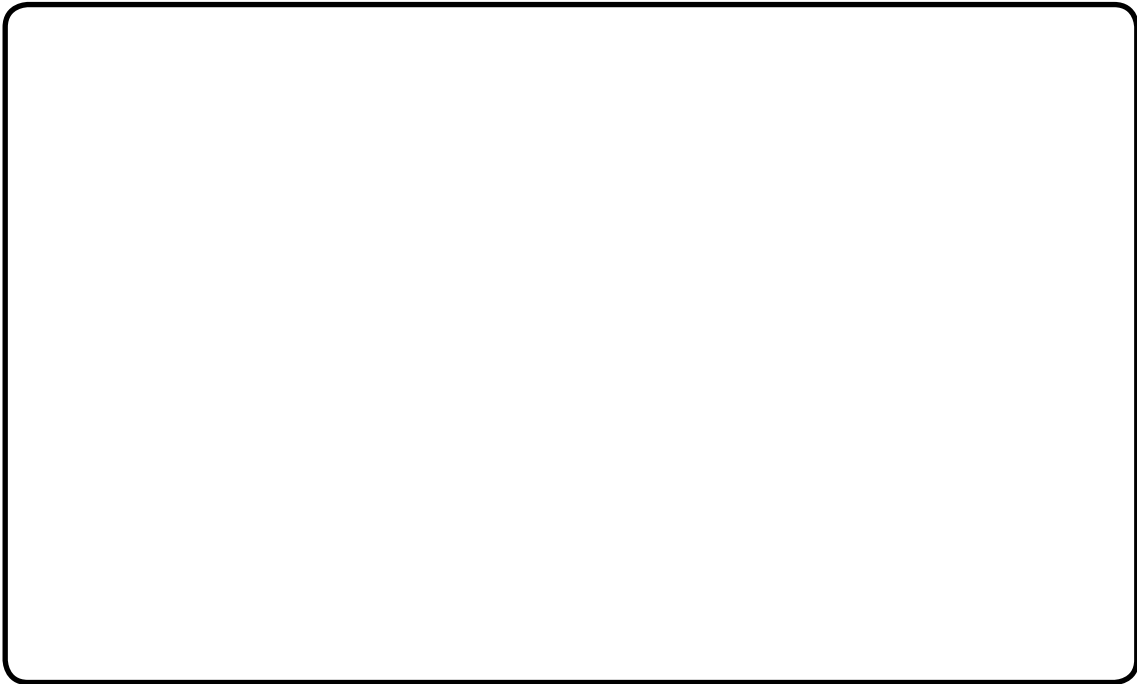
Remember:

Dial 1100 before you dig in areas where power cables are underground.

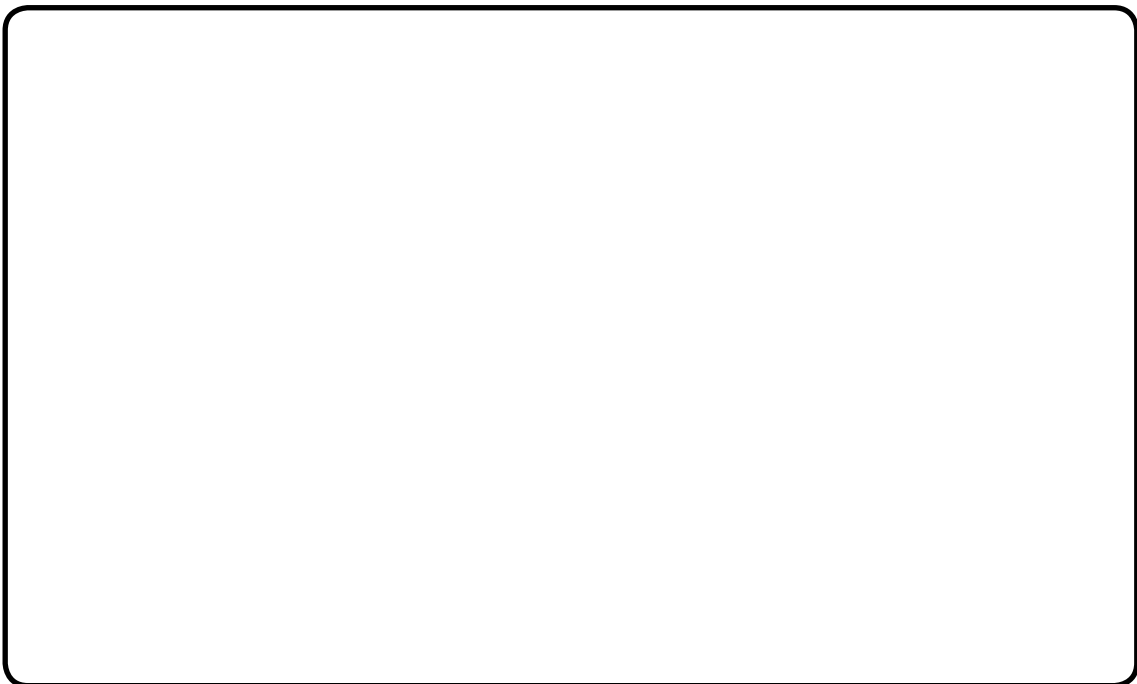
Dangers associated with powerlines

Sketch a dangerous situation involving overhead powerlines and each of the following things:

A sailing boat.

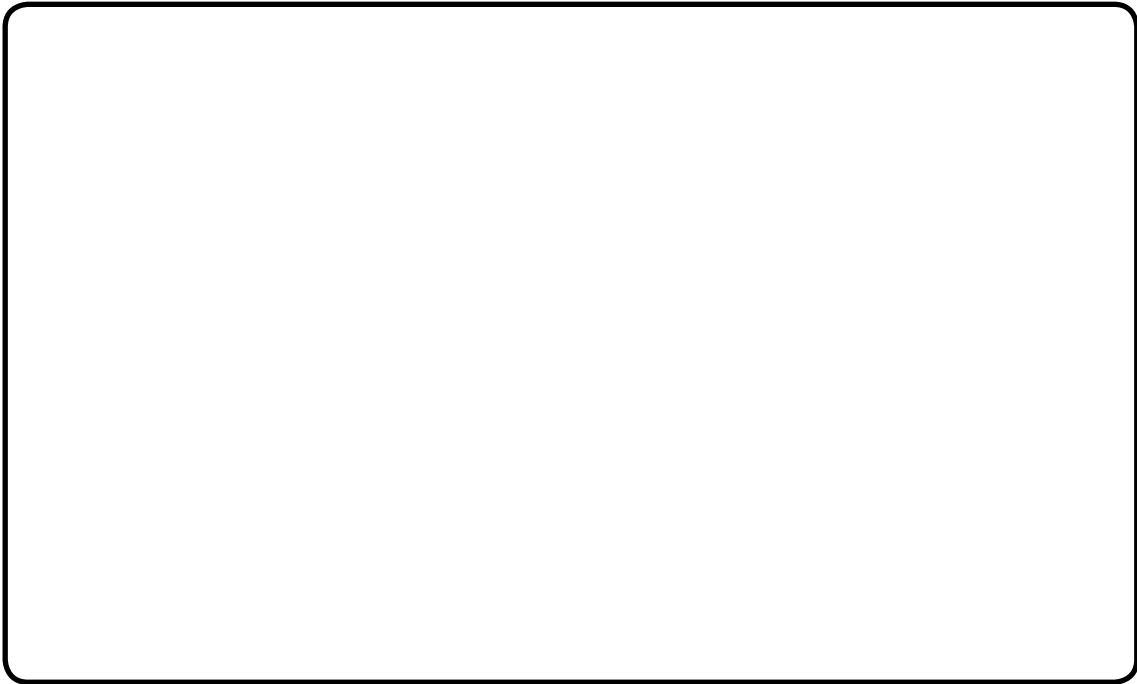


A long steel ladder.

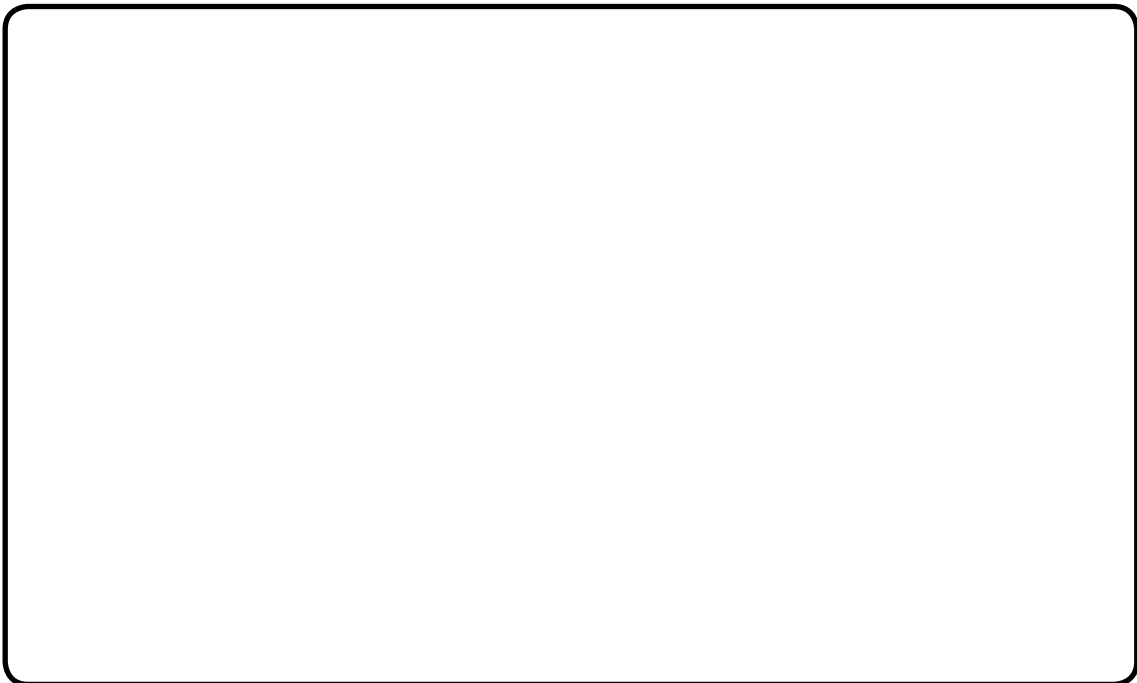


Dangers associated with powerlines (continued)

A tree branch.



A kite on a string.



Dangers associated with power lines (continued)

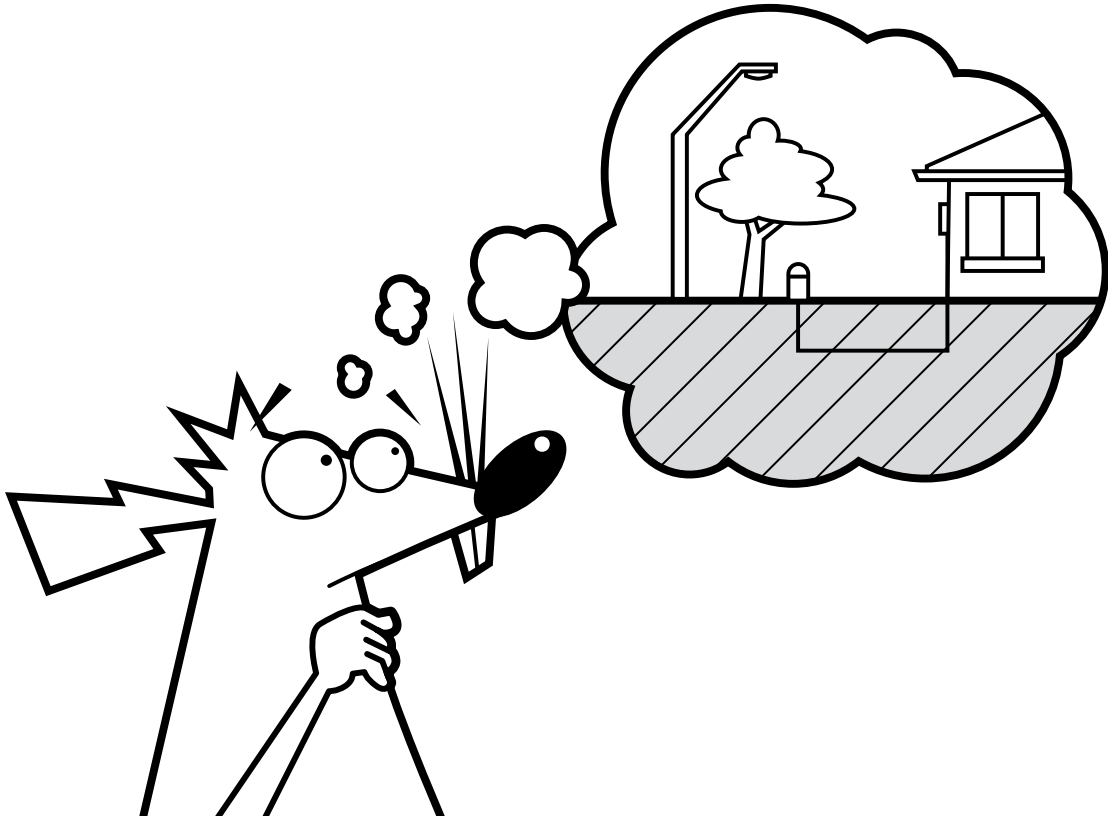
Remember!

- Overhead powerlines carry enough energy to turn almost anything into a conductor of electricity.
- The greater the voltage carried, the higher up the powerlines are, so stay right away from them.
- Do not touch anything that is touching powerlines. People working on lines follow very strict safety procedures.
- When flying kites choose an open place well away from overhead powerlines.
- If walking with long fishing rods near overhead powerlines, dismantle the rods before moving or carry them horizontally.
- If moving sailing boats near powerlines, either dismantle the mast or keep well away.
- When manoeuvring any tall equipment near overhead powerlines, LOOK UP AND LIVE!
- If kites, tree branches or any object should get caught in overhead powerlines, do not attempt to retrieve it yourself. Call 13 13 51.

Dial 1100 before you dig

Class discussion

1. What are some of the advantages to the public of having electricity placed underground?
2. What is the major advantage from Western Power's point of view?
3. The picture below shows a house on a street that has underground power. The dome near the tree contains electrical cable connections. More of these green domes will appear on our street verges as Western Power places more distribution lines underground. What precautions would the family need to take to avoid damaging the power supply and possible electrical injury?



Make up a television commercial

There are many different cutting power tools. These help make the home handy person's job much easier.

List some cutting power tools you can think of:

Why are these tools particularly dangerous around electric cords?

Imagine you work in an advertising agency and you have been asked to produce a commercial to make people aware of the possible dangers of using cutting power tools around electrical cords.

In the boxes below create a story sequence for your commercial.

1	2
3	4
5	6

Electrical safety officer

You are now an Electrical Safety Officer and have been asked to give a presentation to a year two class at your local primary school. What should you say and do?

Outline the talk below. Check that you have covered all the main points.

Introduction.

Key points.

Questions you may ask the class. (With the correct answers).

Find out for yourself

Use your library to find out about the following electrical terms. Draw lines to match them with the definitions.

Electrical Term	Definition
Direct Current (DC)	An electrical generator.
Conductor	An electrical current that flows in one direction then reverses to flow in the opposite direction.
Dynamo	Used to change the sun's energy into electricity.
Static electricity	Material that easily permits the flow of an electric current.
Solar cell	An electrical current that flows in one direction.
Alternating Current (AC)	Electricity at rest, usually not flowing as a current.

What is the difference between a conductor and an insulator of electricity?

Conductor

Insulator

Why should you always wear rubber-soled shoes when using electrical equipment outside or on wet floors?

It is all Greek to me

It seems hard to believe but the history of electricity goes back to ancient Greece sometime around 600 B.C.
A Greek philosopher, Thales of Miletus, experimented with a resin called amber. He also used pieces of iron ore magnetite which people called lodestones.
While he was experimenting with amber and lodestone he found that lodestones attracted heavier metal objects, such as nails and needles and that the rubbed amber attracted lighter objects such as feathers or parchment.

Find Thales in an encyclopaedia or on the Internet. What other information can you find out about him?

What two scientific concepts was he experimenting with when he used:

Lodestones?

Rubbed amber?

The Greek word for amber is elekton. Electricity comes from this Greek word, because electricity is electrons in motion.

The next significant development in the study of electricity was not until 1600 A.D. when William Gilbert published a book that discussed the same ideas that Thales had so many years before. See if you can find out the name of the book and any other information about his discoveries.

Positive and negative

For these experiments, you will need:

- Plastic pens;
- A variety of objects, such as plastic, glass, wood and metal;
- Different materials, such as cotton, wool, polyester, silk and fur;
- Thread; and
- A coat hanger.

Take a plastic pen and hang it from a length of thread attached to the coat hanger so it is free hanging. Take the objects one at a time and rub them with each piece of material for 30 seconds. Bring the objects in turn close to the hanging pen and see if it has been charged. An object with an electrical charge makes the pen swing around towards it.

Record your observations here.

Object	Material	Observation

Rub one end of the hanging pen with fur or another piece of material. Leave it to settle and then charge another pen.

Bring the new pen up to the one that is suspended. What happens?

Now try a glass rod or tube rubbed with silk. What happens this time?

Can you think of a reason for this?

Some great inventors

Benjamin Franklin



Benjamin Franklin

Benjamin Franklin proved that lightning and the spark from amber were one and the same thing. The story of this scientific milestone is a familiar one, the famous experiment of the kite and the thunderstorm. In 1752, Franklin fastened an iron spike to a silken kite, holding the end of the kite string by an iron key. Lightning flashed, and a tiny spark jumped from the key to his wrist. The experiment proved Franklin's theory, but was much more dangerous than he realised and he could easily have been killed.

In 1790, Aloisio Galvani, an Italian professor of medicine, found that when the leg of a dead frog was touched by a metal knife which had been lying next to an electrical machine, the leg twitched violently.

Galvani thought that the muscles of the frog must contain electricity, but another Italian scientist, Alessandro Volta, solved the mystery of the jerking leg.

Alessandro Volta



Alessandro Volta

Volta realised the main factors of Galvani's discovery were the two different metals concerned – the steel of the knife and the tin plate upon which the frog was lying. He showed that when moisture comes between two different metals, electricity is created. This led him to invent the first electric battery, which he made from thin sheets of copper and zinc separated by paper soaked in acid.

In this way, a new kind of electricity was discovered, electricity that flowed steadily like a current of water instead of discharging itself in a single spark or shock. Volta showed that electricity could be made to travel from one place to another by wire, thereby making an important contribution to the science of electricity. The unit of electric potential, the Volt, is named after Volta.

However, the credit for producing or generating current electricity on a practical scale goes to the famous English scientist Michael Faraday.

Michael Faraday



Michael Faraday

Faraday was greatly interested in the invention of the electro-magnet, but his brilliant mind took earlier experiments still further.

If electricity could produce magnetism, he asked himself, why couldn't magnetism produce electricity?

In 1831, Faraday found the solution. Electricity could be produced through magnetism by motion.

Faraday discovered that when a magnet is moved inside a coil of copper wire, a tiny electric current flows through the wire. Of course, Faraday's electric dynamo or generator was small and crude, and provided only a small electrical current by today's standards. But he discovered the first method of generating electricity by means of motion in a magnetic field.

Nearly 40 years went by before a really practical generator was built by Thomas Alva Edison in America. Edison used it to produce electric current to light his laboratory and later to

Thomas Edison



Some great inventors (continued)

James Watt



supply the necessary current for the first New York street to be lit by electric lamps in September 1882.

Yet Edison's dynamo or generator, was a mere toy compared with the powerful generators installed in modern power stations.

Thomas Edison

Thomas Edison, born 1847, led an adventurous boyhood before he became a telegraph operator and interested himself in electrical problems. In 1876 he set up an elaborate laboratory in New Jersey.

Edison's many inventions include the phonograph, an improved printing telegraph and the first commercially usable incandescent lamp in 1879. Commercial production of lamps started the following year. Before he died in 1931, Thomas Alva Edison had patented 1300 inventions.

James Watt

James Watt, Scottish inventor of the modern steam condensing engine, was born

James Maxwell



in 1736. His improvements to steam engines were patented over a period of 15 years starting in 1769.

Thermal power stations continue to use the principles of the steam engine developed by Watt and his immortality is assured by his name being used for the electric unit of power.

James Maxwell

James Clerk Maxwell, Scottish physicist, was born with an inquiring mind. Dissatisfied with the toys he was given, the youngster made his own scientific toys at the age of eight! In 1846, when Maxwell was 15, he delivered his first scientific paper.

His best known work is a treatise on electricity and magnetism published in 1873. He made the discovery that founded the electro-magnet theory of light. It is to Maxwell's electrical researches that the advent of radio is due. He died in 1879 at the age of 48.

Andre Ampere



Andre Ampere

Andre Marie Ampere (1775 – 1836) was the first to explain the electro-dynamic theory.

He was a French mathematician who devoted himself to the study of electricity and magnetism. A permanent memorial to Ampere is the use of his name for the unit of electric current.

George Ohm

George Simon Ohm, German mathematician and physicist, was born in Bavaria in 1787. He was a college teacher in Cologne when in 1827 he published, "The Galvanic Circuit Investigated Mathematically". His theories were coldly received by German scientists.

Ohm's research was recognised in England and he was awarded the Copley Medal in 1841. His name has been given to the unite of electrical resistance.

Glossary

Alkaline Batteries

Batteries that can last for a long time because they do not corrode easily.

Alternating Current (AC)

An electric current with its direction reversed at regular intervals, used to send high voltage electricity over long distances. A transformer then lowers the current so that it can be used by regular households.

Ammeter

An instrument for measuring the strength of an electric current.

Ampere

A unit of measure of electric current.

Anthracite

'Hard coal', appearing bright and shiny, generally found deeper in the Earth than bituminous coal. It produces no smoke when burnt.

Atmosphere

The layers of gases surrounding the Earth.

Atom

The smallest parts of an element; the building blocks of matter. Made up of a positively charged nucleus surrounded by negatively charged electrons.

Base load

The minimum demands of electricity on a power station over a given period of time. Muja is a base load power station.

Battery

A device that stores energy by converting electrical energy into chemical energy. This energy can be reconverted to electrical energy by the reversal of the chemical reactions.

Bedrock

The part of the Earth's crust that is almost unbroken rock, and is relatively unaffected by the process of erosion.

Biomass

The total amount of biological material in a given area, including material from plants and animals, as well as bacteria, fungi, and plant and animal organisms.

Bituminous coal

'Soft coal', containing between 15 and 50 percent volatile matter. It is 'younger' and of lower heat value than anthracite. It is the chief fuel in power plants that generate electrical energy with steam.

Glossary (continued)

Blackout

A total power failure caused unintentionally by storm damage, equipment failure or overloading power supply equipment.

Boyle's Law

The volume of gas is inversely proportional to the pressure on it if the temperature is unchanged. That is, the more pressure, the smaller the volume of a gas.

Brown coal

Brownish-black coal that is about 50 per cent water.

Capacity

The load for which a generator, turbine, power plant, transmission circuit, or power system can supply under specified conditions for a given time interval without exceeding approved limits of temperature and stress.

Circuit

The complete path electricity takes.

Circuit breaker

A device that shuts off electricity, or breaks its path, if there is a problem.

Coal

A solid, combustible, organic hydrocarbon formed by the decomposition of vegetable material without free access to air.

Coal gasification

The process of making a gaseous fuel from coal.

Coal seam

A bed of coal usually thick enough to be mined with profit.

Cogeneration

The production of heat and electrical energy from the same fuel source.

Combustion

A complex series of chemical reactions in which substances combine with oxygen and release heat energy,

Compound

A substance containing more than one element.

Conductor

A material capable of carrying an electrical current.

Conserve

To manage or use wisely.

Glossary (continued)

Crude oil

Petroleum liquids as they come from the ground, formed from animal and plant material, which collected at the bottom of ancient seas.

Direct Current (DC)

An electric current that flows in only one direction in a circuit, as from a battery.

Distribution lines

Wires that bring electricity into your neighbourhood.

Double glazed window

Two panes of glass, factory-sealed together with a small air space between them.

Electric current

A flow of electrically charged particles (electrons) along a conductor, such as wire.

Electromagnet

A soft iron core surrounded by a coil of wire that temporarily becomes a magnet when an electric current flows through the wire.

Electron

A particle of an atom with a negative electrical charge.

Electrostatic precipitator

An air pollution control device that removes particles in a gas stream by giving an electrical charge to the particles for the mechanical collection on an electrode with an opposite charge. Used by coal-fired power stations to remove fly-ash from combustion gases.

Element

Any substance that cannot be separated into different substances by ordinary chemical methods, made up of only one type of atom eg. hydrogen, oxygen and fluorine.

Energy audit

The systematic measuring and recording of energy consumption to identify opportunities for reduce and minimise energy use and cost.

Fly-ash

Fine, solid particles of non-combustible ash.

Fossil fuels

Coal, oil, natural gas and other fuels originating from geologic deposits of ancient plant and animal life.

Fuel cell

A device in which fuel and oxygen are combined to produce chemical energy that is then converted directly into electrical energy.

Glossary (continued)

Fuse

Used to stop too much electricity travelling through a house's wires - it breaks the electricity's pathway.

Gas (Natural)

A mix of hydrocarbon gases and vapours, which occur naturally in certain geological formations with or without accompanying crude oil.

Gas Turbine

An engine driven by high-speed combustion gases striking rotating blades.

Generating capacity

The capacity of a power plant to generate electricity, usually measured in megawatts (MW).

Generator

A machine that converts mechanical energy into electrical energy through turning a coil of wire within a magnetic field, or visa versa.

Geothermal energy

The heat energy available in the subsurface of the Earth.

Gigawatt (GW)

1,000,000,000 watts; 1,000,000 kilowatts; 1,000 megawatts.

Greenhouse effect

The heating effect of the atmosphere upon the Earth. Light waves from the sun pass through the air and are absorbed by the Earth. The Earth then re-radiates this energy as heat waves that are absorbed by the air, especially by carbon dioxide. This carbon dioxide behaves like the glass in a greenhouse, letting in the light but trapping the heat. It is believed that increasing carbon dioxide emissions will increase the global surface temperature.

Hertz (Hz)

A unit of frequency. One hertz equals one cycle per second.

Horse power

A British unit of the measure for the rate at which energy is produced or used.

1 Hp = 746 watts.

Hydrocarbons

A vast family of compounds containing carbon and hydrogen in various combinations, found particularly in fossil fuels.

Hydroelectricity

The production of electric energy by a water-powered turbine generator.

Insulation

Any material that provides high resistance to the flow of heat, sound or electricity from on surface or area to another.

Glossary (continued)

Inverter

A device, usually electronic, to change direct current to alternating current.

Joule

A metric unit of work or energy, equivalent to one watt second.

Kilovolt (kV)

1000 volts.

Kilowatt (kW)

A unit of power, usually used for electric power (equal to 1000 watts), or the consumption of energy (at a rate of 1000 joules per second).

Kilowatt-Hour (kWh)

The amount of work or energy delivered during the steady consumption of 1 kilowatt of power for a period of one hour.

Liquefied Natural Gas (LNG)

Natural gas which has been changed into a liquid by cooling to approximately -160°C.

Liquefied Petroleum Gas (LPG)

Principally propane and butane, it is a gas that turns to a liquid at normal room temperature and moderate pressure.

Load

The power and energy requirements of users on the electric power system in a designated area.

Magnetic field

A field of force around a magnet's poles or around a wire carrying an electric current.

Megawatt (MW)

A unit of electrical power equal to 1000 kilowatts or one million watts.

Megawatt-Hour (MWh)

One thousand kilowatt-hours.

Meter

Used at your home or other buildings to measure and record the amount of electricity used at that site.

Molecule

Atoms combined to form the smallest natural unit of an element or compound.

Motor

A machine which converts electrical energy into mechanical energy.

Glossary (continued)

Neutron

An unchanged elementary particle that has a mass nearly equal to that of a proton. Present in the nuclei of all known atoms except hydrogen.

Newton

The force required to change the velocity of a one-kilogram mass one metre per second in a period of one second. Corresponds approximately to 4.4 pounds of force.

Non-renewable resources

Energy resources that are depletable, for example, fossil fuels.

Nucleus

The central part of an atom where most of the mass and all of the positive charge is concentrated.

Off-Peak

Energy supplied during periods of relatively low demand.

Ohm

The unit of measure of electrical resistance. One volt will force a current of one ampere through a resistance of one ohm.

Oscillator

An electric circuit that produces an alternating electric current, which repeatedly changes direction.

Output

The amount of power delivered from a generating station during a specified period.

Peak load

The maximum amount of power delivered during a stated period of time.

Photovoltaic cell

A device that produces an electric current from solar radiation. Materials that can be used in the production of photovoltaic cells include silicon and cadmium sulphide.

Power

The rate at which work is done or energy expended. It is measured in units of energy per unit of time, such as calories per second.

Power grid

A network of electrical powerlines and associated equipment used to transmit and distribute electricity.

Power station

A factory that makes electricity through the use of a generator.

Glossary (continued)

Proton

An elementary particle found in the nucleus of all atoms. It carries a positive charge equal to the negative charge of the electron.

Recycle

To process waste materials in order to regain new material for human use.

Renewable resources

Energy resources that, when used, are not depleted eg. wind energy and solar energy.

Safety switch (Residual Current Device)

An electrical safety device specifically designed to immediately switch the electricity off when electricity leaking to earth is detected as a level harmful to you. These devices offer a high level of personal protection from electric shock.

Solar energy

Radiation energy from the sun falling upon the Earth's surface.

Solar passive system

A means of capturing, storing and using heat from the sun.

Static electricity

An unbalanced electric charge that is sitting on top of an insulator, not moving, as opposed to an electric current which is flowing along a conductor.

Stirling Engine

An external combustion engine in which air is alternately heated and cooled to drive a piston up and down.

Substation

An electrical control centre between a power station and your home where transformers lower electricity's voltage.

Transformer

Raises or lowers the voltage of alternating current.

Transmission

The process of transporting electric energy in bulk from a source of supply to other power systems, eg. substations. It is done at high voltage to reduce loss.

Transmission lines

Wires or cables through which high voltage electricity is carried from a power station.

Turbine

Has blades that can be pushed by water, steam, gas or wind to spin a shaft. When attached to a generator, the spinning shaft helps to drive the generator to make electricity.

Glossary (continued)

Velocity

The distance travelled in a certain direction per unit of time. Velocity differs from speed in that the direction of motion is also specified.

Volt

A unit of electrical pressure which forces electrical charges to move through a wire or other conductors. The voltage in an electric circuit pushes electrons around the circuit.

Watt

A metric unit of power, which gives the rate at which work is done or energy expended. One watt equals one joule per second.

Watt-Hour

The amount of electricity used by one watt in one hour eg. A 100 watt light bulb will use 100 watt-hours of electricity each hour it is used.

Wind Turbine generators

Devices which are designed to convert wind energy into electrical energy.



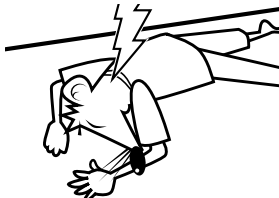
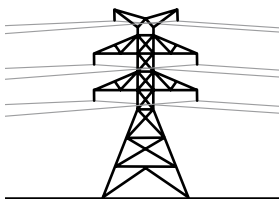
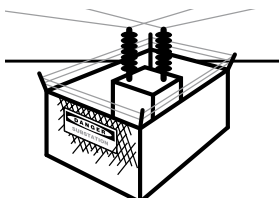
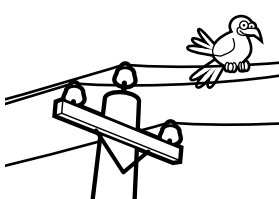
Work

The transfer of force from one body or system to another. Work is performed by a force moving an object.

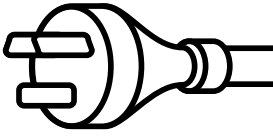

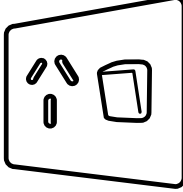
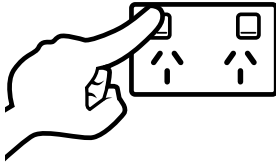
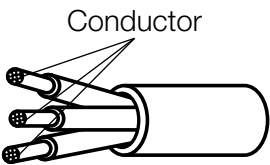
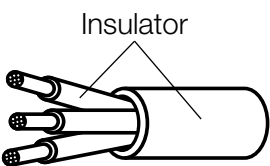
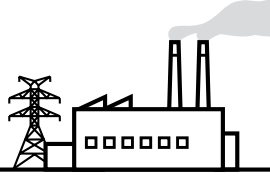
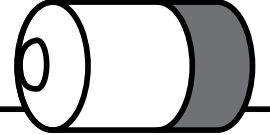
Vocabulary activity

Make your own Electricity Dictionary


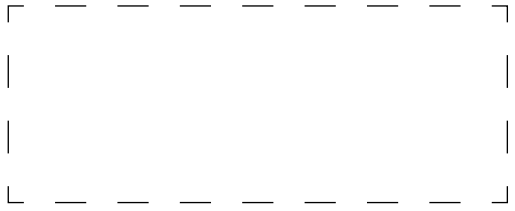
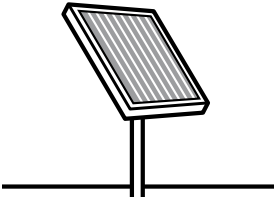
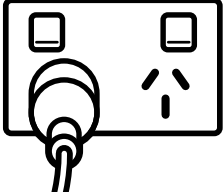
Look at the following illustrations. Match these illustrations with the correct definitions on the “cut out” sheets. Paste the definitions next to the correct illustration to make your own Electricity Dictionary.

<p>Electricity</p>		<div style="border: 1px dashed black; height: 100px; width: 100%;"></div>
<p>Electrical Appliance</p>		
<p>Electrical Shock</p>		
<p>Pylon</p>		
<p>Substation</p>		
<p>Cables</p>		

Vocabulary activity (continued)

<p>Plug</p>		
<p>Socket</p>		
<p>Switch</p>		
<p>Conductor</p>		
<p>Insulator</p>		
<p>Power Station</p>		
<p>Battery</p>		

Vocabulary activity (continued)

<p>Vander Graaf</p>		
<p>Cell</p>		
<p>Alternating Current (AC)</p>		

Vocabulary activity (cut outs)

Look at the vocabulary activities on the previous pages. Match up the cut outs with the pictures and then glue each one in the correct place to make your own Electricity Dictionary.



These cables bring electricity from the power station to us. They can be overhead or underground.



An electric shock can kill you. You can get an electric shock by touching electricity.



A big metal structure which holds the electric cables very high.



A place where electricity comes to and is shared out to all who use it.



Electricity can pass through this.



A switch will turn the electricity on or off.



A machine that uses electricity.



A place where electricity is made (generated).



Electricity cannot pass through this.



Every electrical appliance has a plug to connect it to the electric wires in the socket.

Vocabulary activity (cut-outs)



There are many electric sockets in your house. Electricity is available through the socket.



Electricity is a type of ENERGY. It makes things work.



Direct Current (DC).



Static electricity.



Solar cell.



Alternating current.