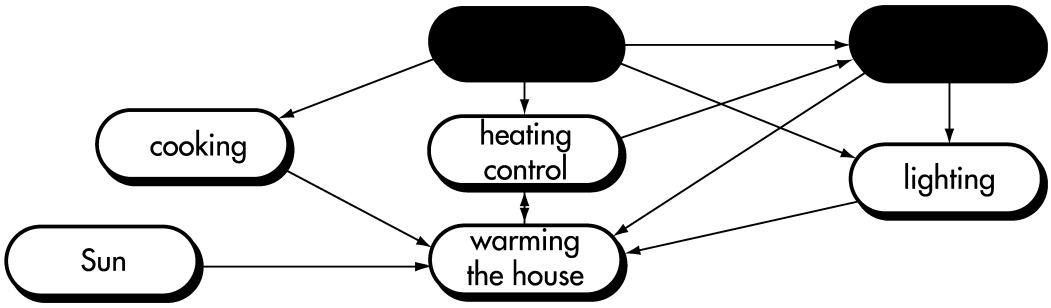
Science in the Kitchen

Part II
Electricity

Name:_____

Electricity in the Kitchen

You have already looked at electrical circuits this year, but now we are going to look at some of the dangers in the kitchen. What causes electrical accidents in the kitchen? How can we prevent these types of accidents from happening at home and at school?



This simple concept map show how electricity is used to heat the home.

Revision

Potential difference (voltage): Electrical energy lost across a component or gained across a cell it is measured in volt (V).

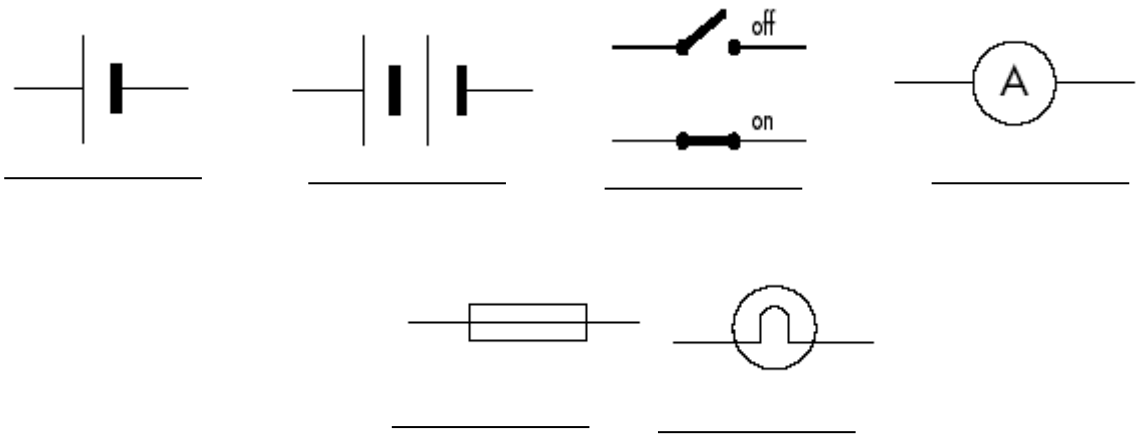
Electric current: A flow of charged particles (electrons).

Resistance: Opposition to the flow of electric current through a conductor, measured in ohms (Ω); measure of voltage required to drive a certain sized current through a component.

Resistor: A component that has resistance only; this makes electron flow difficult, almost impossible. Can be fixed or variable resistance.

Activities

Find the names of the following circuit components



Electrical Energy

Electric energy can be used to produce heat energy, this happens whenever electrical current flows through a conductor. The higher the resistance of the conductor the more electrical energy converted into heat energy. Sometimes, the heat produced may be so great that it makes the conductor glow brightly. This is how normal household light globes work.

Conductors that heat up are called heating elements. They can be used to heat many different substances including air, water and even the concrete slabs on which houses are built.

Converting electrical to heart energy Experiment

AIM

To produce heat energy from electric energy.

MATERIALS

- heating element made from nichrome wire
- beaker
- thermometer
- low-voltage DC power supply
- connecting wires
- stop watch

Stop

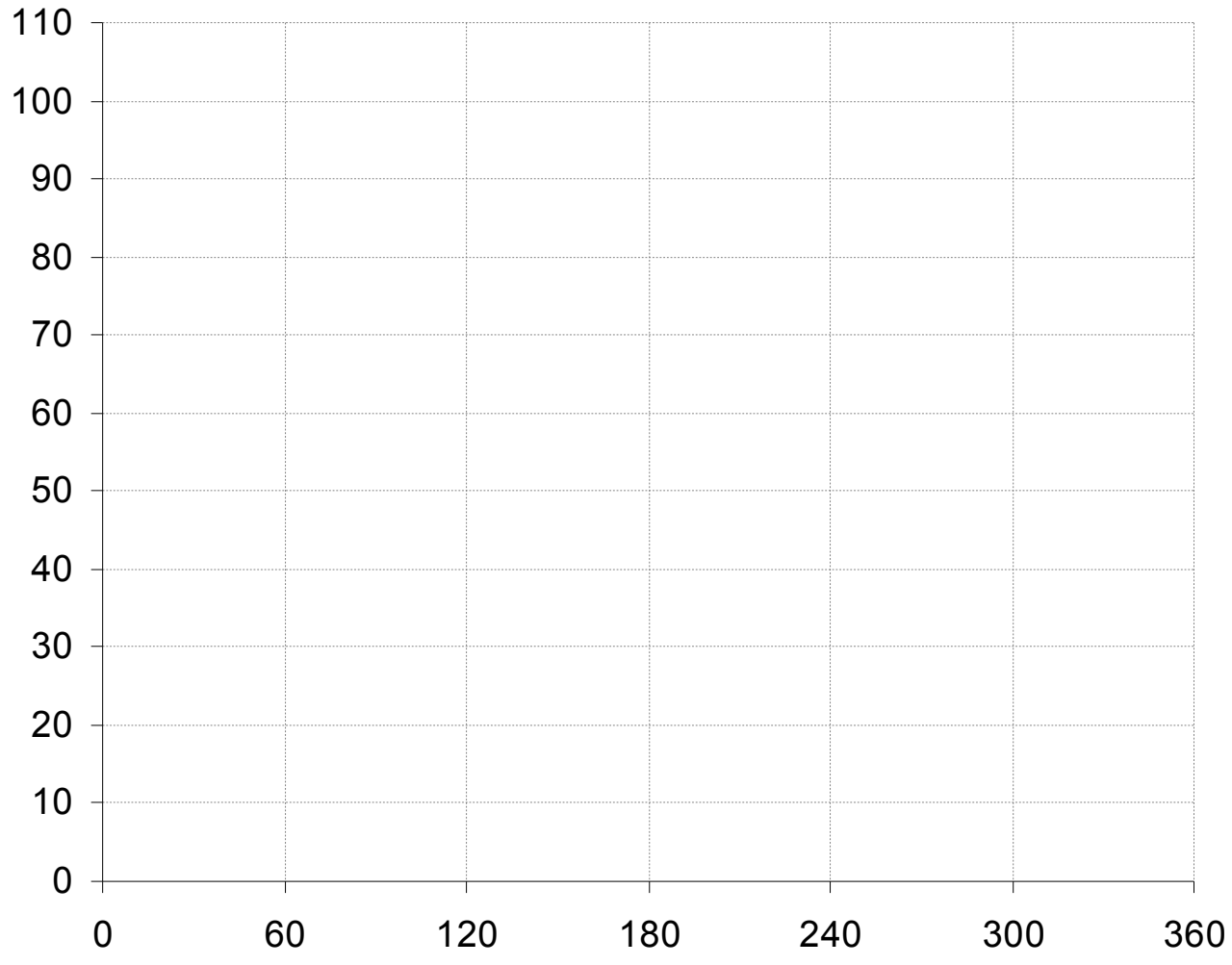
Before you can start an experiment you need to get your teacher's signature, Beware you may be asked some questions so you will have to read it before starting

METHOD

1. Connect the heating element to the low-voltage DC supply.
2. Completely cover the heating element with water.
3. Set the voltage to 2-4 V and switch on the power supply.
4. Stir the water gently with the thermometer. Record the change in temperature.
5. Results

Record the temperature in the following table.

Time Seconds												
Temperature ^{o}C												



DISCUSSION

1 Did the temperature of the water, fall, stay the same or rise?

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2 Describe the energy changes that took place.

What can go wrong

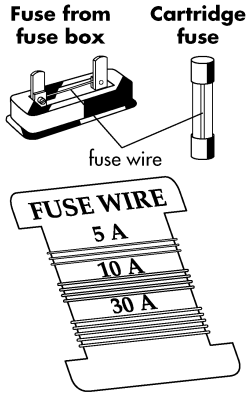
Electricity is a quick, clean and reliable form of energy. However, care must be taken when using it. When people ignore safety rules electrical accidents can occur. Each year hundreds of people in New South Wales experience electric shocks from faulty circuits or unsafe practices. About 25 people die each year as a result of electrical accidents. For this reason it is important that everyone makes a commitment to play it safe when using electricity.

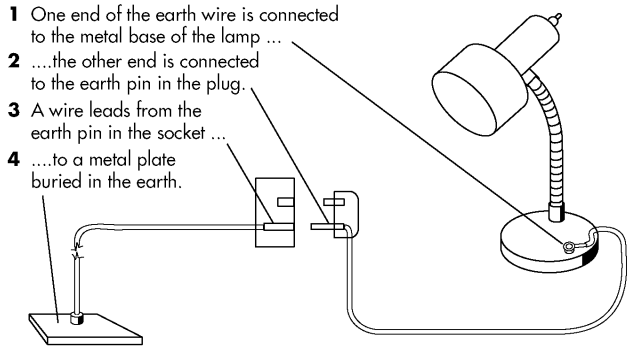
When all components in an electric circuit are in good working order, with all wires covered in insulation and all connections secure, then electricity is safe to use. However, when insulation wears away and exposes wires, and connections work loose, the circuit becomes dangerous.

If an exposed wire that is 'live' (carrying electric current) comes in contact with a conductor such as the metal frame of an appliance, then that appliance also becomes 'live'. The electric current flows into the frame instead of taking its usual path back along the neutral wire. This alternative path is called a short circuit. Short circuits are very dangerous because the current increases as it takes the easier path with less resistance through metal. The high current may cause a spark or a fire as wires overheat.

Fuses and safety switches

Fuses, circuit breakers and safety switches protect us from dangerous short circuits. A fuse work when a large current melts the fuse wire and breaks the circuit. Circuit breakers and safety switches work automatically to switch off the electricity before a fire can start. Safety switches (also called earth leakage devices) cut off the current in less than 30/1000 of a second, preventing a fatal accident.





Fuses and short circuits experiment

AIM

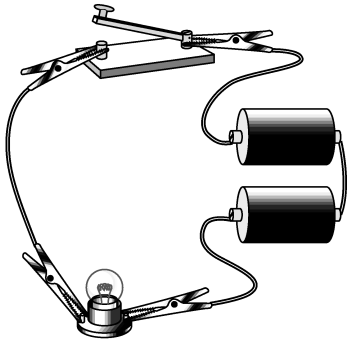
To observe a short circuit and find out how a fuse works.

MATERIALS

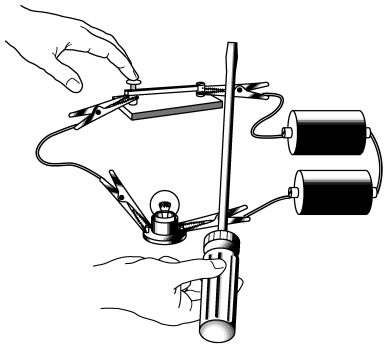
- power supply
- globe in holder
- switch
- screwdriver
- large cork
- 2 long pins
- 5 A fuse wire
- 4 leads with alligator clips

METHOD PART A

1. Connect the cells then make a simple circuit as shown in below and close the switch.



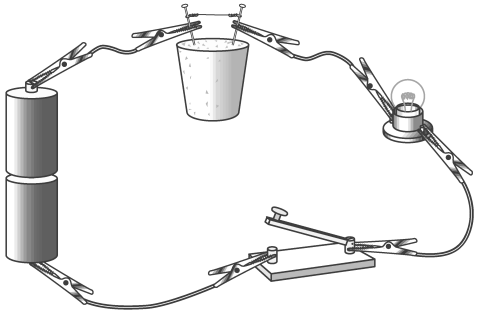
2. Place the metal end of the screwdriver so that it contacts the alligator clips between the globe and the switch as in below.



3. As soon as you observe what happens, remove the screwdriver.

PART B

1. Construct a simple fuse from corks, pins and 5 A fuse wire.



2. Connect the fuse into the circuit from Part A.

3. Again use the screwdriver to create a short circuit and observe what happens.

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_____

DISCUSSION

In Part A what effect did the short circuit have on the globe?

_____

_____

_____

In Part B what effect did the short circuit have on the fuse wire?

_____

_____

_____

How might fuses be used to protect circuits and prevent accidents?

_____

_____

_____

Down to earth

Many electrical plugs have three pins. Each pin is connected to a different wire. There is a live wire, a neutral wire and an earth wire. The live and neutral wires carry the current when the switch is turned on. The earth wire is for safety. The earth wire connects appliances with metal surfaces to the ground. If the metal surfaces become live the current flows safely down to the earth wire.

Activities

1. Why are loose connections and broken insulation dangerous?

2. Describe what happens in a short circuit.

3. Explain how a fuse works.

4. What colour insulation is used on the three wires in electrical cable?

5. Why do some appliances' plugs only have two pins?

Revision

Dilute acids have the following chemical properties:

- They react with most metals to produce hydrogen gas.
- They react with marble chips to produce carbon dioxide gas.
- They change the colour of indicators, e.g. litmus from blue to red.

An indicator is a substance that changes colour depending on whether it is in an acidic or basic solution.

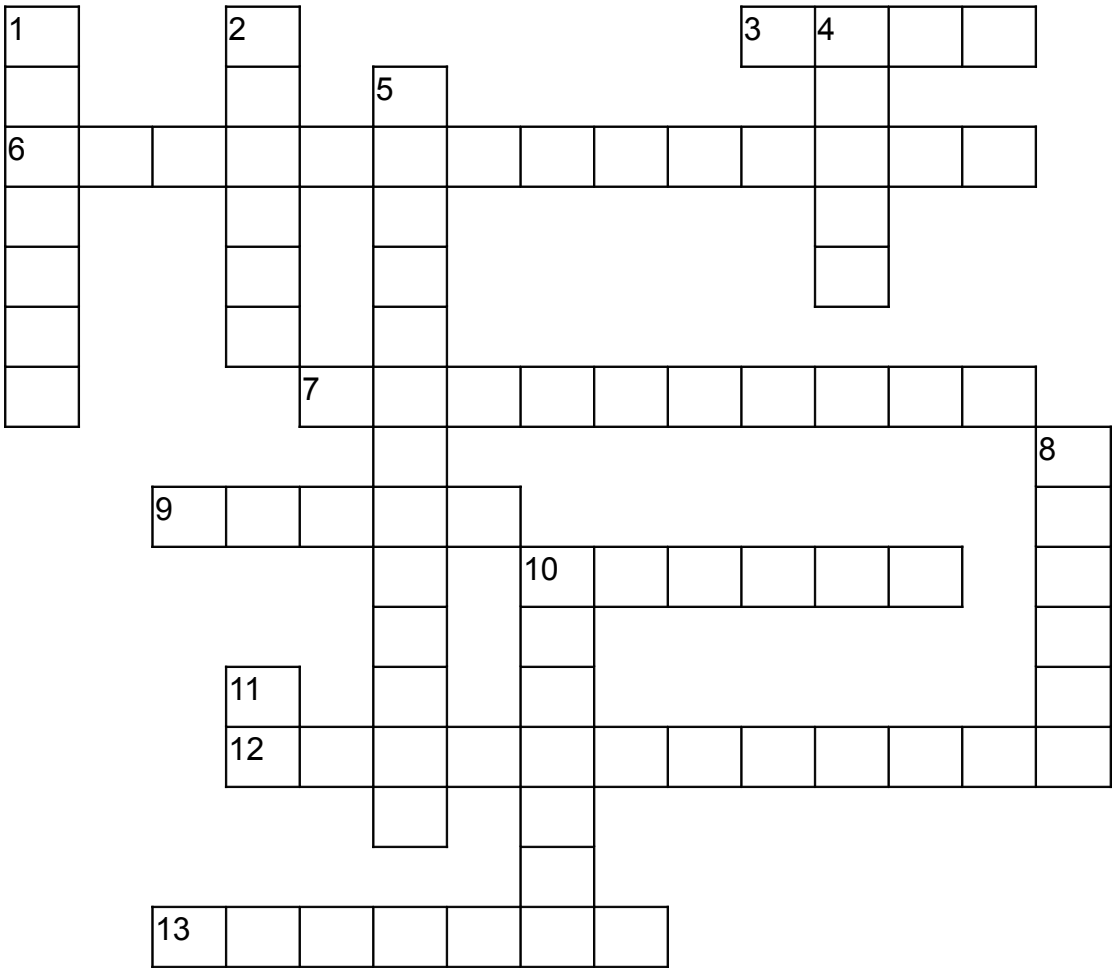
Bases are the opposite of acids. In solution they change the colour of indicators, e.g. litmus from red to blue.

Alkalis are bases that are soluble in water.

The pH is a number that indicates how acidic or basic a solution is. (A pH of 1 is very acidic, and a pH of 14 is very basic.)

Neutralisation is the process in which an acid reacts with a base to produce neutral substances

Cross word



ACROSS CLUES

3 Opposite of acid
6 When an acid and a base react
7 These tell you whether a solution is acidic or basic
9 Type of solution whose pH is more than 7
10 Soluble base
12 The acid bricklayers use
13 Not acidic or basic

DOWN CLUES

1 Household liquid containing acetic acid
2 Turns from blue to red in acids
4 These react with metals to produce hydrogen
5 Gas produced when acids react with marble chips (two words)
8 Type of solution whose pH is less than 7
10 Alkali used as a household cleaner
11 Number that tells you how acidic or basic a solution is

Multiple choice

1 When a metal reacts with a dilute acid it —

a. fizzes to produce carbon dioxide gas
b. changes the colour of the acid
c. produces bubbles of hydrogen gas
d. causes a slight explosion

2 Acids change the colour of litmus paper from —

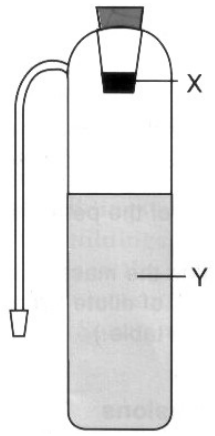
a. green to pink
b. blue to red
c. red to blue
d. blue to yellow

3 Which of the following household substances is a base? (There may be more than one.)

a. vinegar
b. ammonia
c. lemon juice
d. oven cleaner

4 To work this fire extinguisher you turn it upside-down. The two chemicals X and Y are most likely to be —

a. marble chips and hydrochloric acid
b. caustic soda and hydrochloric acid
c. marble chips and caustic soda
d. magnesium and hydrochloric acid



For question 5 to 8

Catherine has been given a number of solutions, and she has the PH of each by using indicator paper here are her results.

Solution	A	B	C	D	E	F	G
pH	3	4	9	6	8	5	7

5 Which solution is the most acidic?
6 Which solution is the most basic?
7 Which solution is neutral?
8 Which of the following will make solution **B** more acidic?

a. adding water
b. adding sodium hydroxide
c. adding solution A
d. adding solution E

9 Brad and Keith tested three solutions with blue litmus paper. The table below shows their results.

SOLUTION	COLOUR OF BLUE LITMUS
1	blue
2	red
3	blue

Brad said that solution 2 was acidic, and solutions 1 and 3 were basic. Keith agreed with solution 2 being an acid, but said that solutions 1 and 3 could be basic or neutral. Who was right? Why?

10 Which one of the following could be used to neutralise sulphuric acid?

a. vinegar
b. sodium hydroxide
c. water
d. hydrochloric acid