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Tutor support material

Entry Level

Edexcel Entry Level Certificate in Science (8938)

Unit 9: Electricity: Its Production and its Applications

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Introduction

This *tutor support material* accompanies the Edexcel Entry Level Certificate in Science specification and has been designed to help teachers prepare for first teaching of the qualification.

This document is for *Unit 9: Electricity: Its Production and its Applications*, and includes worksheets to aid the teaching of this unit.

Additional documents are available for all other units within the Edexcel Entry Level Certificate in Science. There is also a *Teacher's guide* document available, which gives more information on specialist language, assessment of practical skills and information on How Science Works.

Attention is drawn to the need for safe practice when students carry out laboratory experiments or observe demonstrations. Centres are responsible for the overall risk assessment of experimental work undertaken by students. Reference must be made to COSHH regulations and any specific local education authority restrictions.

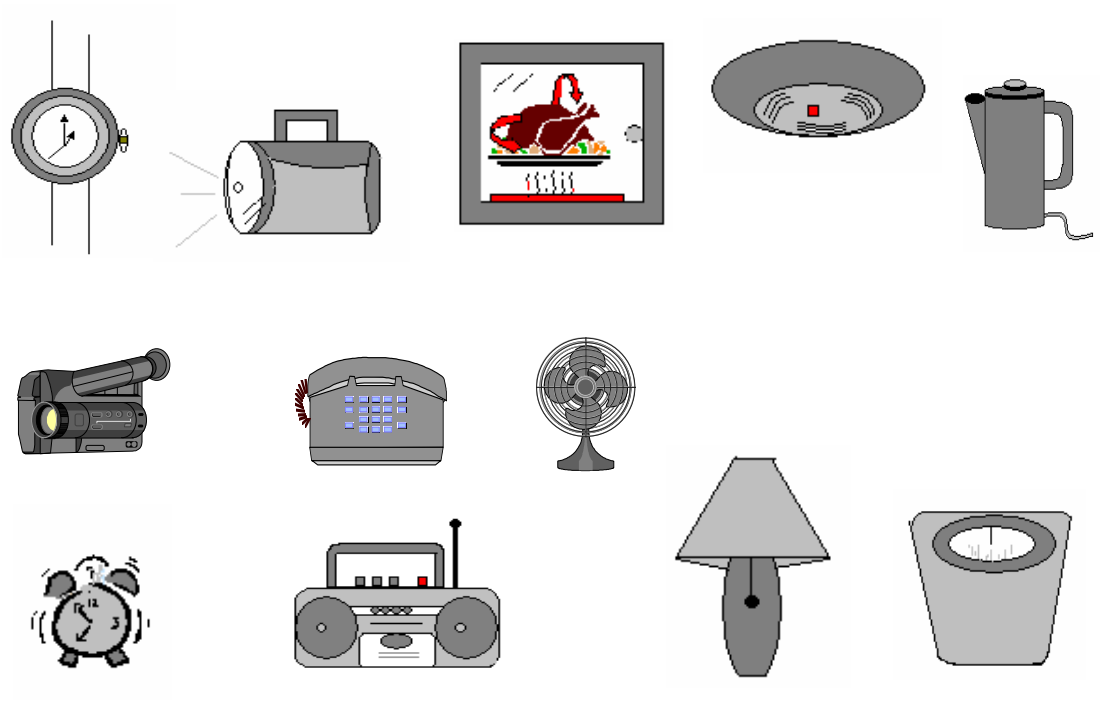
Relevant advice can be obtained from the following publications.

- *CLEAPSS Laboratory Handbook* (available from CLEAPSS School Science Service, website www.cleapss.org.uk)
- *Control of Substances Hazardous to Health Regulations* (HSE, 2005) ISBN 0717629813
- *Hazcards* (2004 update available from CLEAPSS School Science Service)
- *Topics in Safety, Third Edition* (ASE January, 2001) ISBN 0863573169

Worksheets for

Unit 9: Electricity: Its Production and its Applications

Household appliances



Look at the pictures above.

Draw a circle around all the things which use electricity.

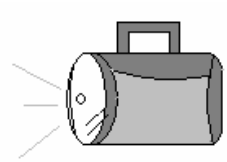
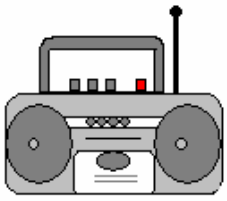
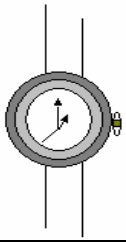
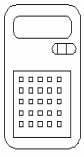
Decide which things use mains electricity and which things use batteries.

Put them in the correct columns below.

Use mains electricity	Use batteries

Electrical appliances

Find out how much voltage, current and power each device needs.

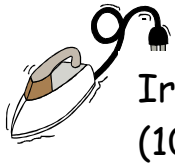
Device	Voltage	Current	Power
Torch 			
Portable radio 			
Alarm clock 			
Watch 			
Calculator 			
Smoke alarm 			

Electrical power

Everything that we plug into the electricity supply runs at the same voltage.

Appliances run at 240V in this country.

Appliances may use different amounts of electricity if they are switched on for the same period of time. This depends on the power rating – how many **watts**.

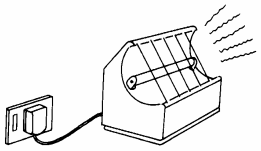


Iron
(1000W)

Hair
dryer
(500W)

Light bulb
(100W)

TV
(150W)



Heater
(1000W)

An iron has a bigger power rating than a TV.
So an iron uses more electricity than a TV set if they are both switched on for the same period of time.

The appliances in the diagram are switched on for the same period of time.

List these appliances in order, the one that costs the most to run goes first.

Order	Appliance	Watts
1		
2		
3		
4		
5		

Cost of electricity

Electricity comes into a house through underground cables. Electricity goes through an electric meter before being wired to the sockets.

Some meters are inside a house.

Some meters are in a box on the wall.

Where is the electric meter in your home?

_____

The meter measures how much electricity is used.

Sometimes a meter is read every three months.

Suppliers often estimate how much was used and don't read the meter.

Ask round the class where everyone's electric meter is and write down all of the different places.

_____

_____

_____

_____

The amount of electricity used by an appliance depends on:

- The power (in watts or kilowatts)
- The time it is switched on (in hours).

The electricity meter shows how many units of electricity have been used in the house.

- **A unit is a kilowatt-hour.**

Cost of electricity *(continued)*

Mr White has his electricity meter read in February.

The reading was 47200.

The time before that was in November when the reading was 47000.

The number of units that Mr White has used is:

48 200 – 47 000 = 1 200 units.

Mrs Green had her electricity meter read in May (58 000) and three months later in August (59 000).

Work out how many units Mrs Green has used.

Who has used the most electricity — Mr White or Mrs Green?

Mr White and Mrs Green have to pay 10p for each unit of electricity that they used.

So Mr. White's electricity bill is 1200 units x 10p per unit.

= 12000 p

= £120.00

Work out Mrs Green's electricity bill:

Cost = _____ units x 10p per unit.

= _____ p

= £ _____

Who has the bigger electricity bill — Mr White or Mrs Green?

Making simple circuits

You will need:

A battery

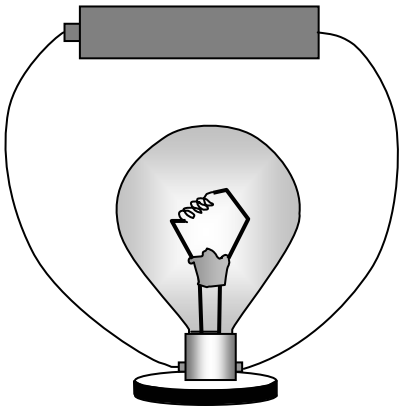
A lamp or bulb

Connecting wires

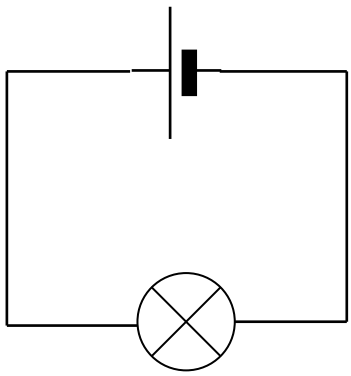
What to do:

1. Build the circuit to make the lamp light.

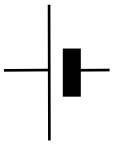
What it looks like



What a circuit diagram looks like

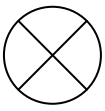


Circuit Diagram Key:



Battery or **cell** (pushes the current around the circuit)

Wire (connects the **circuit**)



Lamp or **bulb**

<u>Keywords</u>

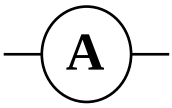
Circuits, Battery, Cell, Lamp, Wires, Push, Current

Measuring current

You will need:

A battery

A lamp

An ammeter 

Wires (connectors)

Circuit board

What to do:

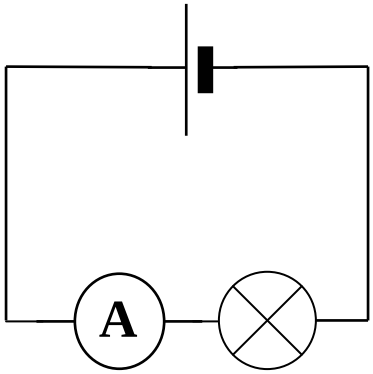
You are going to investigate the current in different parts of the circuit.

You will use an ammeter.

An ammeter measures how much current goes around a circuit.

1. Build the circuit shown here.
2. What is the current reading on the ammeter?

   Current = _____Amps.



3. Make up two more circuits, moving the ammeter and make a note of the current readings.
4. Draw your two circuits, using the correct symbols.

Circuit 2	Circuit 3
Current = _____Amps	Current = _____Amps

Keywords

Circuit, Current, Ammeter, Amps

Connecting lamps and batteries in series — 1

You will need:

1 battery

1 ammeter

2 lamps

Wires

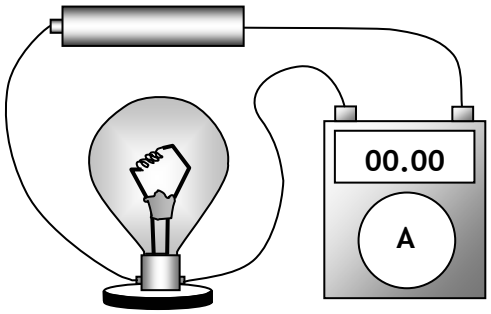
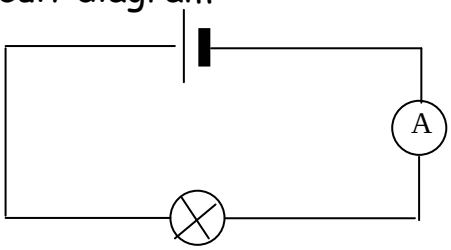
Circuit board

What to do:

Connect the bulb the ammeter and battery in series.

We call the brightness of this lamp normal.

Circuit A

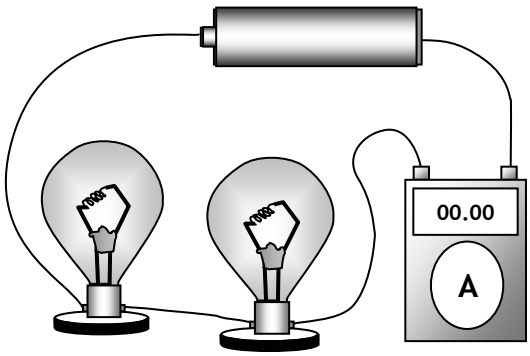
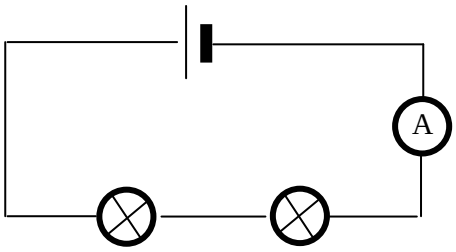
What it looks like	Circuit diagram
	

The ammeter reads _____

Connecting lamps and batteries in series — 2

Now insert an extra bulb in series with the first bulb as shown below.

Circuit B

What it looks like	Circuit diagram
	

The reading on the ammeter is _____.

The ammeter reading has increased/decreased/not changed *(delete the wrong words).*

The brightness of the bulb has increased/decreased/not changed *(delete the wrong words).*

What do you think will happen to the brightness of the bulbs if a third bulb is inserted between two bulbs?

_____

What do you think will happen to the reading on the ammeter if a third bulb is inserted between two bulbs?

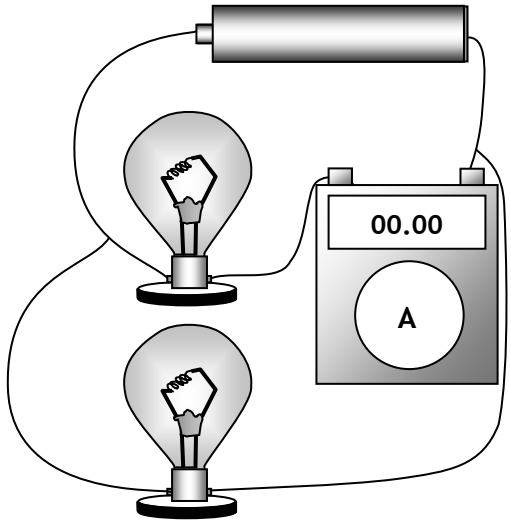
_____

Connecting lamps and batteries in parallel

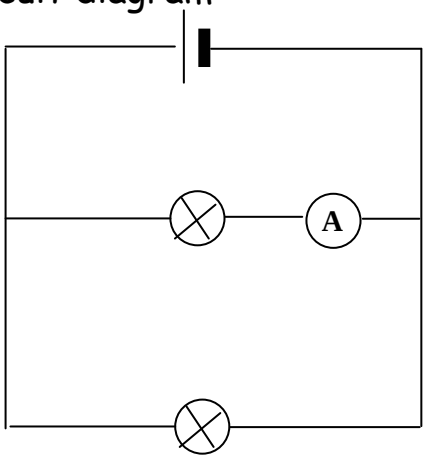
Connect two bulbs in parallel as shown below:

Circuit C

What it looks like



Circuit diagram



The reading on the ammeter is _____ .

The brightness of the bulbs are normal/less than normal/brighter than normal *(delete the wrong words).*

If another bulb is inserted across the first bulb what will happen to the brightness of the bulbs?

_____

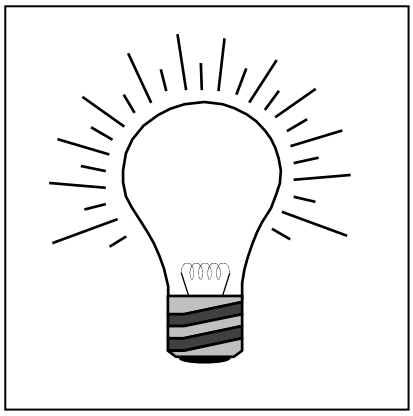
_____

If another bulb is inserted across the first bulb what will happen to the reading on the ammeter?

_____

_____

The electric light bulb



Have a look at a real electric light bulb.

Label the

- filament
- glass bulb
- contacts.

Which part of the light bulb gives out the light energy?

_____

Which part connects the light bulb to the electricity?

_____

Which part is made from a see-through material?

_____

Say how many light bulbs there are in each room in your home.

Room	Number of light bulbs

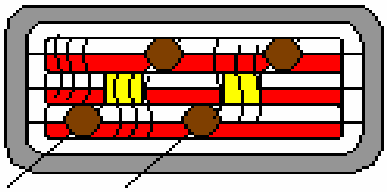
Explain how the light bulb works.

_____

Heating effects produced by an electric current

Electric bar heaters

Electric bar heaters are used in grills.

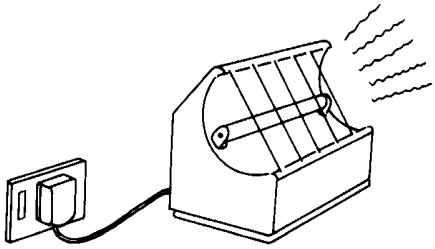


The bars get so hot that they glow red.

This produces radiation that is similar to light except that it cannot be seen.

The food absorbs the radiation.
This warms it up.

Electric bar fire



Explain how the energy from an electric bar fire warms you up in the winter.

Heating effects produced by an electric current — 2

Convection heaters — ovens

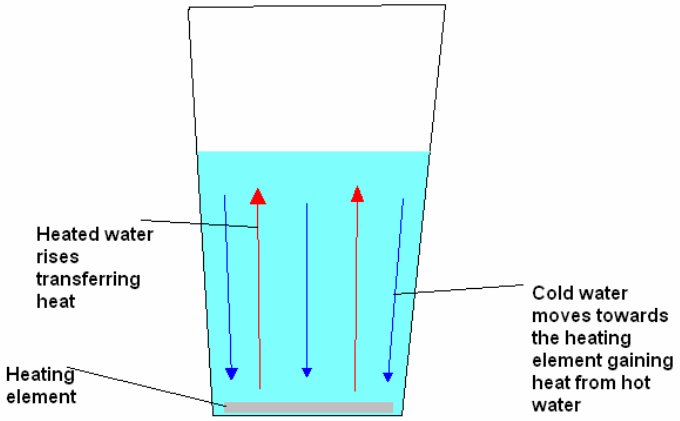
An oven is an example of a convection heater.

The heating element warms up the air that is in contact with it.

The hot air flows to the food.

The air transfers its heat to the food.

Convection heaters – water



Kettles

A kettle is another example of a convection heater.

Water in contact with the heating element becomes hot.

The hot water rises, transferring heat to cold water.

Why is the heating element placed near the bottom of the kettle?

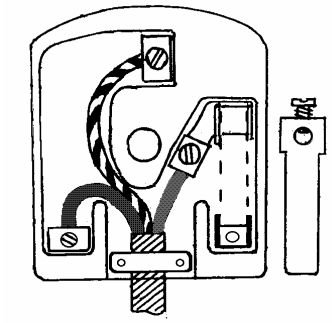
Immersion heater

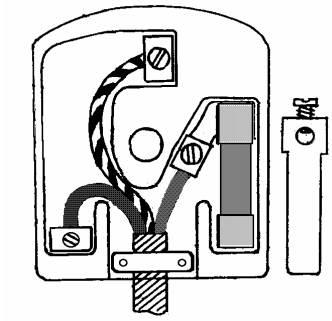
Hot water comes from a tank that contains an immersion heater.

How does the colder water near the top of the tank become warmer?

The three pin plug

MAINS ELECTRICITY CAN BE DANGEROUS





This is what a plug looks like with the top off.

You must never use a plug without a top on it.

The live wire carries current to the appliance.

The neutral wire carries current back from the appliance.

The earth wire is a safety wire.

The earth wire stops someone getting an electric shock if there is a fault.

What you need

A three pin plug (earth pin covered in thick layer of insulation)
Three core cable (outer insulation already stripped)
Screw driver
Wire stripper (if only simple wire strippers are available, they are very difficult to use correctly.

What you do

SAFETY - Your teacher must switch off the electricity supply to the sockets before you begin this activity.

You must not try to push any of the plugs into a socket.

Wire your three pin plug.

When you think you have wired it correctly, ask someone to check it and then show it to your teacher.

What's wrong with the wires?

Collect three more plugs that have been wired incorrectly.
For each one say what is wrong with it.

Plug *A*

_____

_____

Plug B

_____

_____

Plug *C*

_____

_____

Fuses

A **fuse** is a piece of wire that will melt if the current becomes too large.

This stops the large current from damaging things.

When it melts, it breaks the circuit and stops the current flowing.

Your teacher will show you a fuse (taken apart).

In a house, the fuses for various things that use mains electricity are in a fuse box near the electricity meter.

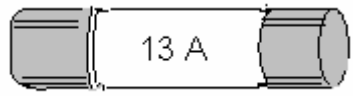
In many houses, **circuit breakers** are used instead of fuses.

Things that use mains electricity are called **applicances**.

Note that you must choose the right size fuse to match the appliance being used (iron, lamp, radio, TV, etc).

Find out more about which fuses to use.

REMEMBER — Never experiment with appliances connected to the mains



Safety

Look at the diagram of a three pin plug.

There are two important safety devices in a three pin plug.

Earth wire	Stops someone from getting an electric shock if they touch an appliance which is faulty.
Fuse	Melts and switches off the appliance if too much current passes through. This stops the appliance overheating.

Now answer these questions:

1. What are the colours of the

   neutral wire _____

   live wire _____

   earth wire? _____

2. What is the earth wire for? _____

   _____

3. What is the fuse for? _____

   _____

4. What do you think the cable grip is for? _____

   _____

5. Why do you think a plug is made from plastic or rubber and not from a metal?

   _____

   _____

Electricity supply

13A fuses and 3A fuses are available. Which fuse would you use for the following appliances that use the current shown?

Electric fire (8A) _____

TV (1A) _____

Kettle (4A) _____

Bulb (0.25A) _____

Different appliances need the correct fuses in their plugs. You have a choice of 3A, 5A and 13A fuses. Which one should be fitted in the plugs of the following?

Appliance	Power	Current	Fuse
Iron	920 W	4 A	
Lamp	100 W	0.5 A	
TV	230 W	1 A	
Hairdryer	1150 W	5 A	
Fire	2000 W	8 A	

Testing a fuse

(Teacher demonstration or student activity)

You will find out how a fuse protects a light bulb (lamp) from damage.

What you need

A low voltage d.c. power supply
One 6V 5W lamp and holder
Crocodile clips and connecting wires
Several 0.5 A fuses (or suitable fuse wires) plus fuse holder

What to do

1. Connect the power supply (switched off) to the lamp and the fuse holder.
2. Put a fuse in the holder.
3. Set the power supply to 4 volts.
4. Switch on the power supply.
5. Increase the setting of the power supply slowly.
6. Examine the fuse. What has happened?
7. Turn off the power supply.
8. Reset the power supply to 6 V.
9. Put in another fuse.
10. Turn on the power supply. Does the lamp still work?

Discuss your results.

Electricity mix n' match

Column A has the first half of some sentences.

The second half of each sentence is in Column B.

Match up the sentences so that they are correct.
The first one has been done for you.

Column A	Column B
1 Energy flows along	a make a complete circuit.
2 The neutral wire is needed to	b power sockets.
3 Batteries supply	c alternating current.
4 People should not use electricity when	d protects the user from electrocution.
5 A bathroom should not have	e the live wire.
6 The mains supply is	f direct current.
7 The earth wire	g their hands are wet.
8 When two bulbs are connected in series their brightness	h increases.
9 When two bulbs are connected in parallel their brightness	i decreases.

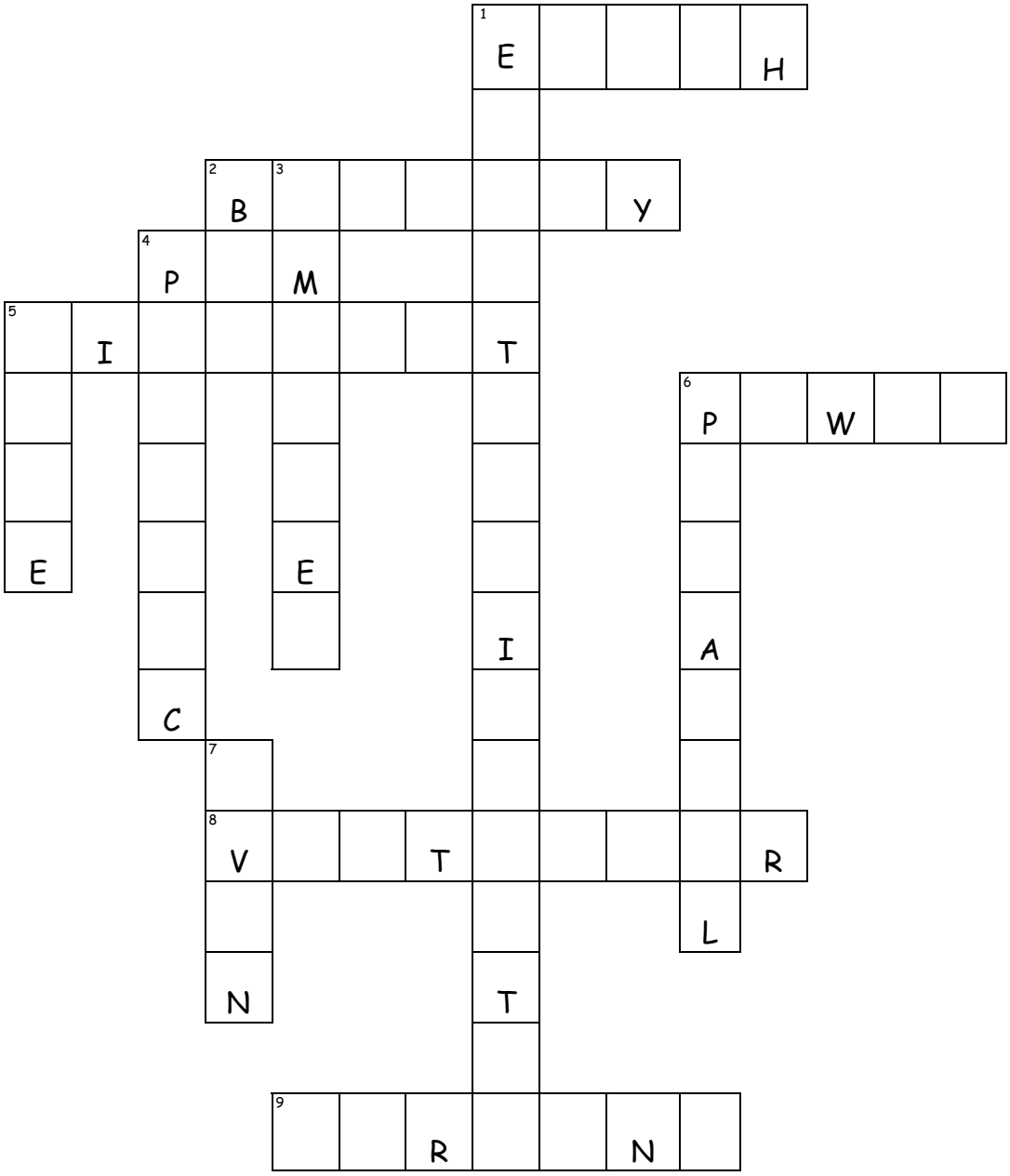
Word search

Find these words in the grid:

live	plug
batteries	neutral
circuit	bulb
electrical	convection
power	wires
fuse	current

L	T	N	E	R	R	U	C	R	L	O	N
T	I	U	C	R	I	C	E	A	L	O	K
S	I	V	A	X	V	S	C	P	I	Q	L
D	E	F	E	W	U	I	B	T	L	S	A
Z	C	R	D	F	R	P	C	L	O	V	R
G	I	E	I	T	J	E	W	U	U	R	T
U	C	M	C	W	V	G	L	S	A	B	U
L	W	E	Q	N	P	O	W	E	R	S	E
P	L	D	O	A	S	C	T	W	N	I	N
E	K	C	S	E	I	R	E	T	T	A	B

Letter Ladder



Across

1 Name one of the wires in a plug.
2 This provides electric energy for a torch.
5 This part of a bulb gives out light.
6 This is measure in watts.
8 This measures voltage.
9 What flows through the wires in an electric circuit?

Down

1 This measures the amount of electricity used in your home.
3 This measures the amount of current flowing in a circuit.
4 Plugs are made from this material.
5 This is found in a plug. It melts if the current is too large.
6 Bulbs may be connected in series or in ……
7 This kitchen device is an example of a convection heater

May 2008

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