

# **S2 Electricity & Magnetism**

## **Self Checks**

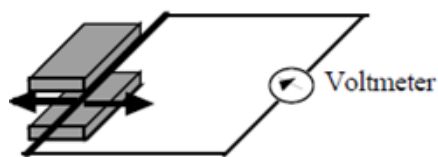


# **Self Check 1**

1. Draw a labelled diagram of an electromagnet. Choose the components from the list below:

**switch      lamp      battery      wire      iron core      spring**

2. State one method of increasing the strength of an electromagnet.
3. (a) What is the advantage of using an electromagnet instead of a permanent magnet?  
(b) Give one use of an electromagnet in everyday life.
4. Name two pieces of equipment that work because of the electromagnet inside them .
5. (a) What is the energy change in an electric motor?  
(b) What is the function of the brushes in an electric motor?
6. When a conductor is moved in a magnetic field there is an induced voltage.



State three things that the size of the voltage depends on.

- 7 (a) What is a dynamo?  
(b) How is electrical energy produced in a dynamo?  
(c) Give one use for a dynamo.

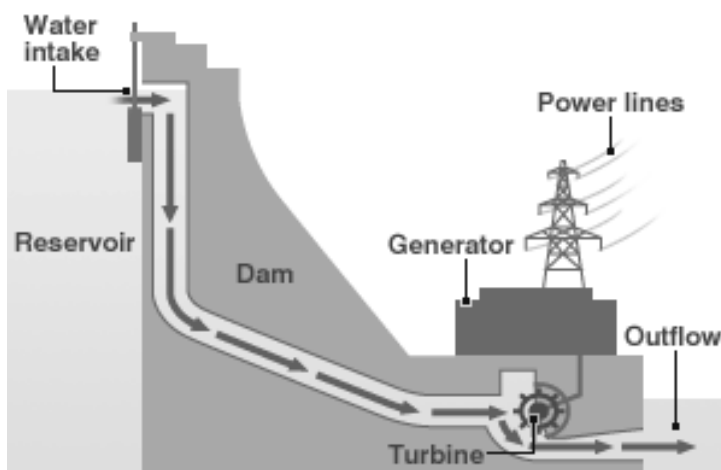


## Self Check 2

5. What is the energy change in a generator?
5. Draw a table with headings **renewable** and **non-renewable** . Place the following sources of energy under the correct headings.

| Coal | hydro | wind | gas | nuclear | solar |
|------|-------|------|-----|---------|-------|
|------|-------|------|-----|---------|-------|

3. Give a reason why we have to find alternatives to coal, oil and gas for generating electricity.
3. Below is a picture of a hydroelectric power plant



- (a) What kind of energy is stored in the water behind the dam of a hydroelectric power station?
- (b) Give one advantage and one disadvantage of using hydroelectric power.
- (c) Why do you think Scotland is a particularly good place for hydroelectric power stations?
4. (a) What fuel is used in a nuclear power station?
- (b) Give one advantage and one disadvantage of using nuclear power.



## **Self Check 3**

1. A pupil wants to give a balloon a charge and stick it to a wall.

- (a) What should the pupil do to give the balloon a charge?
- (b) What are the two types of electrical charge?



2. In another investigation a pupil brings two charged rods close together. The pupil notices that the rods are repelled from each other.

- (a) What does this tell the pupil about the charge on each rod?
- (b) What will the pupil have to do if she wants the rods to be attracted to one another?

3. Some substances conduct electricity and some do not.

- (a) What are “non-conductors” of electricity called?
- (b) Using the materials listed below, create a table to separate them into conductors and insulators.

|               |                |               |             |                    |
|---------------|----------------|---------------|-------------|--------------------|
| <b>copper</b> | <b>plastic</b> | <b>glass</b>  | <b>iron</b> | <b>graphite</b>    |
| <b>air</b>    | <b>silver</b>  | <b>rubber</b> | <b>gold</b> | <b>polystyrene</b> |

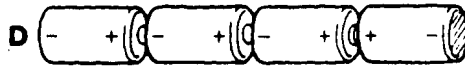
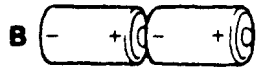
4. When connected to a battery, a bulb allows an electrical current to flow.

- (a) What is meant by the term “electrical current”?
- (b) Why does the bulb not light when a wire is removed?
- (c) What does the battery provide in this example?



## Self Check 3 Continued

5. Look at these groups of cells. Each cell has a voltage of 1.5V.



- (a) Which group has the biggest voltage and what is its voltage?
- (b) Which group has the smallest voltage and what is its voltage?
6. A student makes the following statements about electricity.
- I Current is a flow of negative charges called electrons.
  - II Current can be measured using a voltmeter.
  - III Current is able to flow if there is a gap in the circuit.

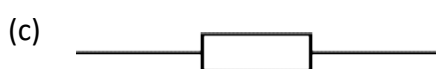
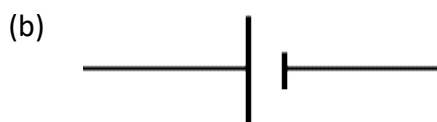
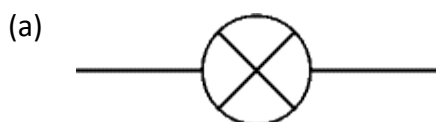
Which of these statements is/are correct?

- A. I only
- B. II only
- C. III only
- D. I and III only
- E. I, II and III

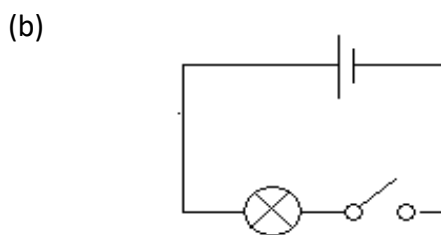
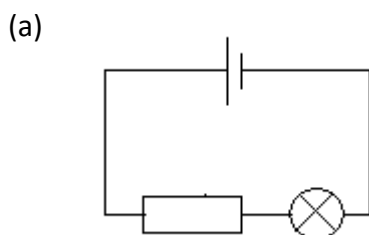


## Self Check 4

1. Copy and identify the following symbols.



2. Describe the circuits below.



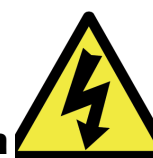
3. (a) What is meant by voltage?

(b) What are the units of voltage?

(c) What piece of apparatus would you use to measure voltage? Draw the symbol for this piece of apparatus.

4. Copy and complete the table below:

| Current (A) | Current (mA) |
|-------------|--------------|
| 5           |              |
|             | 300          |
|             | 1            |
| 0.009       |              |

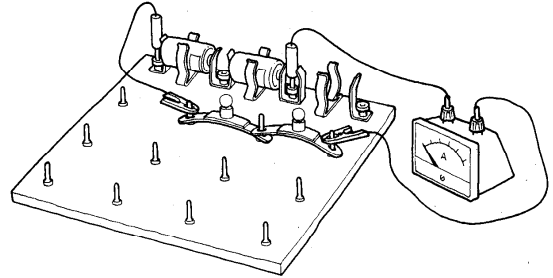


# Self Check 4 Continued

6. In the circuit to the right the bulbs are identical.

(a) Draw a circuit diagram for this circuit.

(b) What can you say about the brightness of each bulb ?

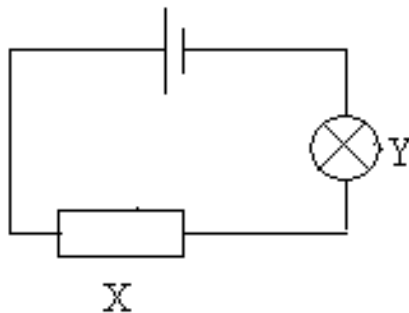


7. Describe how :

(a) an ammeter is positioned to measure current

(b) a voltmeter is positioned to measure voltage.

8. A pupil builds the following circuit:



(a) Identify components X and Y.


(b) Redraw the circuit showing how the current through X can be measured.

(c) Redraw the circuit showing how the voltage across Y can be measured.




## Self Check 5

1. What are the units of resistance?
2. (a) What meter is used to measure resistance?  
(b) Draw the symbol for this meter.
3. Students are having a discussion about resistance:




Student A

When resistance increases the reading on an ammeter will get smaller



Student C

Resistance does not affect the current so an ammeter will be the same



When resistance increases the current increases.

- (a) Which student is correct? Explain your answer.
  - (b) Design a circuit so that the student could prove he/she is correct.
- (a) An ohmmeter states that the resistance of an electrical component is  $3.5 \text{ k}\Omega$ . What is the components resistance in ohms?
  - (b) Copy and complete the following table:

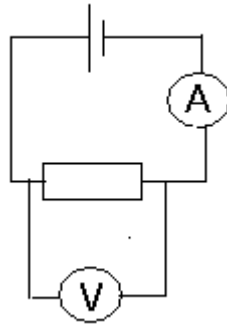
| Resistance ( $\Omega$ ) | Resistance ( $\text{k}\Omega$ ) |
|-------------------------|---------------------------------|
| 2000                    |                                 |
|                         | 0.3                             |
|                         | 0.04                            |
| 250                     |                                 |
|                         | 5.4                             |



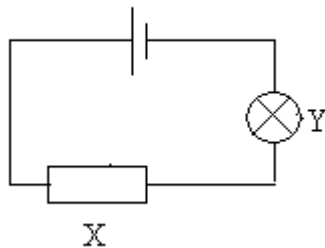


## Self Check 5 Continued

5. The circuit below is set up to determine the value of the resistor.



- (a) What quantities are being measured in the circuit?
- (b) What would happen to the current if the resistor was replaced with a larger resistor?
6. Resistor X is added to the circuit below.



- (a) What happens to the brightness of bulb Y when the resistor is added to the circuit?
- (b) Explain the change in brightness of the bulb.



# Self Check 6: Series Circuits

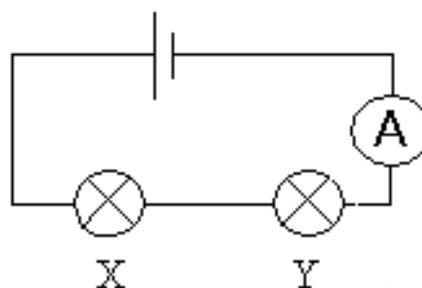
1. Look at the circuit diagram below, X and Y are identical bulbs :

(a) What can you say about the brightness of the bulbs?

(b) What can you say about the current flowing through each of the bulbs?

(c) How many paths are there for the current to take in this circuit?

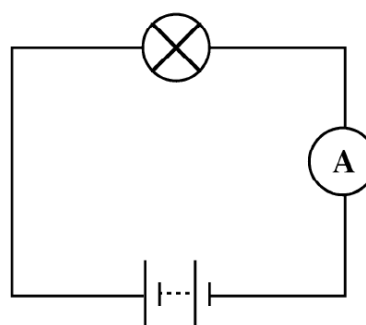
(d) What name is given to this type of circuit ?



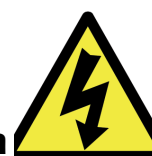
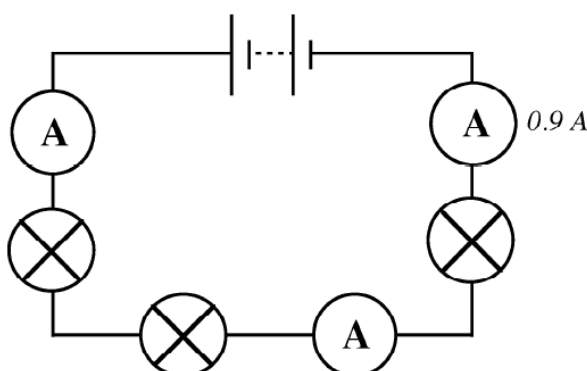
2. (a) In a series circuit is the current at the negative terminal of the supply greater than, less than or equal to the current at the positive terminal ?

(b) What can you say about the current at all points in a series circuit ?

3. In the circuit opposite the ammeter reads 0.6 amperes.  
What is the current through the lamp?

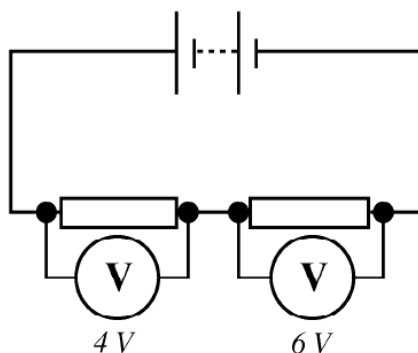


4. Redraw the circuit below and write the reading beside each ammeter symbol.

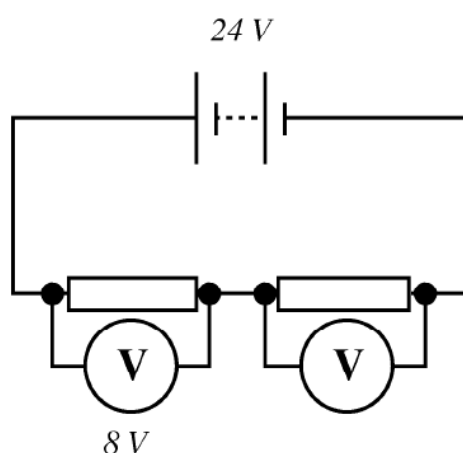


## Self Check 6 continued

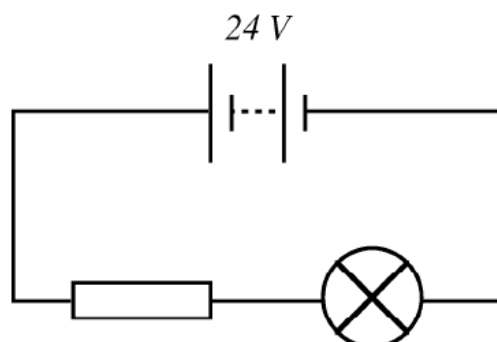
5. State the rule for voltage in a series circuit.
6. In the circuit below, the voltages are as shown. What is the voltage of the supply?



7. In the circuit below, the voltages are as shown. What is the voltage across the second resistor?



8. The diagram shows a  $6\text{ V}$  bulb working correctly off a  $24\text{ V}$  supply. What must be the voltage across the resistor?

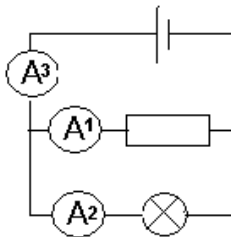
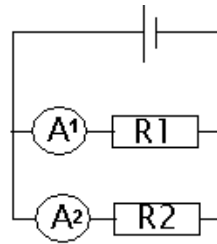


# Self Check 7 : Parallel Circuits

- Which of the following statements is/are true for **parallel** circuits.  
 A There is only one pathway round the circuit.  
 B There is more than one pathway around the circuit.  
 C The potential differences around the circuit add up to the supply voltage.  
 D The potential difference (voltage) is the same across all components.  
 E The current is the same at all points in the circuit.  
 F The current through each component adds up to the supply current.

- In the circuit opposite, ammeter  $A_1$  reads 0.2 A and  $A_2$  reads 0.3 A.

What is the supply current in the circuit ?

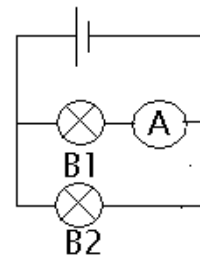


- In the circuit, ammeter  $A_1$  reads 0.2 A and  $A_3$  reads 1.5 A.

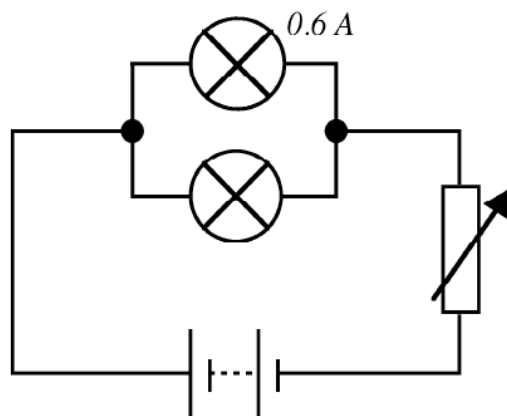
What current passes through  $A_2$  ?

- In the circuit opposite, bulbs B1 and B2 are identical. The ammeter next to B1 reads 0.5 A.

What is the current (i) flowing through bulb B2 ?  
 (ii) at the supply ?

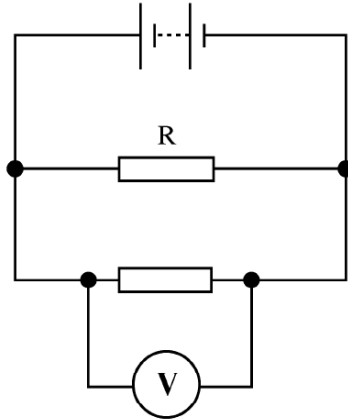


- In the circuit below, the lamps are identical and the current through each lamp is 0.6 A. Redraw the circuit and mark beside each component the value of the current through it.

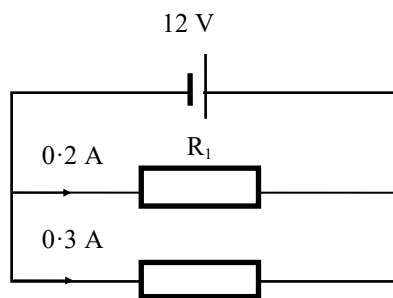


# Self Check 7 continued

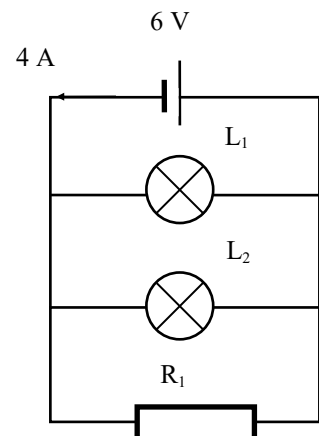
6. In the circuit below, the voltmeter reads 4 volts.  
What is the voltage across the resistor R?



7. Two resistors are connected in parallel to a 12 V battery as shown below.

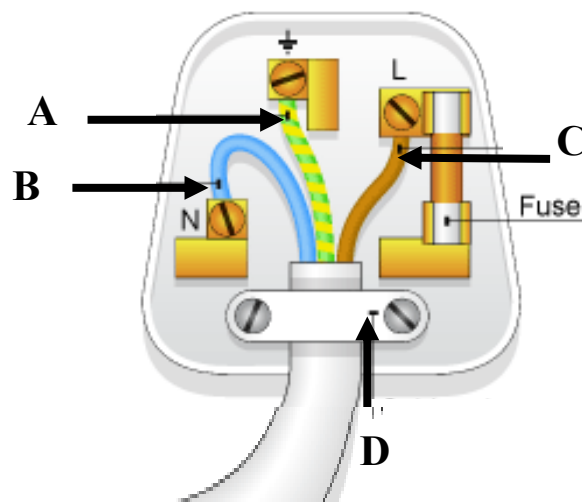


- (a) What is the voltage across R<sub>1</sub>?
- (b) What is the voltage across R<sub>2</sub>?
- (c) What size of current is drawn from the battery?
8. Two identical bulbs and a resistor are connected in parallel to a 6 V supply as shown opposite.
- (a) What is the voltage across L<sub>2</sub> ?
- (b) A current of 1.8 A flows through each of the bulbs.  
What is the current flowing through the resistor?



## Self Check 8

1. Draw the circuit symbol for a fuse.
2. What is the purpose of the fuse in a plug?
3. A pupil decides to put a 3A fuse in an appliance which draws a current of 7A.
  - (a) Explain why the appliance will not work properly.
  - (b) What value of fuse should the pupil have used?
4. The inside of a plug is shown below.

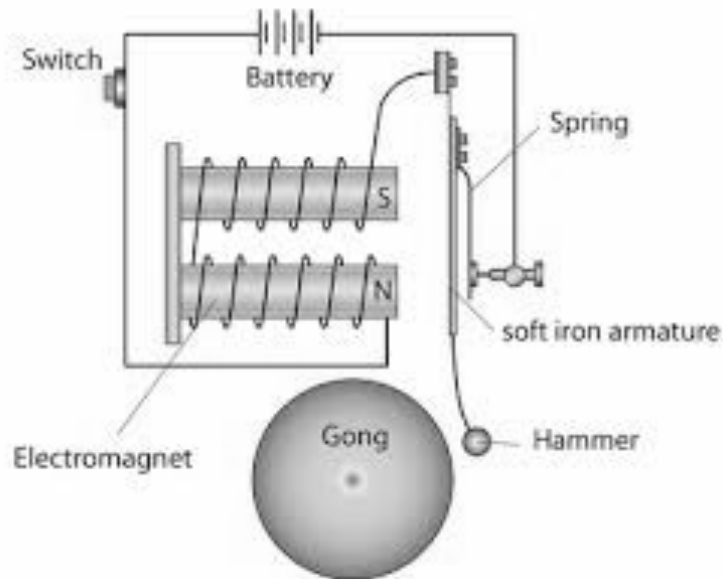


- (a) Identify wire C. What colour is the wire's insulation?
- (b) Identify wire B. What colour is the wire's insulation?
- (c) What is the name of wire A? What is the purpose of this wire?
- (d) What is the purpose of the device labelled D?



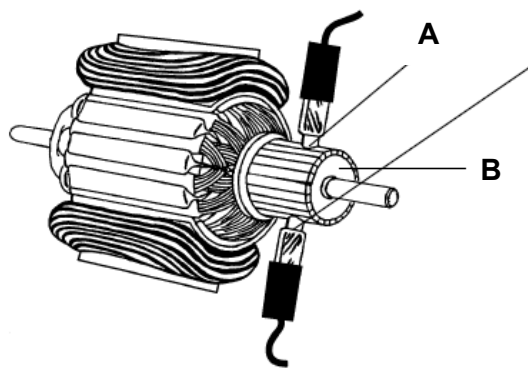
# Extra Work Self Check 1

3. The circuit diagram of an electric bell is shown below.



When the switch is pushed, explain how the bell operates..

4. A diagram of an electric motor is shown .  
Identify labels **A** and **B** on the diagram.



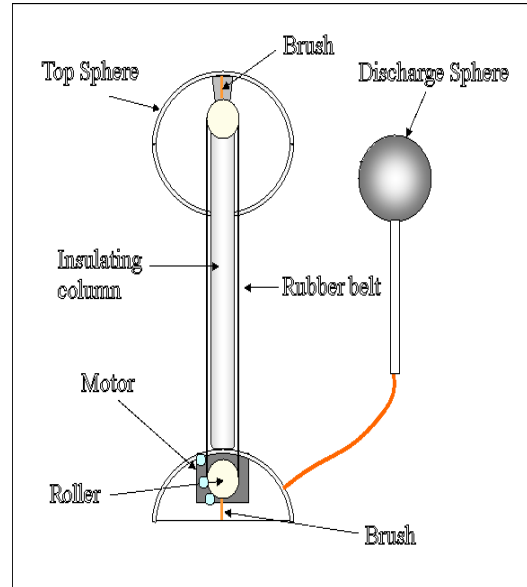
5. When a conductor is moved in a magnetic field there is an induced voltage.  
State three things that the size of the voltage depends on.



# Extra Work Self Check 2

1. A Van de Graaf generator is used by a student investigating electrostatic charges.

- (a) Explain why charges build up on the dome of the Van de Graaf.
- (b) What will happen if an earthed rod is brought close to the Van de Graaf?
- (c) Give one other example of an experiment the student could carry out to investigate electrostatic charges.



2. The current flowing in a circuit is:

- A. A flow of protons from negative to positive.
- B. The push given to the charges in a wire.
- C. Electrons flowing from negative to positive.
- D. Electrons flowing from positive to negative.
- E. The flow of neutrons.

3. Why are electric cables:

- (a) made of copper?
- (b) coated with plastic?





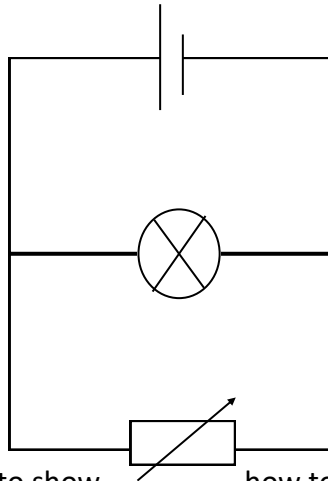
# Extra Work Self Check 3

1. (a) Draw a circuit, using symbols, that contains the following items:

**wires      cell      resistor      two bulbs      switch**

- (b) (i) Redraw your circuit to show how a voltmeter would be connected to measure the voltage across one of the bulbs.
- (ii) Redraw your circuit to show how an ammeter would be connected to measure the current flowing through the resistor.

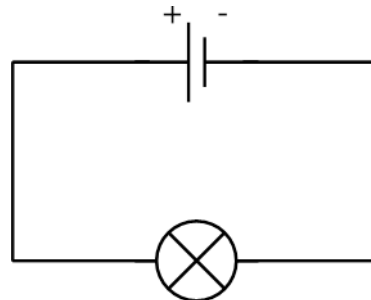
2. Another student builds a different circuit:



- (a) Redraw the circuit to show how to measure the current through the variable resistor.
- (b) Redraw the circuit to show how the voltage across the bulb should be measured.

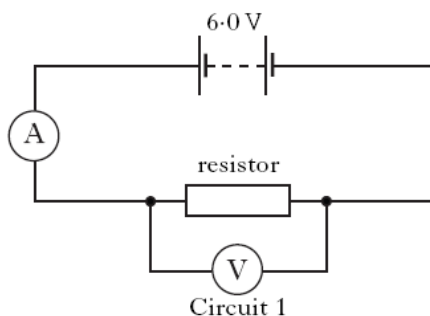
3. In the simple circuit, opposite

- (a) What is the purpose of the cell?
- (b) What is the energy change in the bulb?
- (c) What would happen to the bulb if the circuit was broken?  
Explain your answer.



# Extra Work Self Check 4

1. A student has four resistors labelled A, B, C and D. The student sets up Circuit 1 to identify the value of each resistor.



Each resistor is placed in the circuit in turn and the following results are obtained.

- (a) Using the relationship

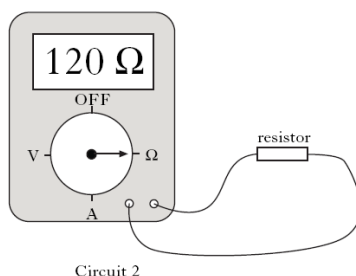
$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

| <i>Resistor</i> | <i>Voltage across resistor (V)</i> | <i>Current (A)</i> |
|-----------------|------------------------------------|--------------------|
| A               | 6.0                                | 0.017              |
| B               | 6.0                                | 0.027              |
| C               | 6.0                                | 0.050              |
| D               | 6.0                                | 0.033              |

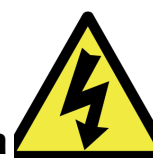
## Current

show which of the resistors has a value of  $120\Omega$ .

The student then sets up Circuit 2 to measure the resistance of each resistor.

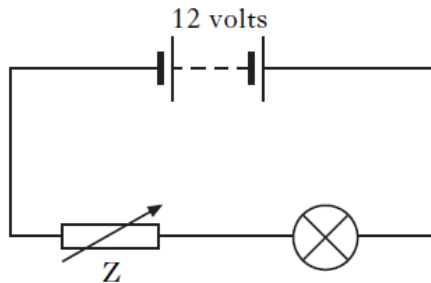


- (b) State one advantage of using Circuit 2 to measure the resistance compared to using Circuit 1.

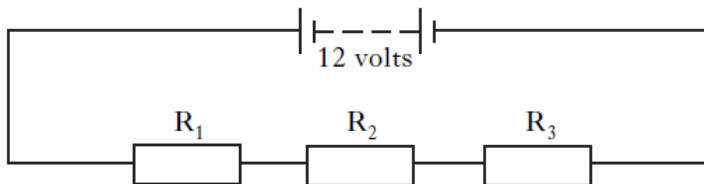


# Extra Work Self Check 5

1. A student builds the following circuit.



- (a) What is component Z?
  - (b) The student measures the voltage across the lamp with a voltmeter. Redraw the circuit diagram above with the voltmeter in place measuring the voltage across the lamp.
  - (c) The voltage across the lamp is 7 volts. What is the voltage across component Z?
  - (d) Suggest two changes you could make to the circuit to make the lamp brighter.
2. A circuit is set up as shown below.

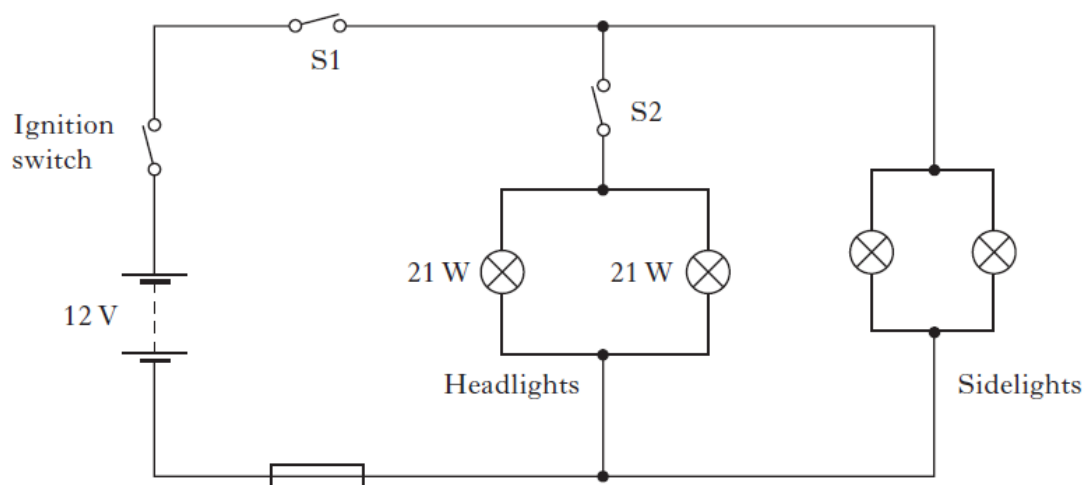


- (a) What would be the voltage across resistor  $R_1$  if the resistors in the circuit are identical?
- (b) What will happen to the current in the circuit if another resistor is added in series to the circuit?

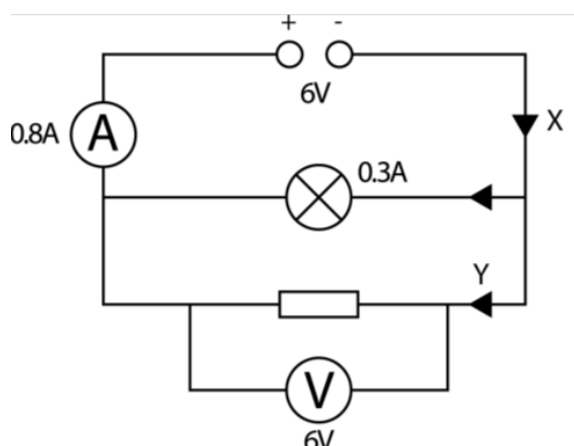


# Extra Work Self Check 6

1. The circuit shows how the headlights and front sidelights are wired in a car.



- Are the headlights connected in series or parallel with each other?
  - Which switch or switches should be closed so that only the sidelights are on?
  - The current in each sidelight is 0.8 amperes. Calculate the total current drawn from the battery when both sidelights are on.
2. In the circuit below the ammeter reads 0.8A, the current through the lamp is 0.3 A and the voltmeter reads 6V.

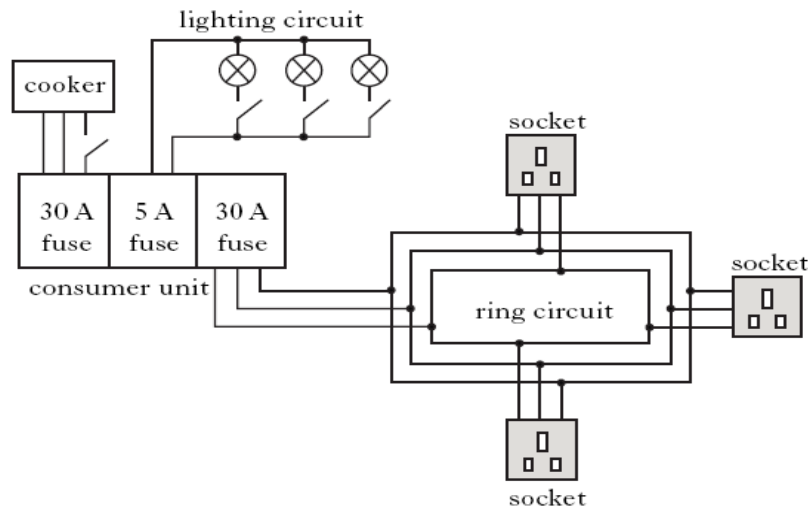


- What are the current values at X and Y?
- What is the potential difference across the lamp?



# Extra Work Self Check 7

1. The diagram shows three household circuits connected to a consumer unit.



- (a) What voltage will an appliance receive when it is plugged into one of the sockets?
- (b) Explain what the purpose of the fuses are in this circuit.
- (c) What would happen if the cooker was accidentally connected to the 5A fuse box?
2. A householder goes on holiday for 14 days. The electric fire is unplugged, every other appliance is left on standby. The table below shows how much power per day each appliance uses when left on standby.

| <i>Appliance</i>          | <i>Power Rating (W)</i> |
|---------------------------|-------------------------|
| Home entertainment centre | 350                     |
| Hi-fi                     | 150                     |
| Games console             | 300                     |
| Electric fire             | 2080                    |

Find the total power used by the appliances whilst the home-owner is away on holiday.

