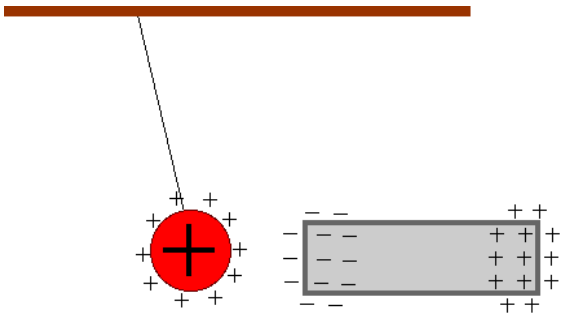
Electricity review questions and answers

1) Charge and induction

The diagram on the right shows a ball suspended on a string. The ball has been given a positive charge.



(a) State what must have been removed from the ball to give it a positive charge.

Electrons

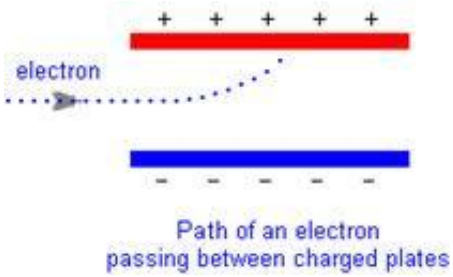
(b) An uncharged bar of metal is brought near the ball.

a. Explain why charge is induced in the bar as shown in the diagram

The positive ball will attract the electrons along the bar making the near end of the bar negatively charged and the far end positively charged

b. Explain why this results in the ball moving towards the bar

The attraction of the ball to the negative end of the bar will be stronger than the repulsion from the positive end. The net result will be an attraction towards the bar.



Path of an electron passing between charged plates

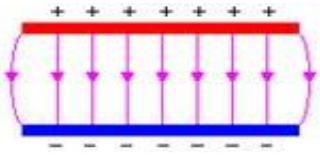
2) The electron and the plates

The diagram on the left shows an electron moving between two charged plates.

(a) Explain why the electron follows the dotted path.

The electron is attracted to the positive plate (and repelled from the negative one)

(c) Re draw the plated showing the the plates and at the edge of the

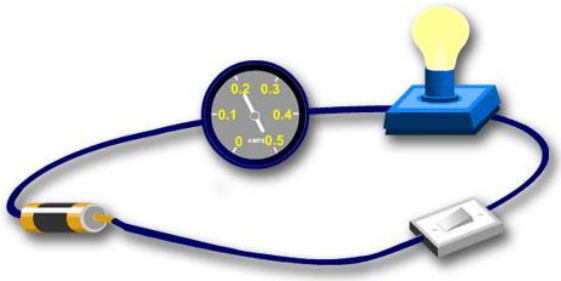


The field between charged plates

electric field lines between plates.

3) Flow of charge

a) The circuit shown has a reading of 0.2 on the meter. State what sort of meter it is , what it is measuring and what units are used for the measurement.

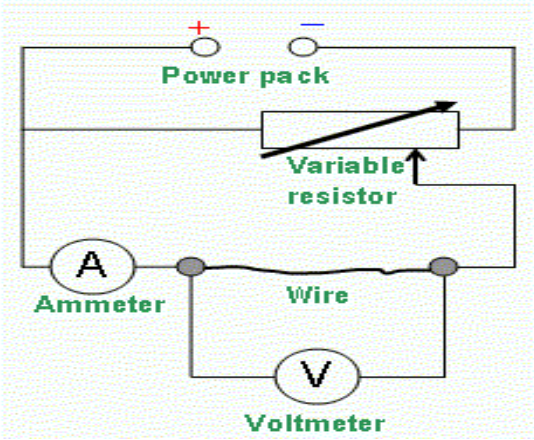


Ammeter measuring current in amps.

b) If the circuit is switched on for 2 minutes how much charge has flowed?

2 minutes is 120 seconds

Q = I t or Charge = Current x time = 0.2 x 120 = 24 coulombs or 24 C



4) **Test circuit**

The circuit on the left can be used for testing the current flowing through a wire at different voltages.

a) If the emf of the power pack is 12V what is the range of voltage that this circuit could test the wire for?

0 to 12 V range can be tested

b) Sketch a graph of current vs voltage to show the likely result of the test.

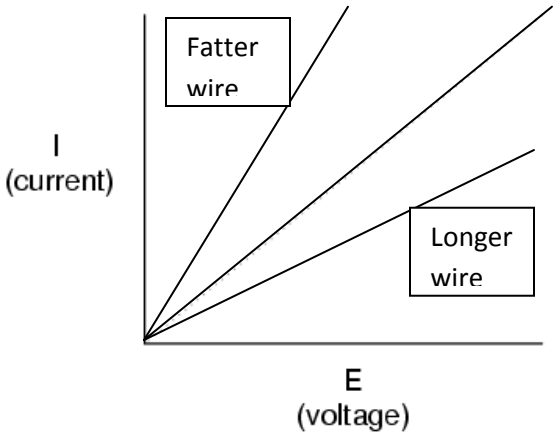
c) Sketch and label two other lines on your graph to show the possible results if

i) A longer wire was used

(more resistance so less current)

ii) A fatter wire was used

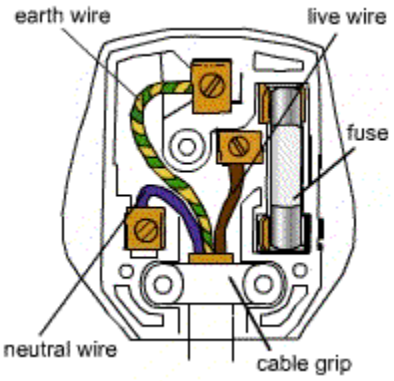
(less resistance so more current)



5) Mains electricity

The diagram opposite shows an electric plug.

Explain the purpose of each of the components labelled.



Earth wire connects to the casing of the device and is at 0 Volts for safety of the user.

Live wire is at 230V and provides the emf for the device

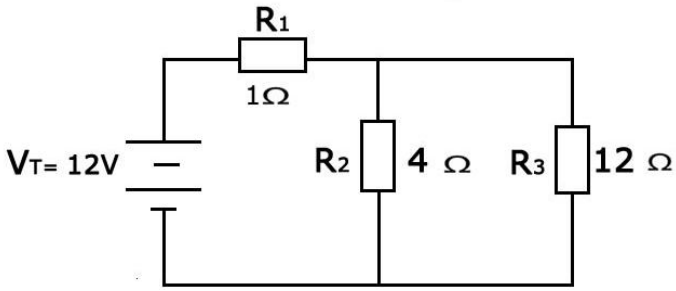
The fuse melts if the current is too great. This can protect the device from overheating. It can also protect the user if a live wires touches the casing. If this happens a large current will flow and cause the fuse to melt making the device safe.

The cable grip holds the wire in place

The neutral wire is a 0V and completes the circuit allowing current to flow to the device.

6) Circuit puzzle

The circuit below has a 4 Ohm and 12 Ohm resistor in parallel.



a) Show that the combined resistance of these two resistors is 3 Ohms?

1 /R = 1/ 4 + 1/12 = 4 / 12 = 1/3

So R = 3

b) What is the resistance of the circuit?

R = 1 Ohms + 3 Ohms = 4 Ohms

c) What is the current in the circuit?

I = V / R = 12 / 4 = 3 Amps

d) What is the potential difference across the 1 Ohm resistor?

V = I x R = 3 Amps x 1 Ohms = 3 Volts

e) What is the potential difference across the two parallel resistors?

If the p.d. of whole circuit is 12 V so if 3 V is dropped across the 1 Ohms resistor that leaves 9V dropped across the parallel resistors.

f) How much current flows thought the 4 Ohms resistor and how much through the 12 Ohm resistor.

I = V / R = 9 / 4 = 2.25 Amps though the 4 Ohm resistor

I = V / R = 9 / 12 = 0.75 Amps though the 12 Ohm resistor

7) Circuit breakers

The fuse box in a house may contain fuses or it may contain circuit breakers.

a) Explain what the fuses/circuit breakers do and what this protects against.

Fuses and circuit breakers protect against a circuit current getting too high. Too high a current could result in damage to the circuit or even an electrical fire or damage to a device.

b) Explain the advantage of a circuit breaker compared to a fuse.

The circuit breaker can be reset but a fuse needs to be replaced

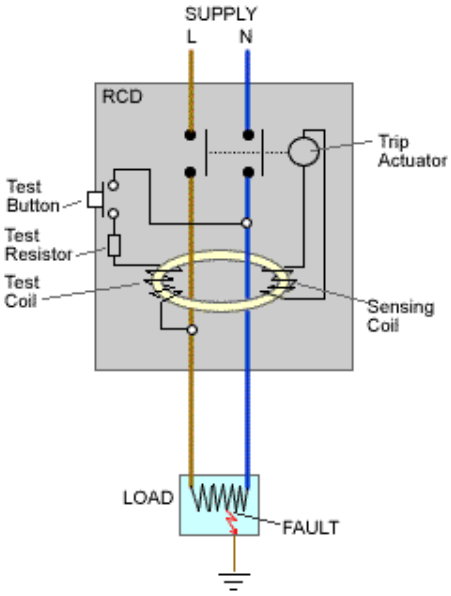
For extra safety you can have residual current devices (RCB) or residual current circuit breakers (RCCB) in some circuits. [They are the same thing]

d) The RCB works by comparing the current in which two wires?

Live and Neutral

e) In normal operation how does the current in these two wires compare?

In normal operation all the current delivered by the live wire flows through the device and back out the neutral wire so the current is the same in both wires.



8) Kilowatt hours and paying for electrical energy

If a 2kW heater is switched on for 10 hours.

a) How many kWh of electrical energy has been used? **2kW x 10 hours = 20 kWh**

b) If this costs the user £2 what is the cost per kWh or unit of electricity?

Cost = Units x Price per unit

Price per unit = Cost ÷ Units = 200p ÷ 20 units = 10 p/kWh

c) How many joules of electricity is 1 kWh?

1 kW is 1000W which is 1000J of energy transfer per second.

1 hours is 60 x 60 = 3600 seconds.

1 kWh = 1000 x 3600 = 3,600,000 J or 3.6 x 106J or 3.6 MJ

Sources:

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