CAIE Physics IGCSE

Topic 4.2 - Electrical Quantities

Flashcards

What force is experienced between objects with the same charge?

What force is experienced between objects with the same charge?

Repulsion

What force is experienced between objects with opposite charges?

What force is experienced between objects with opposite charges?

Attraction

What is an electric field? (supplement)

What is an electric field? (supplement)

A region of space in which the effects of charge can be felt. When another charge enters the field, both charges interact and experience a force.

What is a conductor?

What is a conductor?

A conductor is a material which **can** conduct electricity; electrons / charged particles are able to flow through it.

What is an insulator?

What is an insulator?

An object which does not conduct electricity. Electrons cannot flow through the material.

What is charging?

What is charging?

The addition or removal of electrons from a material.

How can insulators be electrostatically charged by friction?

How can insulators be electrostatically charged by friction?

- Rub two insulators together (a cloth and a rod).
- Electrons transfer from one to the other (from the rod to the cloth).
- Each object becomes oppositely charged (the rod becomes positively charged, and the cloth becomes negatively charged).

How can electrostatic charge be detected?

How can electrostatic charge be detected?

- Charge two rods of insulator using friction, one after the other.
- Hold the charged ends of both rods together.
- If a force is experienced, it indicates both rods are charged.
- If they repel, they have the same charge.
- If they attract, they have opposite charges.

How can conductors and insulators be distinguished from one another ?

How can conductors and insulators be distinguished from one another?

Using a Gold-leaf electroscope (GLE).

How are electric fields around charged objects represented? (supplement)

How are electric fields around charged objects represented? (supplement)

Using field lines.

What does the direction of an electric field line at a certain point show? (supplement)

What does the direction of an electric field at a certain point show? (supplement)

The direction of the force on a positive charge placed in the magnetic field at that point

How are strength and direction of an electric field demonstrated using field lines?

(supplement)

How are strength and direction of an electric field demonstrated using field lines? (supplement)

- Arrows on the field lines pointing away from positive charges and towards negative charges
- The distance between field lines shows the strength. (closer together = stronger).

Where is the electric field strongest?
(supplement)

Where is the electric field strongest? (supplement)

Closest to the charge object.

How do you draw the electric field around a point charge?

(supplement)

How do you draw the electric field around a point charge?(supplement)

- For a positive charge, the field lines point radially outwards.
- For a negative charge, the field lines point radially inwards.
- The field lines are closer together near the point charge.

How do you draw the electric field around a charged conducting sphere? (supplement)

How do you draw the electric field around a charged conducting sphere? (supplement)

- In the same way as a point charge.

How do you draw the electric field between two oppositely charged conducting plates? (supplement)

How do you draw the electric field between two oppositely charged conducting plates? (supplement)

Draw straight lines from the positive plate to the negative plate, spaced equally apart.

What does an electric current show?

What does an electric current show?

The flow of charge.

What is an electric current defined as?
(supplement)

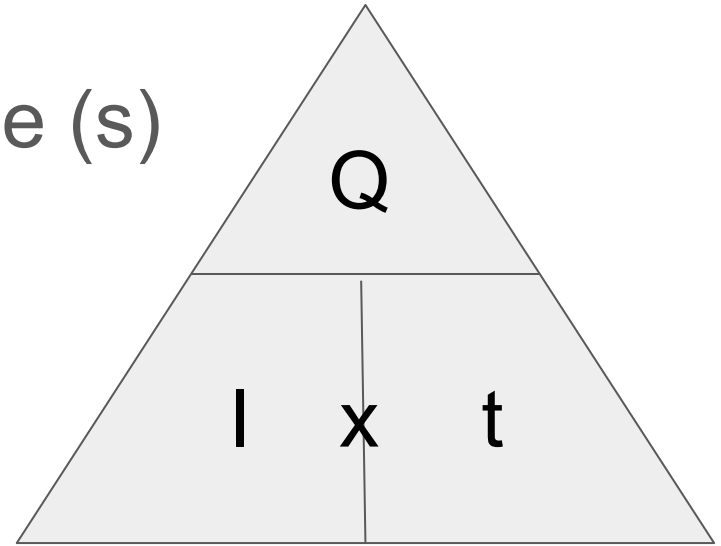
What is an electric current defined as? (supplement)

The charge passing a point in the circuit per unit time

Give an equation linking charge and current, giving SI units (supplement)

Give an equation linking charge and current, giving SI units (supplement)

charge (C) = current (A) x time (s)



What is conventional current defined as?

(supplement)

What is conventional current defined as?
(supplement)

The rate of flow of positive charge (from a positive to a negative terminal).

How is current measured?

How is current measured?

Using an ammeter, wired in series to the circuit.

Do digital or analogue ammeters/ voltmeters usually have a larger range?

Do digital or analogue ammeters/voltmeters usually have a larger range?

Analogue.

Describe electrical conduction in metals.

Describe electrical conduction in metals.

Metals conduct using their electrons which are free to move through their structure from one end to another, carrying charge.

Describe the movement of electrons in terms of conventional current.
(supplement)

Describe the movement of electrons in terms of conventional current. (supplement)

A metal's current is the opposite of a conventional current because free electrons flow from negative to positive.

What is the difference between an a.c. and d.c. current?

What is the difference between an a.c. and d.c. current?

- In a d.c. current, electrons flow in one direction, from the negative terminal to the positive terminal
- In an a.c. current, electrons change direction of flow regularly.

Describe the differences in the value of current across a closed series or parallel circuit.

Describe the differences in the value of current across a closed series or parallel circuit

- Current is the same at any point in a closed series circuit.
- Current is split between the branches of a parallel circuit.

What is e.m.f.?

What is e.m.f.?

Electromotive force (the electrical work done by a power source to move a unit charge round a full circuit).

What are the units of e.m.f.?

What are the units of e.m.f.?

Volts, V.

What equation is used to calculate e.m.f and p.d, and why can is be used to calculate both?

(supplement)

What equation is used to calculate e.m.f. and p.d, and why can it be used to calculate both? (supplement)

charge / time

E = W / Q and V = W/Q

Because e.m.f is the p.d of the power source

What are the units of potential difference?

What are the units of potential difference?

Volts, V.

Define potential difference

Define potential difference.

The work done by a unit charge passing through a component.

How is potential difference measured?

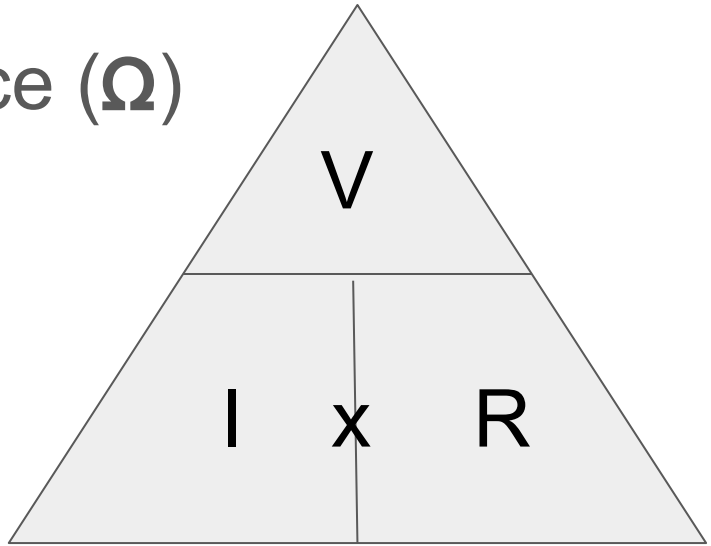
How is potential difference measured?

Using a voltmeter, wired in parallel.

Give an equation linking current and voltage, giving all SI units

Give an equation linking current and potential difference, giving all SI units

p.d. (V) = current (A) x resistance (Ω)



What is resistance?

What is resistance?

The opposition of a component in a circuit to the current flowing through it.

How does resistance affect the current flowing through a circuit?

How does resistance affect the current flowing through a circuit?

The larger the total resistance in the circuit, the smaller the current will be.

Describe an experiment to investigate the resistance.

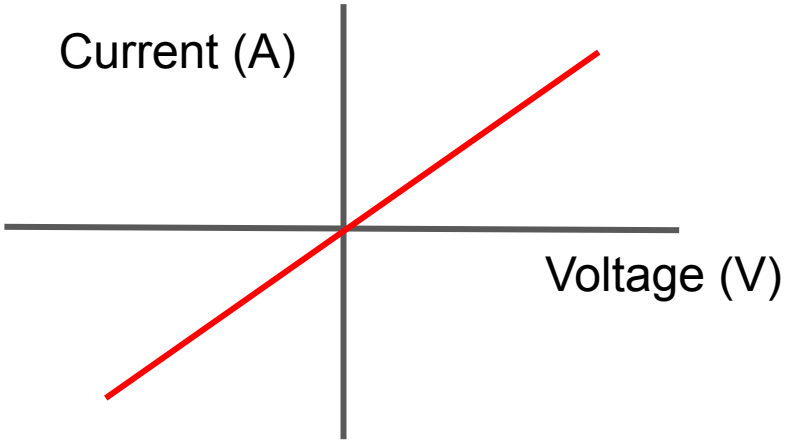
Describe an experiment to investigate the resistance.

- Connect a length of wire in a circuit with a power supply, a voltmeter in parallel, and an ammeter in series with the component being investigated.
- Record the current on the ammeter and voltage on the voltmeter.
- Use the current and voltage to calculate the resistance with the equation: $R=V/I$.
- Repeat three times, remove anomalies, and calculate a mean.
- Repeat for resistors with different properties to investigate the factors affecting resistance (e.g. by varying length of the wire using crocodile clips).

What would the current-voltage graph for a resistor with constant resistance show? (supplement)

What would the current-voltage graph for a resistor with constant resistance show? (supplement)

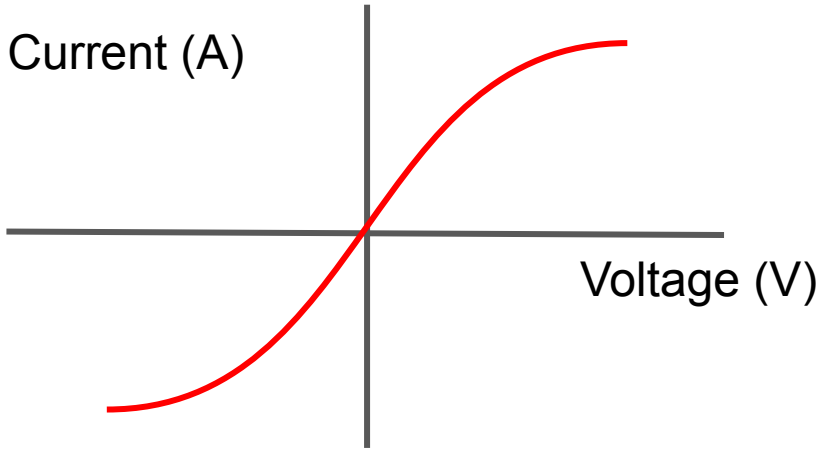
That the current is directly proportional to the voltage.



What would the current-voltage graph for a filament lamp show? (supplement)

What would the current-voltage raph for a resistor with constant resistance show? (supplement)

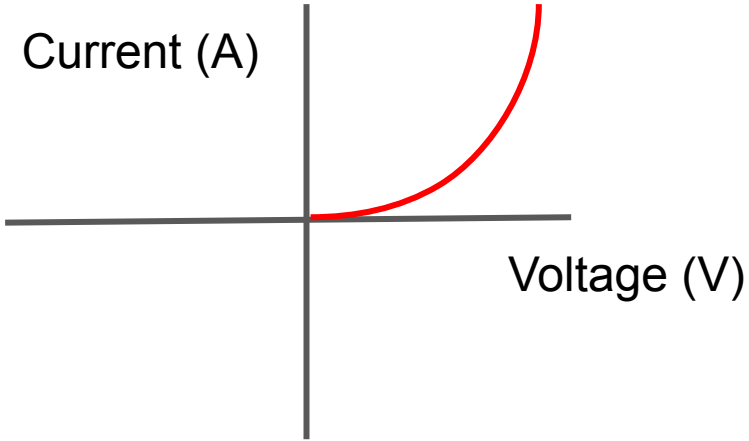
That as current increases, more heat is produced, increasing resistance.



What would the current-voltage graph for a diode show? (supplement)

What would the current-voltage raph for a diode show? (supplement)

A plot in only one quadrant because current only flows in one direction and after a particular voltage has been reached



How does resistance relate to the length of a wire?

How does resistance relate to the length of a wire?

Resistance increases with length (they are directly proportional).

$R \propto L$

How does resistance relate to the cross sectional area of a wire?

How does resistance relate to the cross sectional area of a wire?

Resistance decreases as cross sectional area increases (they are inversely proportional).

$R \propto 1/A$

How is energy transferred in a circuit?

How is energy transferred in a circuit?

From the battery/power source to the circuit components, and dissipated into the surroundings as heat.

What factors affect the energy transferred when charge flows through a component?

What factors affect the energy transferred when charge flows through a component?

- Amount of charge
- The potential difference across the component

What is electrical power?

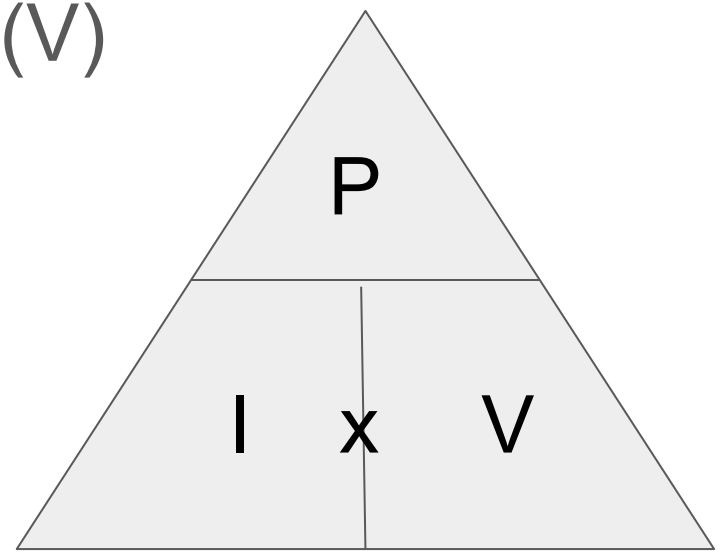
What is electrical power?

The rate at which a component transfers electrical energy

Give the equation linking power and potential difference, giving all SI units

Give an equation linking power and potential difference, giving all SI units (supplement)

power (W) = current (A) x p.d. (V)



Give the equation linking power and electrical energy, giving all SI units

Give an equation linking power and energy, giving all SI units

energy (kWh) = power (kW) x time (hrs)

E = Pt

Power = IV so E = IVt