Name: Ms Woodhouse

Teacher:

N5 Physics and Electronics
Electricity 3 – Concepts

	Success Criteria	Test	Prelim	Exam
L1	I can describe current as the rate of flow of charge and state the units for current (A), charge (C) and time (s).			
	I can use Q = It to calculate charge, current or time, including correct units and converting minutes to seconds.			
L2	I can describe power as the energy transferred each second and state the units for power (W), energy (J) and time (s).			
	I can use P = E/t (and E = Pt) to calculate power, energy or time, including correct units and time conversions.			
L3	I can describe the relationship between power, current, voltage and resistance.			
	I can choose and use P = IV, $P = I^2R$ or $P = V^2/R$ to calculate power, including correct units and unit conversions (mA → A, kW → W)			
L4	I can describe the function of a fuse as a safety device that melts when the current is too high, breaking the circuit.			
	I can calculate current using I = P/V (mains ≈ 230 V) and select an appropriate fuse rating (usually 3 A or 13 A).			
L5	I can describe the difference between AC and DC in terms of direction of current and how the voltage changes with time.			
	I can identify AC and DC waveforms on an oscilloscope trace and give examples (mains 230 V, 50 Hz is AC; cells/batteries are DC).			
L6	I can draw and interpret electric field patterns for point charges and opposite charges			
	I can state correct arrow direction (from + to −) and the rule that field lines do not cross.			
	I can predict the direction of a charged particle in an electric field.			

L1 - Charge and current

- I can describe current as the rate of flow of charge and state the units for current (A), charge (C) and time (s).
- I can use Q = It to calculate charge, current or time, including correct units and converting minutes to seconds.

$$Q = It$$

Where:

Q is charge (coulombs/C)
I is current(amperes/A)
t is Time (seconds/s)

1) Q = ? | Q = I x t
I = 2A | Q = 2x3
t = 3s | Q = 6A

2) Q = 50C | Q = I x t
I = ? | 50 = I x 10
t = 10s | ÷10
50/10 = I
I = 5A

Common mistakes (avoid losing marks):

- Time must be in **seconds (s)** (convert minutes → seconds).
- Write the **unit** in the final answer (C, A or s).
- Don't mix up **C** (charge) with **A** (current).

3) Q = 5000C | Q = I x t
I = 0.5A | 5000 = 0.5 x t
t = ? | ÷0.5
5000/0.5 = t = 10000s

Practice

Questions: (in Jotter)

1. Calculate the charge flowing through a lamp in 3 seconds if the current in the lamp is 2 amperes?

2. Fifty coulombs flow through a heater in 10 seconds. Calculate the current in the heater

3. A lamp operates at 0.5 Amperes. How long will it take for 5000 C of charge to pass through the lamp?

4. **Explain (1 sentence):** What does "2 A" tell you about charge flow?

→ 2C of charge flows every second

Special Example:

A metal sphere gains a charge of **−3.2 C.**

Calculate the **number of electrons** added to the sphere.
Use $e = 1.6 \times 10^{-19}$ C. (from data sheet)

Answer:

total charge (C)

number of electrons

$$N = \frac{Q}{e} = \frac{3.2}{1.6 \times 10^{-19}} = 2.0 \times 10^{19} \text{ electrons}$$

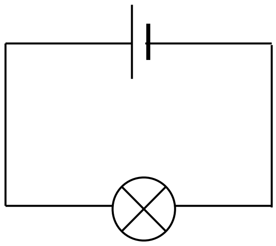
charge of one electron (C)

Extra Practice - Yellow Books P54/55

L2 - Power and Energy

- I can describe power as the energy transferred each second and state the units for power (W), energy (J) and time (s).
- I can use P = E/t (and E = Pt) to calculate power, energy or time, including correct units and time conversions.

When an electric current flows through a lamp, energy changes occur.



As the electrons flow through the supply, they gain electrical potential energy. This energy is transformed into heat energy and light energy in the filament of the bulb. The filament is a long, thin piece of tungsten wire that has resistance.
Electrical energy is transformed into heat energy in any resistive circuit.

Definition: **Power is a measure of the energy transferred each second.**

$$P = \frac{E}{t}$$

Where:

P is power (watts/W)
E is energy(joules/J)
t is Time (seconds/s)

Common mistakes (avoid losing marks):

- Convert **minutes → seconds** before using P = E/t.
- Energy must be in **joules (J)**, not "watts".
- Always finish with a **unit** (W, J, s).

Practice:

1. How much Energy is required to power a 100W lamp for 30 seconds?
2. How much electrical energy is converted into heat and light energy when a 60W bulb is turned on for 5 minutes?
3. **Explain (1 sentence):** Why does a higher power appliance transfer more energy each second?
4.

Extra Practice - Yellow Books P56.57

1.) P = 100W
E = ?
t = 30s

$P = \frac{E}{t}$

$100 = \frac{E}{30}$ ×30

100×30 = E
E = 3000J

2) P = 60W
E = ?
t = 5 minutes
= 5×60s = 300s

$P = \frac{E}{t}$

$60 = \frac{E}{300}$ ×300

60×300 = E = 18,000J

L3 - Power Current and Voltage

- I can describe the relationship between power, current, voltage and resistance.
- I can choose and use $P = IV$, $P = I^2R$ or $P = V^2/R$ to calculate power, including correct units and unit conversions (mA → A, kW → W)

$$P = IV \qquad P = I^2R \qquad P = \frac{V^2}{R}$$

Which equation should I use? (circle what you know)

- Know **V and I** → use **P = IV**
- Know **I and R** → use **$P = I^2R$**
- Know **V and R** → use **$P = V^2/R$**

Step rule: Circle the givens → pick the matching equation → substitute with units.

Where:

Symbol	Name	Units	Unit Symbol
P	Power	watts	W
I	Current	amperes	A
V	voltage	volts	V
R	resistance	ohms	Ω

Common mistakes (avoid losing marks):

- Convert **mA → A** (divide by 1000) before squaring in I^2R.
- Include **units** in the final answer (W).
- If you get a huge answer, check you didn't leave mA as A.

Examples:

1. A small torch lamp is rated as '2.5 V, 0.2 A'. What is the power of this lamp?

$P = IV$

$P = 0.2 \times 2.5$

$P = 0.5$ W

$m = \div 1000$ so $280 mA = 280 \div 1000 A$
$\approx 0.28 A$

2. A current of 280 mA flows in a lamp filament of resistance 16.5 Ω. Calculate the power of the lamp.

$$P = I^2 R$$

$$P = (280 \times 10^{-3})^2 \times 16.5$$

$$P = 1.29 \text{ W}$$

3. A 50 Ω resistor has a p.d. of 100 V across it. What is the power of the resistor.

$$P = \frac{V^2}{R}$$

$$P = \frac{100^2}{50}$$

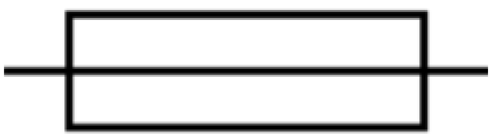
$$P = 200 \text{ W}$$

L4 - Fuses

- I can describe the function of a fuse as a safety device that melts when the current is too high, breaking the circuit.
- I can calculate current using I = P/V (mains ≈ 230 V) and select an appropriate fuse rating (usually 3 A or 13 A).

A fuse is a safety device used in a plug or circuit. If **too high a current** flows, the fuse wire melts and **breaks the circuit.** The correct fuse rating depends on the **power** of the appliance (use I = P/V).

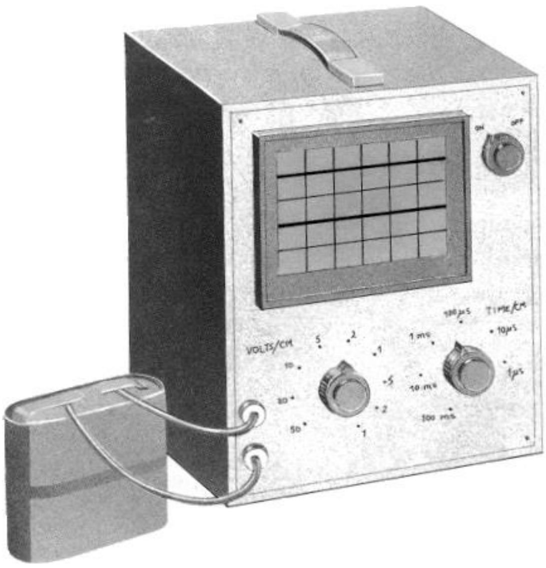
3 A fuse up to 720 W 13 A fuse above 720 W



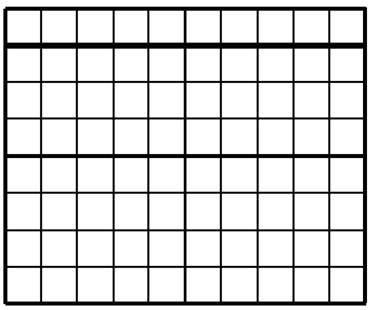
L5 – AC/DC

- I can describe the difference between AC and DC in terms of direction of current and how the voltage changes with time.
- I can identify AC and DC waveforms on an oscilloscope trace and give examples (mains 230 V, 50 Hz is AC; cells/batteries are DC).

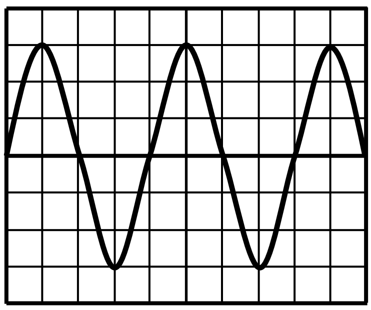
The electrical energy needed to operate electrical circuits usually comes from cells, batteries or the mains supply. The voltage supplied by each of these sources can be displayed on a **cathode ray oscilloscope** (C.R.O.).



Below are examples of types of **analogue voltage trace** when displayed on an oscilloscope:



Constant d.c. waveform



sinusoidal a.c. waveform

	Name	Description	Example
AC	Alternating Current	Particles constantly changing direction	Mains Electricity (230 V and 50Hz)
DC	Direct Current	Particles go in one direction	Cells and Batteries

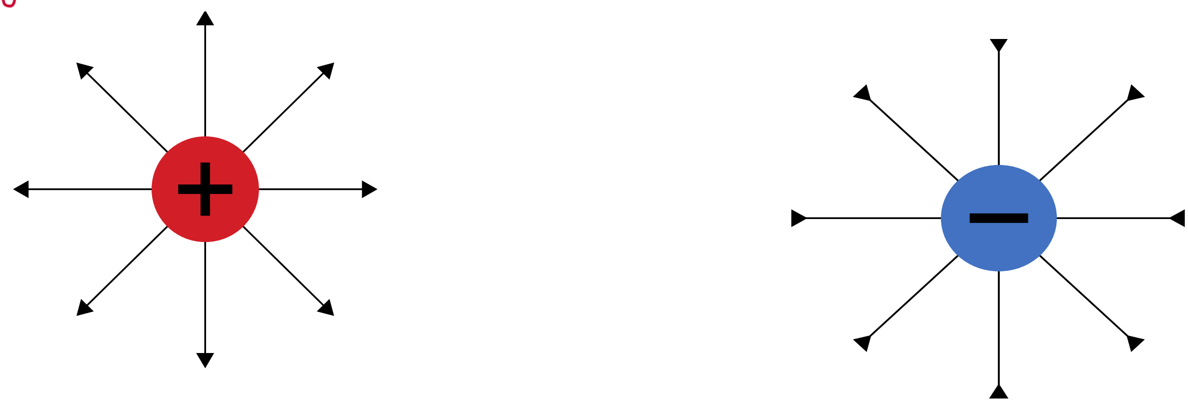
L6 - Fields

- I can draw and interpret electric field patterns for point charges and opposite charges
- I can state correct arrow direction (from + to −) and the rule that field lines do not cross.
- I can predict the direction of a charged particle in an electric field.

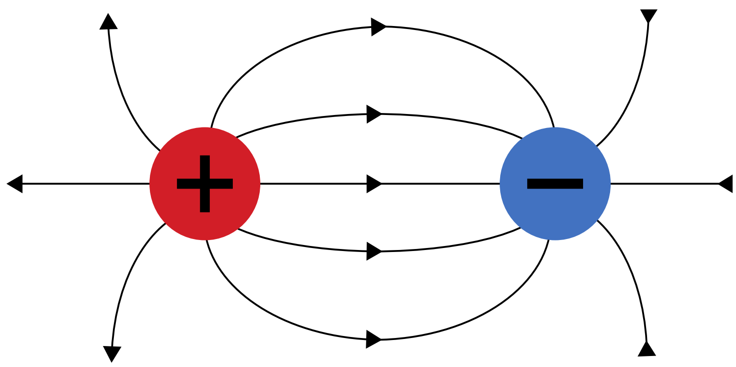
Common mistakes (avoid losing marks):

- Arrows show the direction of force on a **positive test charge**.
- Field lines go **from + to −**.
- Lines are closer together where the field is **stronger**.

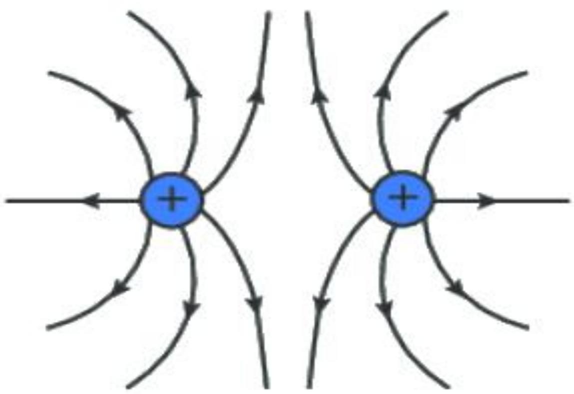
Single Point charge



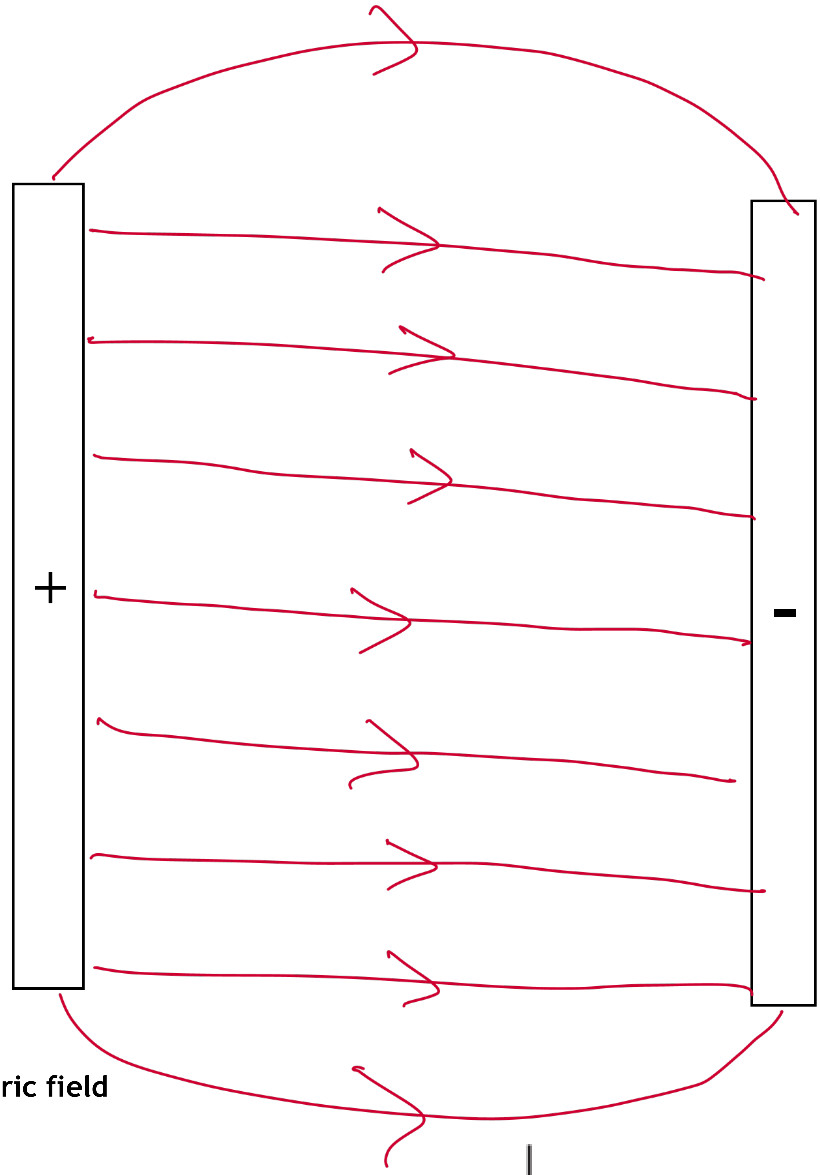
Opposite Point charges



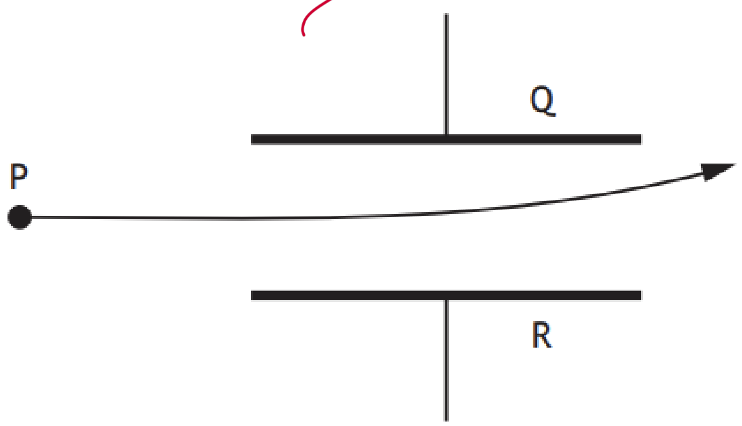
Like Point charges



Parallel Plates:



Particle in an electric field



which row is correct

	P	Q	R
A	positive	positive	negative
B	negative	negative	positive
C	no charge	positive	negative
D	positive	negative	positive