

2.1 Circuit symbols, charge and current

Name: _____ Class: _____ Date: _____ **Total: 17 marks**

KEY WORDS circuit symbols • in series • in parallel • Electric current
• charge

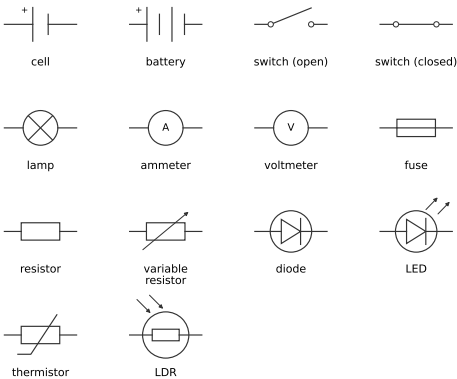
Objective

Draw and read the standard circuit symbols, state the conditions for charge flow, and use $Q = It$ with time in seconds. Original questions for spec statements 4.2.1.1–4.2.1.2.

1 Key knowledge and worked examples

A circuit diagram shows components as **symbols**. You must draw and recognise: cell, battery, switch (open and closed), lamp, resistor, variable resistor, ammeter, voltmeter, diode, LED, thermistor, LDR, fuse.

Meter	Where it goes	What it measures
ammeter	in series with the component	current in A
voltmeter	in parallel across the component	potential difference in V



Draw them exactly; a fuse is a rectangle with a wire through it.

Charge flows only when the circuit is **closed** and includes a source of **potential difference**. A cell in an **open** (switched-off) circuit pushes no charge round the loop.

Electric current is a flow of charge; its size is the *rate* of flow:

$$Q = It$$

- Q charge flow in coulombs, C; I current in amperes, A; t time in **seconds**.
- The current has the same value at every point of one series loop.
- Conventional current runs + to –; electrons move the opposite way.

Worked example. A phone charger delivers 0.90 A for 25 minutes. Find the charge flow.

- Known: current and time. Convert time first: 25 min = 1500 s.

$$Q = It = 0.90 \text{ A} \times 1500 \text{ s} = 1350 \text{ C}$$

- Check: 1 A for 1 s moves 1 C, so 0.9 A for 1500 s moves $0.9 \times 1500 \text{ C}$ ✓.

Reverse forms the exam uses: $t = Q/I$ (how long did the current flow?) and $I = Q/t$ (what current moved this charge?). Convert minutes and milliseconds to seconds before substituting.

2 Practice

2.1 Name the component for each symbol. [4]

(a) a circle with an A inside (b) a rectangle with an arrow through it diagonally (c) a triangle and bar that passes current one way (d) a rectangle whose resistance falls when light shines on it

2.2 State two conditions needed for charge to flow in a circuit. [2]

2.3 A lamp carries 2.0 A for 4.0 minutes. Calculate the charge flow. [2]

3 Exam-style questions

3.1 The fuse in a plug melts when a charge of 2.0 C flows through it in 0.40 s.

(a) Calculate the current in the fuse wire. [3]

(b) The fuse is replaced by one that melts at the same current. State what would happen to the charge flow before it melts if the fault current were larger, and explain why. [2]

3.2 A student sets up a series circuit: cell, switch, lamp, ammeter. The ammeter reads 0.31 A with the switch closed.

(a) State what the ammeter would read at a point between the lamp and the cell, with reasons. [2]

(b) The switch is opened. State the new ammeter reading and explain it using the conditions for charge flow. [2]

