Battery, diode, meters and drawing circuits

LEARNING INTENTION

We are learning to draw circuit diagrams correctly, with the battery, diodes and meters the right way round and in the right place.

SUCCESS CRITERIA – I CAN

- ☐ draw a battery with the long plate as positive
- ☐ state the function of a diode and draw it the right way round
- ☐ connect an ammeter in series and a voltmeter in parallel
- ☐ follow the rules for clear circuit diagrams

Battery and diode

Symbol	Component	Type	Function
	**Battery**	supply	Two or more cells. Provides the voltage. **Long thin plate = +**, short thick plate = –.
	**Diode**	protection	Lets current flow one way only: from anode (triangle) to cathode (bar). Used to protect circuits (unit E5).
	**Ammeter**	meter	Measures current in amps (A). Connected **in series**.
	**Voltmeter**	meter	Measures voltage in volts (V). Connected **in parallel** (across a component).

SHORT CIRCUIT

× WHAT EXAMINERS SAW

Many candidates orientated the battery symbol incorrectly in simulations, so meters read negative or polarised parts did not work.

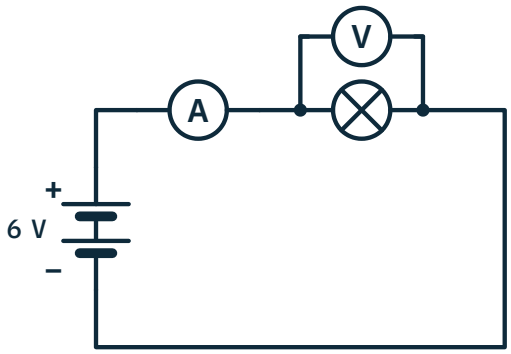
√ THE FIX

Long thin plate = positive (+). Short thick plate = negative (–). Put + to the positive rail. Check every symbol before you run a simulation.

Course reports 2024 (Task 2a) and 2025 (Task 2a): battery orientation in circuit diagrams and simulations.

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Meters



Ammeter in series, voltmeter across the lamp

An **ammeter** must have the current flow **through** it, so it goes in the loop.

A **voltmeter** measures the difference between two points, so it connects **across** the component.

WORKED EXAMPLE **Where do the meters go?**

1 GIVEN	2 FIND	3 FORMULA	4 SUBSTITUTE	5 ANSWER + UNIT
measure the current through a lamp and the voltage across it	meter positions	ammeter: in series voltmeter: in parallel	break the circuit, put A in the loop connect V across the lamp's two ends	**A in series, V across the lamp**

An ammeter measures what flows through it. A voltmeter compares two points.

SHORT CIRCUIT

× WHAT EXAMINERS SAW

Ammeters drawn across a component (in parallel) or voltmeters drawn in the loop (in series).

✓ THE FIX

Ammeter: in series, in the same loop as the component. Voltmeter: in parallel, across the component's two ends.

Common error in circuit drawing questions.

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Rules for drawing circuits

DATASHEET · DRAWING RULES

01 Use BS symbols, the same size each time.

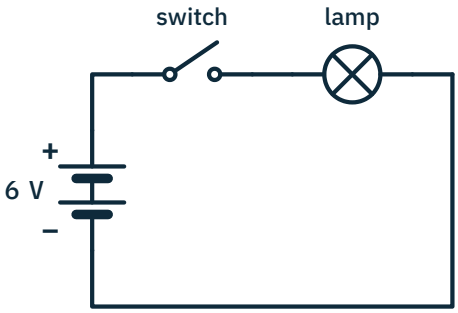
02 Draw wires as straight lines with square corners.

03 Put a filled dot where three or more wires join.

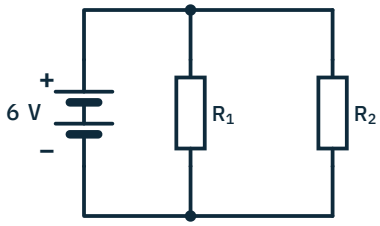
04 No gaps: every symbol joins a wire at both ends.

05 Battery: long plate +; LEDs point to 0 V; protection diode: bar to +V.

06 Label values (6 V, 4.7 kΩ) next to the symbol.



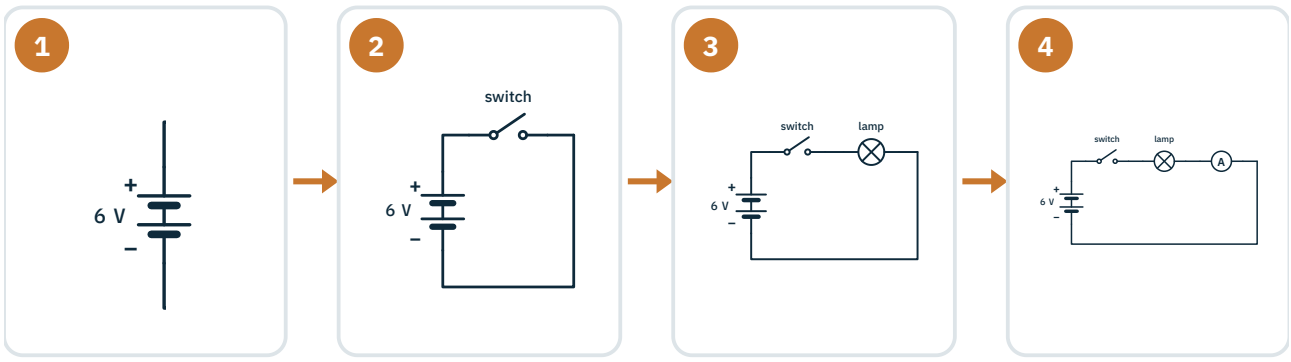
Series: one loop



Parallel: junction dots where wires join

Drawing a circuit step by step

BUILDING A CIRCUIT DIAGRAM



Start with the battery: long plate is +

Add parts along the top wire

Add the output

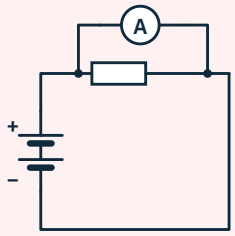
Ammeter in the loop (series)

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WORKED EXAMPLE Placing an ammeter and a voltmeter

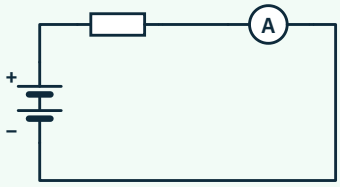
1 GIVEN	2 FIND	3 FORMULA	4 SUBSTITUTE	5 ANSWER + UNIT
lamp in a series circuit	where each meter goes	ammeter: in series, in the loop voltmeter: in parallel, across	break the loop, put the ammeter in it connect the voltmeter across the lamp	**A in series, V in parallel**

WRONG



Ammeter across the resistor (parallel): wrong.

RIGHT



Ammeter in the loop: all the current flows through it.

WORKED EXAMPLE Does current flow through the diode?

1 GIVEN	2 FIND	3 FORMULA	4 SUBSTITUTE	5 ANSWER + UNIT
diode with its bar towards 0 V	forward or reverse	triangle points + → –: forward bar towards +: reverse	triangle points from + to –	**Forward biased: current flows**

WORKED EXAMPLE Reading a battery symbol

1 GIVEN	2 FIND	3 FORMULA	4 SUBSTITUTE	5 ANSWER + UNIT
cell symbol: long thin plate on the left	which side is +	long plate = + short thick plate = –	long plate on the left	**Left side is +**

In simulations, check before you run.

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REAL ENGINEERING · HIGHLAND RAIL SERVICES SIGNAL BOX

Technicians at Highland Rail Services (fictional) work from circuit diagrams drawn to British Standards.

A symbol drawn the wrong way round could mean a warning lamp is wired backwards. Clear, standard drawings keep railways safe.



PROBE · QUICK CHECKS

1. Which plate of the battery symbol is positive? _____
2. How is an ammeter connected? _____
3. What does a diode do? _____

EXAM READY · 6 MARKS

1 **State** which plate of a cell symbol is positive. **[1]**

2 **Describe** how a voltmeter must be connected to measure the voltage across a resistor. **[1]**

3 **Complete** a circuit diagram of a 6 V battery, a switch and a lamp in series, with an ammeter measuring the current. **[3]**

4 **State** the function of a diode. **[1]**