Domestic Electricity

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Why Appliances Are Wired in Parallel

All domestic appliances are connected in **parallel** across the mains supply:

- Each appliance receives the **full mains voltage** (e.g. 110 V in Trinidad and Tobago; 220-240 V in many other countries).
- Each appliance can be switched on or off **independently** without affecting others.
- If one appliance develops a fault, the others continue to work.

The Three-Pin Plug and Its Wires

In a three-pin plug, three wires connect the appliance to the mains:

Cross-section of a UK three-pin plug showing internal wiring

1. Cable grip
2. Neutral terminal (blue wire)
3. Earth terminal (green/yellow wire)
4. Live terminal (brown wire)
5. Fuse

Wire	Colour (international)	Function
Live (L)	Brown	Carries current to the appliance at mains voltage
Neutral (N)	Blue	Completes the circuit; at approximately 0 V
Earth (E)	Green/yellow	Safety wire: connects metal casing to earth (0 V)

The **earth wire** protects against electric shock. If the live wire inside the appliance breaks and touches the metal casing, the casing could become live (dangerous). The earth wire provides a low-resistance path directly to ground, a large current flows, which blows the fuse and cuts off the supply before anyone can be harmed.

Fuses and Circuit Breakers

A **fuse** is a thin wire made of metal with a low melting point. It is connected in series in the **live** wire. If too much current flows (e.g. due to a fault), the fuse wire heats up and melts, breaking the circuit and protecting the appliance and wiring.

Selecting the correct fuse rating: always choose the fuse rated just above the normal operating current. If a 5 A fuse blows too easily, check the appliance rating before fitting a higher-rated fuse.

Circuit breakers serve the same purpose as fuses but can be reset (switched back on) after tripping, whereas blown fuses must be replaced. Residual current devices (RCDs) detect imbalance between live and neutral current and cut off the supply very rapidly, protecting against electrocution.

Choosing the correct fuse

A hairdryer is rated 1200 W at 240 V. Find the operating current and choose an appropriate fuse from 3 A, 5 A, and 13 A options.

Operating current:

$$I = \frac{P}{V} = \frac{1200}{240} = 5\text{A}$$

The fuse must be rated just above 5 A: choose the **13 A** fuse. (The 5 A fuse would blow immediately at normal use since the hairdryer draws exactly 5 A and may momentarily draw more on startup.)

Effects of Incorrect Voltage

Situation	Effect on appliance
Voltage too high	Excess current damages or burns out windings, elements, or components; overheating
Voltage too low	Appliance operates below its design power, motor runs slowly, heating elements produce less heat; may cause motors to draw more current and overheat

Always check appliance voltage rating before connecting to a supply.

Exam Tip

The fuse and the switch are always placed in the **live** wire, never in the neutral. If a switch or fuse is in the neutral wire, the appliance may be electrically isolated from the circuit but the live terminal is still connected and remains dangerous.

The earth wire does not normally carry current, it only carries current if a fault develops.