

2.1 Mains electricity

Name: _____ Class: _____ Date: _____

Total: 19 marks

Objective

Cover mains electricity (2.2–2.6): insulation and protection devices, heating in resistors, $P = IV$, $E = IVt$, a.c. and d.c. Original IGCSE-level practice.

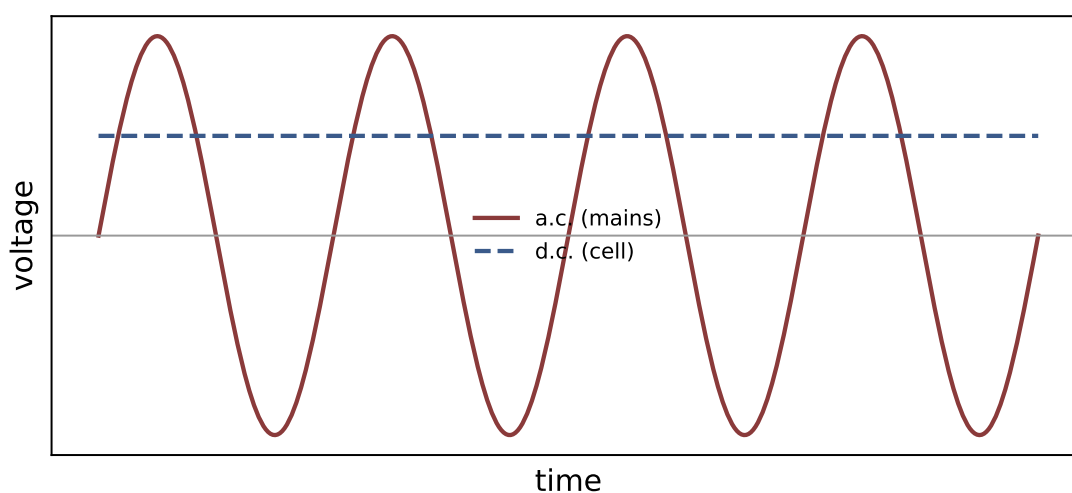
1 Key knowledge and worked examples

■ Choose the fuse from the current

Worked check. A 230 V hairdryer rated 920 W: $I = 920/230 = 4 \text{ A}$ – fit a 5 A fuse (the next standard rating above). A fuse rated below the operating current blows constantly; far above fails to protect.

■ Why appliances warm

Current in a resistor transfers electrical energy to thermal energy – useful in heaters and kettles, wasteful elsewhere. Insulation, double insulation, earthing, fuses and circuit breakers protect the device and the user.



2 Practice

2.1 State two differences between mains a.c. and battery d.c. [2]

2.2 Explain how a fuse protects a device. [2]

2.3 A 230 V lamp draws 0.5 A. Calculate its power. [2]

2.4 The lamp runs for 2 hours. Calculate the energy transferred in joules. [3]

2.5 Name the protection device that can be reset without replacement. [1]

3 Exam-style questions

3.1 Explain why a heater with a metal casing must be earthed, but one with a double-insulated plastic casing need not be. [3]

3.2 An electric kettle is rated 2.2 kW at 230 V. Calculate the current and choose a fuse from 3 A, 5 A, 13 A, justifying the choice. [4]

3.3 Explain why the same heater is cheaper to run for 30 minutes than for 1 hour, using $E = IVt$. [2]

Solutions

2.1 a.c. reverses direction repeatedly (mains); d.c. flows one way only (cell/battery).

2.2 A fault or overload draws excess current; the fuse wire melts, breaking the circuit before wiring or the device overheats.

2.3 $P = 0.5 \times 230 = 115 \text{ W}$.

2.4 $t = 2 \times 3600 = 7200 \text{ s}$; $E = 0.5 \times 230 \times 7200 = 828\,000 \text{ J}$.

2.5 Circuit breaker.

3.1 If a live wire touches the metal casing, the casing becomes live and would shock anyone touching it; the earth wire gives the fault current a low-resistance path to earth, blowing the fuse and cutting the supply; a plastic casing cannot conduct, so a fault cannot make the outside live – double insulation makes earthing unnecessary.

3.2 $I = 2200/230 = 9.6 \text{ A}$; choose the 13 A fuse – the smallest standard rating above the operating current, so it carries the kettle normally but blows on a fault.

3.3 Energy $E = IVt$ rises in proportion to time; doubling the time from 30 min to 1 h doubles the energy – and the cost.