

Exercise walk-through

Electrical safety ■ 4.4

eXercise

You must be able to

- state mains hazards (damaged insulation, overheating, damp, overloading)
- name the three mains wires and the role of each
- explain how a fuse and earthing protect the user

Method — Fuses and earthing

- **wires:** live (high voltage), neutral (≈ 0 V), earth (safety wire to ground).
- the switch and fuse go in the **live** wire.
- **earthing:** if a live wire touches a metal case, a large current flows to earth and blows the fuse.
- choose a fuse rating just **above** the normal working current.

Method — Fuses and earthing



cell



battery



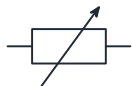
switch



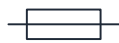
lamp



resistor



variable
resistor



fuse



ammeter



voltmeter



diode



thermistor



LDR

Standard circuit symbols, including the fuse

Practice 2.1 ■ 2 marks

Name the three wires in a mains cable.

Solution 2.1

Worked steps

live, neutral and earth **B1** **B1** *for any two, for the third.*

Practice 2.2 ■ 1 mark

State one hazard of using mains electricity in damp conditions.

Solution 2.2

Worked steps

water lets current pass into a person, increasing the risk of an electric shock **B1**.

Exam-style 3.1 ■ 1 mark

A fuse should be fitted in the:

A earth wire

B neutral wire

C live wire

D casing

Solution 3.1

A earth wire

B neutral wire

C live wire



D casing

Worked steps

C. The fuse (and switch) must be in the live wire.

Exam-style 3.2 ■ 2 marks

An appliance normally draws a current of 8 A. Fuses are available rated 3 A, 5 A, 10 A and 13 A.

- (a) State which fuse should be used, and why.
- (b) Explain how the fuse protects the cable.

Solution 3.2

Method: Fuses and earthing

Worked steps

- (a) the 10 A fuse **M1**; it is just above the normal working current of 8 A, so it carries normal current but blows on a fault **A1**.
- (b) if the current gets too large, the thin fuse wire melts and breaks the circuit before the cable overheats **M1 A1**.

Exam-style 3.3 ■ 3 marks

Explain how earthing a metal-cased appliance keeps the user safe if a fault makes the case live.

Solution 3.3

Method: Fuses and earthing

Worked steps

if a live wire touches the metal case, the earth wire provides a low-resistance path to the ground (M1); a large current flows to earth (M1); this blows the fuse, cutting off the supply so the case cannot give a shock (A1).