

GCSE Combined Science: Trilogy

Worksheet: Mains electricity

TIME 30 min	TOTAL 28 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Mains electricity

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Most electrical appliances are connected to the mains using a three-core cable.

0 1 . 1

What colour is the insulation on the earth wire?

Tick (✓) **one** box.

blue

☐

brown

☐

green and yellow stripes

☐

red

☐

[1 mark]

0 1 . 2

Which wire carries the alternating potential difference from the supply?

Tick (✓) **one** box.

earth wire

☐

live wire

☐

neutral wire

☐

[1 mark]

0 1 . 3

Give the colour of the insulation on the neutral wire.

.....

.....

.....

.....

[1 mark]

0 1 . 4

State the potential of the earth wire.

.....

.....

.....

Potential = V

[1 mark]

0 2

0 2 . 1

What colour is the insulation on the neutral wire?

Tick (✓) **one** box.

Brown

☐

Blue

☐

Green and yellow stripes

☐

[1 mark]

0 2 . 2

Which wire is a safety wire that only carries a current if there is a fault?

Tick (✓) **one** box.

The live wire

☐

The neutral wire

☐

The earth wire

☐

[1 mark]

0 3

0 3 . 1

Why are the cases of many appliances made from plastic?

Tick (✓) **one** box.

To look attractive

☐

Plastic is an electrical insulator, so the case cannot become live if there is a fault inside

☐

To make the appliance lighter

☐

To reduce the cost

☐

[1 mark]

0 3 . 2

State the colour of the insulation on the live wire and on the earth wire.

.....

.....

.....

.....

[2 marks]

0 4

An electric kettle has a metal case. It is connected to the mains using a three-core cable. Table 1 gives some information about the wires in the cable. Two pieces of information are missing, labelled X and Y.

Table 1

Wire	Colour of insulation	Potential in V
live	X	230
neutral	blue	Y
earth	green and yellow stripes	0

0 4 . 1

What colour is the insulation of the live wire (X in Table 1)?

.....

.....

.....

[1 mark]

0 4 . 2

What is the potential of the neutral wire (Y in Table 1)?

.....

.....

.....

Potential = V

[1 mark]

0 4 . 3

Which **two** wires carry a current when the kettle is working normally?

Tick (✓) **two** boxes.

earth

☐

live

☐

neutral

☐

[2 marks]

0 4 . 4

Explain why the earth wire is connected to the metal case of the kettle.

.....

.....

.....

.....

[2 marks]

0 5

An electric heater has an on–off switch.

0 5 . 1

Explain why the switch is connected in the live wire, not in the neutral wire.

.....

.....

.....

.....

[2 marks]

0 6

A student is replacing the lamp in a ceiling light. The light switch, which is in the live wire, is open (off).

0 6 . 1

State the potential difference between the live wire and earth.

.....

.....

.....

Potential difference = V

[1 mark]

0 6 . 2

The wire between the mains supply and the switch is still live.
Explain why the student could get an electric shock by touching this wire, even though the switch is open.

.....

.....

.....

.....

.....

[3 marks]

0 6 . 3

The earth wire is a safety wire. It only carries a current if there is a fault.
What is the purpose of the earth wire?

.....

.....

[1 mark]

0 6 . 4

Explain why it is dangerous to provide any connection between the live wire and earth.

.....

.....

.....

.....

[2 marks]

.....

0 7

A vacuum cleaner is rated '230 V, 1200 W'. A fuse contains a thin wire that melts, breaking the circuit, if the current through it becomes greater than the fuse's rating. The fuse fitted should have the lowest rating that is greater than the normal operating current. Fuses are available with ratings of 3 A, 5 A and 13 A.

0 7 . 1

Calculate the normal operating current of the vacuum cleaner.

.....

.....

.....

.....

Current = A

[2 marks]

0 7 . 2

State which fuse should be fitted, and explain why the other two fuses are not suitable.

.....

.....

.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Mains electricity · 28 marks

Question 1 (4 marks)

01.1 [1 mark]

Correct: green and yellow stripes

01.2 [1 mark]

Correct: live wire

01.3 [1 mark]

Answer: Blue

- blue (1)
-

01.4 [1 mark]

Answer: 0 V

- 0 (V) (1)
-
-

Question 2 (2 marks)

02.1 [1 mark]

Correct: Blue

02.2 [1 mark]

Correct: The earth wire

Question 3 (3 marks)

03.1 [1 mark]

Correct: Plastic is an electrical insulator, so the case cannot become live if there is a fault inside

03.2 [2 marks]

Answer: Live: brown. Earth: green and yellow stripes.

- live: brown (1)
 - earth: green and yellow (stripes) (1)
-

Question 4 (6 marks)

04.1 [1 mark]

Answer: Brown

- brown (1)

04.2 [1 mark]

Answer: 0 V (at or close to earth potential)

- 0 (V) / at or close to earth potential (1)

04.3 [2 marks]

Correct: live; neutral

04.4 [2 marks]

Answer: If a fault caused the live wire to touch the case, the case would become live (230 V); the earth wire keeps the case at 0 V, providing a low-resistance path to earth, so the case does not become live.

- if there is a fault (e.g. the live wire touches the case), the case could become live (1)
- the earth wire stops the case becoming live / keeps it at 0 V / provides a low-resistance path to earth (1)

Question 5 (2 marks)

05.1 [2 marks]

Answer: When the switch in the live wire is open, the heater is disconnected from the live wire, so no part of it is at the high potential of the live wire. If the switch were in the neutral wire, the heater would still be connected to the live wire when switched off, so touching a faulty part could still give an electric shock.

- with the switch in the live wire, opening it disconnects the heater from the (230 V) live wire (1)
- if the switch were in the neutral wire, the heater would still be connected to the live wire when switched off, so touching a faulty part could give an electric shock (1)

Question 6 (7 marks)

06.1 [1 mark]

Answer: 230 V

- (about) 230 (V) (1)

06.2 [3 marks]

Answer: The wire is still at about 230 V while the student's body is at (or close to) 0 V (earth potential), so there would be a large pd across the student's body and a current would flow through the student to earth.

- the live wire is still at (about) 230 V / a high potential (1)
- the student is at 0 V / earth potential (1)
- so there is a (large) potential difference across the student and a current flows through them (to earth) (1)

06.3 [1 mark]

Answer: To stop an appliance (its metal case) becoming live.

- to stop the appliance / metal case becoming live (1)

06.4 [2 marks]

Answer: There is a large pd (230 V) between the live wire and earth, so a large current would flow through the connection; this could give an electric shock (if the connection is a person) or cause overheating and a fire.

- (there is a pd of 230 V so) a large current would flow (through the connection) (1)
 - which could cause an electric shock / overheating / a fire (1)
-

Question 7 (4 marks)

07.1 [2 marks]

Answer: 5.2 A

- $I = 1200 \div 230$ (1)
- $I = 5.2$ (A) (1)

Notes: Allow 5.22 (A).

07.2 [2 marks]

Answer: The 13 A fuse; the 3 A and 5 A fuses have ratings below the normal operating current (5.2 A), so they would melt when the vacuum cleaner is used normally.

- 13 A (1)
- the 3 A and 5 A fuses have ratings below the operating current (5.2 A), so they would melt in normal use (1)

Notes: Allow ECF from the previous part.
