Mark schemes

(a) \( V = 0.10 \times 45 \)

\[ 4.5 \text{ (V)} \]

1

(b) \( R = 12 / 0.10 \)

\[ \text{total resistance} = 120 \text{ (Ω)} \]

1

\[ R = 120 - 105 = 15 \text{ (Ω)} \]

1

(c) (total) resistance decreases

(so) current increases

1

[7]

2

(a) 20

1

(b) 50

1

(c) (i) 115

1

(ii) 230

1

(iii) if one goes out the other still works

or

brighter

\[ \text{accept power (output) is greater} \]

\[ \text{can be switched on/off independently is insufficient} \]

1

(d) the outside/casing is plastic

\[ \text{there is plastic around the wires is insufficient} \]

\[ \text{it is plastic is insufficient} \]

1

and plastic is an insulator

\[ \text{an answer the light fitting is double insulated gains both marks} \]
(e) (residual current) circuit breaker
   accept RCCB
   accept RCBO
   accept RCCD
   accept RCB
   accept miniature circuit breaker / MCB
   trip switch is insufficient
   breaker is insufficient
   do not accept earth wire

(a) 3rd box from the left ticked

\[ \begin{array}{c}
\text{T} \\
\text{T}
\end{array} \]

(b) correct symbol drawn in series with other components
   symbol must have upper case A

(c) (i) \[ 9 + 3 = 12V \]
   reason only scores if this mark scored
   pd of battery is shared between the variable resistor and fixed resistor
   accept \( V_1 + V_2 = \text{pd of the battery} \)
   accept p.d. is shared in a series circuit
   accept voltage for p.d.

(ii) 600
   reason only scores if this mark scored
   p.d. of supply shared equally when resistors have the same value
   or
   ratio of the p.d. is the same as the ratio of the resistance
(iii) 0.015

or

their (c)(i) ÷ (their (c)(ii) + 200) correctly calculated

allow 2 marks for correct substitution ie 12 = I × 800

or

their (c)(i) = I × (their (c)(ii) + 200)

allow 1 mark for total resistance = 800 (Ω) or their (c)(ii) + 200

or

allow 1 mark for a substitution of 12 = I × 200

or

their (c)(i) = I × 200

or

alternative method using the graph

V = 3 V (1)

3 = I × 200 (1)

(a) filament bulb

(b) (i) 6 V

(ii) 3 Ω or their (i) / 2 correctly calculated

allow 1 mark for correct substitution ie

6 = 2 × R

or their (i) = 2 × R

(iii) 1 A

(iv) 6 Ω or their (i) / their (iii) correctly calculated

(v)

<table>
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<th>Decrease</th>
<th>Stay the same</th>
<th>Increase</th>
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1 1 1 [9]
(a) 35

An answer with more than 2 sig figs that rounds to 35 gains 2 marks.

Allow 2 marks for correct method, i.e., \[ \frac{230}{6.5} \]

Allow 1 mark for \( I = 6.5 \) (A) or \( R = \frac{230}{26} \).

An answer 8.8 gains 2 marks.

An answer with more than 2 sig figs that rounds to 8.8 gains 1 mark.
(b) (maximum) current exceeds maximum safe current for a 2.5 mm\(^2\) wire
   
   *accept power exceeds maximum safe power for a 2.5 mm\(^2\) wire*

   or

   (maximum) current exceeds 20 (A)
   
   *(maximum) current = 26 (A) is insufficient*

   a 2.5 mm\(^2\) wire would overheat / melt
   
   *accept socket for wire*
   
   *do not accept plug for wire*

(c) a.c. is constantly changing direction
   
   *accept a.c. flows in two directions*
   
   *accept a.c. changes direction*
   
   *a.c. travels in different directions is insufficient*

   d.c. flows in one direction only

(a) (i) 6

   (ii) variable resistor

   (iii) voltmeter

(b) (i) point at 3 V ringed

   (ii) The student misread the ammeter.

   (iii) 1 (volt)
   
   *accept every volt*

(c) as one increases so does the other
   
   *or*
   
   directly proportional
   
   *or*
   
   positive correlation
   
   *accept a numerical description, eg when one doubles the other also doubles*