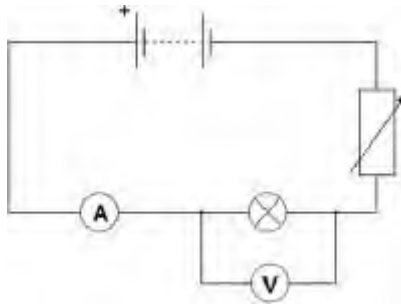


M1.(a)



battery in series with bulb and ammeter

1

voltmeter in parallel with bulb

1

variable resistor

or

variable power pack

or

potentiometer

1

(b) A is brighter because it has a higher current (than lamp B at any p.d.)

1

(therefore A has a) higher power output (than bulb B)

accept higher energy output per second

1

(c) lower current (than lamp A) for the same potential difference

accept answer in terms of $R = V / I$

1

lower gradient (than lamp A)

1

(d) 0 – 2 Volts

allow a range from 0 V up to any value between 1 and 2 V.

1

(for an ohmic conductor) current is directly proportional to potential difference

allow lines (of best fit) are straight and pass through the origin

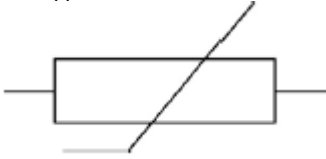
1

(so) resistance is constant

1

[10]

M2. (a) (i)



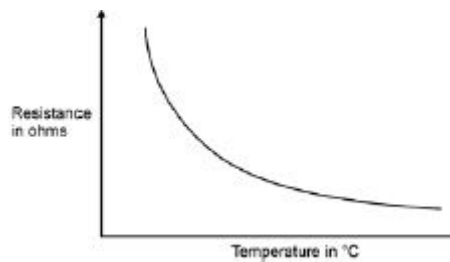
1

(ii) 360

allow 1 mark for correct substitution, ie $9 = 0.025 \times R$

2

(iii) sketch graph of correct shape, ie



1

(iv) An automatic circuit to switch a heating system on and off.

1

(b) so ammeter reduces / affects current as little as possible
accept so does not reduce / change the current (it is measuring)
accurate reading is insufficient
not change the resistance is insufficient

1

(c) gives a common understanding
accept is easier to share results
accept can compare results
do not need to be converted is insufficient
prevent errors is insufficient

1

- (d) replace Bunsen (and water) with a lamp
accept any way of changing light level

1

replace thermometer with light sensor
accept any way of measuring a change in light level
datalogger alone is insufficient

1

[9]

M3. (a) 35

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

allow 2 marks for correct method, ie $\frac{230}{6.5}$

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

3

(b) (maximum) current exceeds maximum safe current for a 2.5 mm² wire
accept power exceeds maximum safe power for a 2.5 mm² wire

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

1

a 2.5 mm² wire would overheat / melt
accept socket for wire
*do **not** accept plug for wire*

1

(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

1

d.c. flows in one direction only

1

[7]

M4. (a) attempt to draw four cells in series 1

correct circuit symbols

*circuit symbol should show a long line and a short line,
correctly joined together*

example of correct circuit symbol:



1

(b) (i) 6 (V)
allow 1 mark for correct substitution, ie
 $V = 3 \times 2$ scores 1 mark
provided no subsequent step 2

(ii) 12 (V)
ecf from part (b)(i)
 $18 - 6$
or
 $18 -$ their part (b)(i) scores 1 mark 2

(iii) 9 (Ω)
ecf from part (b)(ii) correctly calculated
 $3 +$ their part (b)(ii) / 2
or
 $18 / 2$ scores 1 mark
provided no subsequent step 2

(c) (i) need a.c. 1

battery is d.c. 1

(ii) 3 (A)

allow 1 mark for correct substitution, ie
 $18 \times 2 = 12 \times I_s$ scores 1 mark

2

[12]

- M5.** (a) (because the) potential of the live wire is 230 V 1
- (and the) potential of the electrician is 0 V 1
- (so there is a) large potential difference between live wire and electrician 1
- charge / current passes through his body
allow voltage for potential difference 1
- (b) diameter between 3.50 and 3.55 (mm)
allow correct use of value of cross-sectional area of 9.5 to 9.9 (mm²) with no final answer given for 1 mark 2
- (c) $18000 = I \times 300$ 1
- $I = 18000 / 300 = 60$ 1
- $13\,800 = (60^2) \times R$ 1
- $R = 13\,800 / 60^2$ 1
- 3.83 (Ω) 1

*allow 3.83(Ω) with no working shown for 5 marks
answer may also be correctly calculated using $P = IV$ and $V = IR$ if 230 V is used.*

[11]