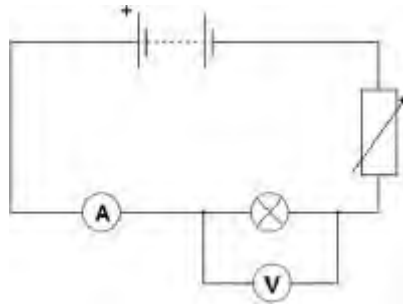


M1.(a)



*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)



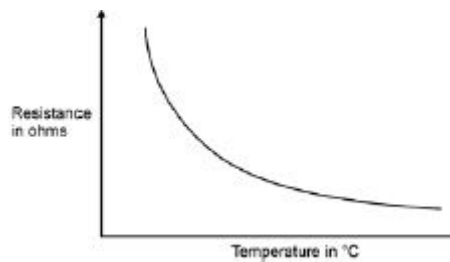
1

(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 mm<sup>2</sup> wire  
*accept power exceeds maximum safe power for a 2.5 mm<sup>2</sup> wire*

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

1

a 2.5 mm<sup>2</sup> 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 ( $\Omega$ )  
*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 (mm<sup>2</sup>) 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 ( $\Omega$ ) 1



*allow 3.83( $\Omega$ ) 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]**