

M1.	(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 <i>allow voltage for potential difference</i>	1
	(b)	diameter between 3.50 and 3.55 (mm) <i>allow correct use of value of cross-sectional area of 9.5 to 9.9 (mm²) with no final answer given for 1 mark</i>	2
	(c)	18000 = I × 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]

M2. (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]

M3. (a) water heated by radiation (from the Sun)
accept IR / energy for radiation 1

water used to heat buildings / provide hot water
allow for 1 mark heat from the Sun heats water if no other marks given
references to photovoltaic cells / electricity scores 0 marks 1

(b) 2 (minutes)

$$1.4 \times 10^3 = \frac{168 \times 10^3}{t}$$
gains 1 mark
calculation of time of 120 (seconds) scores 2 marks 3

(c) (i) 150 (kWh) 1

(ii) £60(.00) or 6000 (p)
an answer of £6000 gains 1 mark
allow 1 mark for $150 \times 0.4(0)$ 150×40
allow ecf from (c)(i) 2

(iii) 25 (years)
an answer of $6000 / 240$
or
 $6000 / \text{their (c)(ii)} \times 4$
gains 2 marks
an answer of $6000 / 60$
or
 $6000 / \text{their (c)(ii)}$ gains 1 mark, ignore any other multiplier of (c)(ii) 3

(iv) any **one** from:

- will get £240 per year
accept value consistent with calculated value in (c)(iii)
- amount of light is constant throughout the year
- price per unit stays the same
- condition of cells does not deteriorate

1

(d) any **one** from:

- angle of tilt of cells
- cloud cover
- season / shade by trees
- amount of dirt

1

[13]

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)	(i)	generator	1
		(ii)	alternating current	1
		(iii)	voltmeter / CRO / oscilloscope / cathode ray oscilloscope	1
	(b)	(i)	time	1
		(ii)	peaks and troughs in opposite directions	1
			amplitude remains constant <i>dependent on first marking point</i>	1
	(c)	any two from:		
		•	increase speed of coil	
		•	strengthen magnetic field	
		•	increase area of coil	
			<i>do not accept larger</i>	2

[8]