AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



MARK SCHEME

4.2.1 CURRENT, POTENTIAL DIFFERENCE AND RESISTANCE (PACK 1)

SCORE	PERCENTAGE
/325	%

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Q1.

(a) 0.08 (s)

1

(b) the current goes higher than normal value

allow the current goes (too) high

or

the current goes higher than 1.5 A

1

(c) P = 1.5 × 24

1

P = 36 (W)

1

*an answer of 36 (W) scores **2** marks*

(d) LED lamps waste a smaller proportion of the input energy than filament lamps

1

[5]

Q2.

(a) correct circuit symbol

1

3 cells joined in series in correct orientation

e.g.



ignore absence of + symbol

1

(b) $R = \frac{12}{1.6}$

1

R = 7.5 (Ω)

1

*an answer of 7.5 (Ω) scores **2** marks*

(c) 4.0 (Ω)

*allow their answer to part **(b)** − 3.5 correctly calculated*

1

(d) it decreases

1

the current would be higher (for the same p.d.)

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reason only scores if correct box is chosen

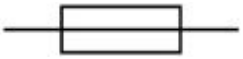
or
more than one path for charge to flow
allow current for charge

or
total resistance is always less than the smallest individual resistance

1

[7]

Q3.

(a) 

1

(b) E = 13 × 230

1

E = 2990 (J)

1

*an answer 2990 (J) scores **2** marks*

(c) charge flow = current × time
allow Q = It

1

(d) 1.52 = I × 0.40

1

$$I = \frac{1.52}{0.40}$$

1

I = 3.8 (A)

1

*an answer of 3.8 (A) scores **3** marks*

(e) E = 0.00175 × 205 000

1

E = 359 (J)
*allow an answer that rounds to 360 (J) for **2** marks*

1

*an answer of 359 (J) scores **2** marks*

[9]

Q4.

(a) $$P = \frac{120\,000}{8.0}$$

1

P = 15 000 (W)

1

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*an answer of 15 000 (W) scores **2** marks*

(b) energy is transferred in heating the surroundings

1

friction causes energy to be transferred in non-useful ways

1

(c) the switches are in parallel

1

(so) closing either switch completes the circuit

1

(d) gravitational potential energy = mass × gravitational field strength × height

allow $E_p = m\ g\ h$

1

(e) $E_p = 280 \times 9.8 \times 14$

1

$E_p = 38\ 416$ (J)

1

$E_p = 38\ 000$ (J)

*an answer that rounds to 38 000 scores **2** marks*

1

*an answer of 38 000 scores **3** marks*

[10]

Q5.

(a) transfer of <u>electrons</u>

mention of positive charge moving negates both marks

1

from the carpet to the student

1

(b) three arrows perpendicular to sphere's surface with all arrows directed inwards and distributed evenly around sphere

1

(c) there is a potential difference between the student and the tap

*do **not** accept the tap / sink is charged*

1

which causes electrons / charges to transfer from the student
or
which causes electrons / charges to transfer to the tap

1

which earths the charge

allow the tap is earthed

1

(d) carpet / copper has a low resistance

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allow carpet is a conductor
or
copper is a conductor

1

lower / no build-up of charge (on the student)
or
(so there is a) smaller / no potential difference between student and tap / earth

1

[8]

Q6.

(a) ammeter and voltmeter symbols correct

1

voltmeter in parallel with wire

1

ammeter in series with wire

1

(b) **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

5–6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3–4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content

- length measured
- length varied
- current measured
- potential difference measured
- repeat readings
- calculate resistance for each length
- $\text{resistance} = \frac{\text{potential difference}}{\text{current}}$
- plot a graph of resistance against length

- hazard: high current
- may cause wire to melt / overheat
- may cause burns (to skin)
- use low currents

(c) the temperature of the wire would not change

1

(d) the accuracy of the student's results would be higher

1

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the resolution of the length measurement would be higher

1

[12]

Q7.

(a) potential difference

allow p.d.
allow voltage

1

temperature

1

in this order only

(b) the current increases (when the potential difference increases)

1

(which) causes the temperature of the filament to increase

1

(so) the resistance increases

*do **not** accept resistance increases and then levels off*

1

(c) a higher proportion / percentage of the (total) power / energy input is usefully transferred

wastes less energy is insufficient

or
higher (useful) power / energy output for the same (total) power / energy input

1

(d) potential difference increases

1

current decreases

1

(e) 1000 (Ω)

reason only scores if R = 1000 (Ω)

1

potential difference is shared in proportion to the resistance

allow a justification using a correct calculation

1

(f) $12 = I \times 7000$

1

$$I = \frac{12}{7000}$$

1

$I = 1.71 \times 10^{-3}$ (A)

*an answer that rounds to 1.7×10^{-3} (A) scores **3** marks*

1

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$I = 1.7 \times 10^{-3}$ (A)

this answer only

or

$I = 0.0017$ (A)

*an answer of 2.4×10^{-3} (A) scores **2** marks*

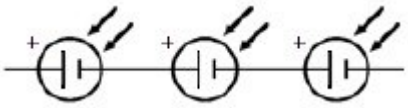
*if no other marks scored allow **1** mark for calculation of total resistance (7000 Ω)*

1

*an answer of 1.7×10^{-3} (A) scores **4** marks*

[14]

Q8.

(a) 

1

(b) $\text{current} = \frac{0.70}{2.5}$

1

current = 0.28 (A)

*an answer of 0.28 (A) scores **2** marks*

1

(c) 0.60 (V)

1

product of potential difference and current gives highest value

1

(d) $\text{efficiency} = \frac{\text{useful power output}}{\text{total power input}}$

1

(e) $0.20 = \frac{\text{useful power output}}{2.4}$

1

useful power output = 0.20 × 2.4

1

useful power output = 0.48 (W)

*an answer of 0.48 (W) scores **3** marks*

1

[9]

Q9.

(a) changes

allow reverses

1

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(b) dependent

1

(c) kettle **C**
or
2.8 kW

1

highest power (output)
allow higher power (output)

1

(d) values for gradient calculation shown on graph or on answer lines

1

power input = 2200 (W)
*accept an answer that rounds to 2200 (W) for **2** marks*

1

(e) charge flow = current × time
allow Q = It

1

(f) 2400 = I × 250

1

$$I = \frac{2400}{250}$$

1

I = 9.6 (A)
an answer of 9.6 (A) scores 3 marks

1

[10]

Q10.

(a) current

1

(b) $4.2 = 3.5 \times 10^{-3} \times R$

1

$R = 4.2 / 3.5 \times 10^{-3}$

1

R = 1200 (Ω)
*an answer of 1200 (Ω) scores **3** marks*
*an answer of 1.2 scores **2** marks*

1

(c) conversion from minutes to seconds (300 s)

1

Q = 0.0035 × (5 × 60)

1

Q = 1.05 C

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*an answer of 1.05 (C) scores **3** marks*
*an answer of 17.5 scores **1** mark*
*an answer of 1050 or 0.0175 scores **2** marks*

1

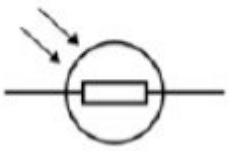
(d) (potential difference) increases

1

(because thermistor) resistance increases

2nd mark dependent on scoring 1st mark

1

(e) 

1

[10]

Q11.

(a) current that is always in the same direction

1

(b) total resistance = 30 (Ω)

1

V = 0.4 × 30

1

12 (V)

1

*allow 12 (V) with no working shown for **3** marks*
*an answer of 8 (V) or 4 (V) gains **2** marks only*

(c) P = 0.4 × 12 = 4.8

1

5 (W)

1

*allow 5 (W) with no working shown for **2** marks*
*allow 4.8 (W) with no working shown for **1** mark*

[6]

Q12.

(a) battery, lamp and ammeter connected in series with variable resistor

1

voltmeter in parallel with (filament) lamp

1

(b) **Level 2 (3–4 marks):**
A detailed and coherent description of a plan covering all the major steps is provided.
The steps are set out in a logical manner that could be followed by another person

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to
obtain valid results.

Level 1 (1–2 marks):
Simple statements relating to relevant apparatus or steps are made but they may not be in a logical order. The plan would not allow another person to obtain valid results.

0 marks:
No relevant content

Indicative content

- ammeter used to measure current
- voltmeter used to measure potential difference
- resistance of variable resistor altered to change current in circuit **or** change potential difference (across filament lamp)
- resistance (of filament lamp) calculated **or** R=V / I statement
- resistance calculated for a large enough range of different currents that would allow a valid conclusion about the relationship to be made

4

(c) (as current increases) resistance increases (at an increasing rate)

1

(d) any value between 6.3 and 6.9 (Ω)

1

(e) **A**: Filament lamp

1

B: Resistor at constant temperature

1

C: Diode

1

[11]

Q13.

(a) V = 0.10 × 45

1

4.5 (V)

1

(b) R = 12 / 0.10

1

total resistance = 120 (Ω)

1

R = 120 – 105 = 15 (Ω)

1

(c) (total) resistance decreases

1

(so) current increases

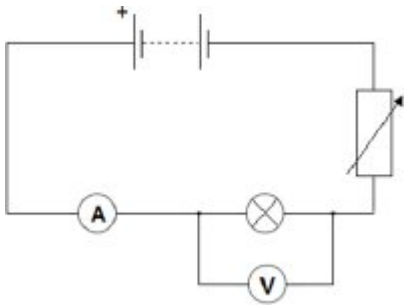
1

[7]

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Q14.

(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]

Q15.

(a) (because the) potential of the live wire is 230 V

1

(and the) potential of the electrician is 0 V

1

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(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^2) 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]

Q16.

(a) last box ticked



1

(b) (i) use hotter water (than 60 °C)

accept use boiling water

accept use water at any stated temperature above 60 °C

or

add ice cubes

accept add water at any stated temperature below 12 °C

use different temperatures is insufficient

1

(ii) the current increases as the temperature increases

1

(iii) 0.02 (A)

1

(iv) 5 (V)

or

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their **(b)(iii)** × 250 correctly calculated

*allow **1** mark for correct substitution ie V = 0.02 × 250*

or

*V = their **(b)(iii)** × 250*

2

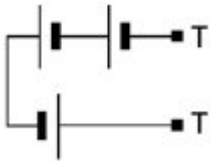
(v) the resistance increases

1

[7]

Q17.

(a) 3rd box from the left ticked



1

(b) correct symbol drawn in series with other components

symbol must have upper case A

1

(c) (i) 9 + 3 = 12V

reason only scores if this mark scored

1

pd of battery is shared between the variable resistor and fixed resistor

accept V_1 + V_2 = pd of the battery

accept p.d. is shared in a series circuit

accept voltage for p.d.

1

(ii) 600

reason only scores if this mark scored

1

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

1

(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

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their (c)(i) = I × 200

or

alternative method using the graph

V = 3 V (1)

3 = I × 200 (1)

3

[9]

Q18.

(a) pin

made from brass because it is (hard and) a (good electrical) conductor

accept copper for brass

metal is insufficient

heat conductor on its own negates

1

outer case

plastic/rubber because it is a (good electrical) insulator

heat insulator on its own negates

1

(b) (i) live

1

(ii) makes it hot/warm

melts is insufficient

1

(iii) 8.7

accept an answer that rounds to 8.7

*allow **1** mark for correct substitution ie 2000 = 230 × I*

*an answer of 0.0087 **or** 0.009 **or** 3.0(4) **or** 5.65 **or** 5.7 gains **1** mark*

2

(c) a (large) current goes from the live wire to the earth wire

accept metal case for live wire

accept a current goes from live to earth

do not accept electricity for current

1

(which causes) the fuse to (overheat and) melt

accept blow for melt

break is insufficient

do not accept snap / blow up for melt

1

(d) reduce chance of an electric shock

accept to reduce the risk of an accident

accept prevent electric shock

accept prevent electrocution

accept prevent or reduce the risk of an (electrical) fire

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accept an electric shock can kill you
accept it can kill you
accept so you can use it safely

1

[9]

Q19.

(a) filament bulb

1

(b) (i) 6 V

1

(ii) 3 Ω or their $\frac{\text{(i)}}{2}$ correctly calculated

allow 1 mark for correct substitution ie
6 = 2 × R
or their (i) = 2 × R

2

(iii) 1 A

1

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

1

(v)

Decrease	Stay the same	Increase
	✔	
✔		
✔		

1
1
1

[9]

Q20.

(a) increases

accept reaches highest value
*do **not** accept increases and decreases*

1

(b) (i) increases

1

(ii) increases

1

(c) 18

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*allow **1** mark for correct substitution i.e. 12 × 1.5 provided no subsequent step*

2

watt

accept W
answer may be indicated in the list

1

[6]

Q21.

(a) (i) p.d. is (directly) proportional to current
or
gradient / slope is constant
or
the lines show constant resistance
accept lines are straight / diagonal

1

(ii) C
reason only scores if C is chosen

1

for the same p.d. the current is the smallest
*accept lowest gradient **and** the gradient = 1 / R*

1

(b) (i) ohm
accept correct symbol Ω
accept an answer written in the table if not given in answer space

1

(ii) K and L
reason only scores if both K and L are chosen

1

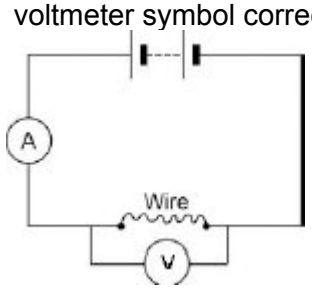
only length varies
accept type of metal and the diameter are the same

1

(iii) measure the resistance of more wires made from different metals
accept test more (types of) metals
measure the resistance of more wires is insufficient
they only use two metals is insufficient

1

(c) (i) voltmeter symbol correct and drawn in parallel with the wire

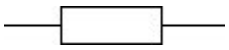


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accept voltmeter symbol correct and drawn in parallel with the battery

1

(ii) correct symbol drawn



symbol must be rectangular

1

[9]

Q22.

(a) (i) 1.7

1

(ii) 51
or
30 × their (i) correctly calculated

*allow **1** mark for correct substitution i.e. 1.7* $= \frac{Q}{30}$

or their (i) $= \frac{Q}{30}$

2

coulomb / C

*do **not** accept c*

1

(iii) 612
or
their (ii) × 12 correctly calculated
or
their (i) × 360 correctly calculated

*allow **1** mark for correct substitution i.e. E = 12 × 51*
or 12 × their (ii)
or their (i) × 360

2

(b) ions vibrate faster
or
ions vibrate with a bigger amplitude

accept atoms for ions throughout
accept ions gain energy
accept ions vibrate more
ions start to vibrate is insufficient

1

electrons collide more (frequently) with the ions
or
(drift) velocity of electrons decreases

electrons start to collide is insufficient
there are more collisions is insufficient, unless both electrons and ions are implied

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1

[8]

Q23.

(a) (i) any **six** from:

- switch on
- read both ammeter and voltmeter

  allow read the meters
- adjust variable resistor to change the current
- take further readings
- draw graph
- (of) V against I

  allow take mean
- R = V / I

  allow take the gradient of the graph

6

(ii) resistor would get hot if current left on

1

so its resistance would increase

1

(iii) 12 (V)

*0.75 × 16 gains **1** mark*

2

(iv) 15 (Ω)

1

16 is nearer to that value than any other

1

(b) if current is above 5 A / value of fuse

1

fuse melts

allow blows / breaks

*do **not** accept exploded*

1

breaks circuit

1

[15]

Q24.

(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:

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1

(b) (i) 6 (V)

*allow **1** mark for correct substitution, ie*
*V = 3 × 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 × 2 = 12 × I_s scores **1** mark*

2

[12]

Q25.

(a) (i) live

1

(ii) react faster

1

(iii) live and neutral

1

(b) (i) ammeter

1

to measure current
accept to measure amps

1

plus any **one** from:

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- *variable resistor* (1)
  to vary current (1)
  accept variable power supply
  accept change or control

- *switch* (1)
  to stop apparatus getting hot / protect battery
  or
  to reset equipment (1)

- fuse (1)
  to break circuit if current is too big (1)

2

(ii) any **two** from:

- use smaller mass(es)
- move mass closer to pivot
- reduce gap between coil and rocker
- more turns (on coil)*coil / loop*
- iron core in coil

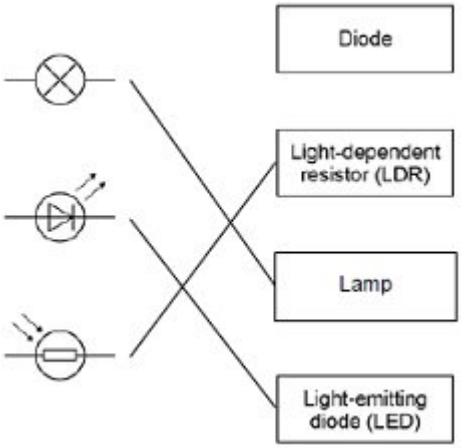
  accept use smaller weight(s)

2

[9]

Q26.

(a)



*allow **1** mark for each correct line if more than one line is drawn from any symbol then all of those lines are wrong*

3

(b) (i) half

1

(ii) 3(V)

1

(iii) V_1

1

(c) (i) potential difference / voltage of the power supply

accept the power supply

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accept the voltage / volts
accept number of cells / batteries
accept (same) cells / batteries
do not accept same ammeter / switch / wires

1

(ii) bar drawn – height 1.(00)A
ignore width of bar
*allow **1** mark for bar shorter than 3rd bar*

2

(iii) as the number of resistors increases the current decreases

1

[10]

Q27.

(a) (i)

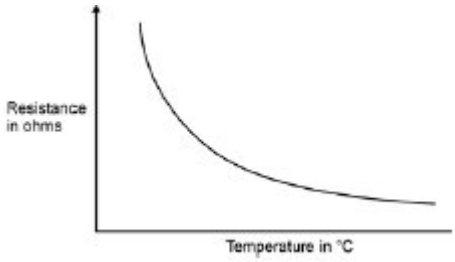


1

(ii) 360
*allow **1** mark for correct substitution, ie 9 = 0.025 × 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

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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]

Q28.

(a) decreases

1

(b) a filament bulb

allow bulb

1

an LED

1

(c) Marks awarded for this answer will be determined by the Quality of Communication (QoC) as well as the standard of the scientific response.

0 marks
No relevant content.

Level 1 (1−2 marks)
There is a basic description of the method. This is incomplete and would not lead to any useful results.

Level 2 (3−4 marks)
There is a description of the method which is almost complete with a few minor omissions and would lead to some results.

Level 3 (5−6 marks)
There is a detailed description of the method which would lead to valid results. To gain full marks an answer including graph, or another appropriate representation of results, must be given.

examples of the physics points made in the response:

- read V and I
- read temperature
- apply heat

  allow hot water to cool
- read V and I at least one other temperature
- determine R from V / I
- range of temperatures above 50 °C

extra detail:
- use thermometer to read temperature at regular intervals of temperature
- remove source of heat and stir before taking readings
- details of attaining 0 °C or 100 °C

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- last reading taken while boiling
- graph of R against T
- at least 3 different temperatures

6

(d) (i) Q

1

(ii) (80, 3.18)

1

(iii) any **one** from:

- measurement of V too small
- measurement of I too big
- incorrect calculation of R
- thermometer misread

allow misread meter

ignore any references to an error that is systematic

1

(iv) any **two** from:

- not portable

allow requires a lot of equipment allow takes time to set up

- needs an electrical supply
- cannot be read directly

accept it is more difficult to read compared to liquid-in-glass

2

[14]

Q29.

(a) (i) to obtain a range of p.d. values

accept increase / decrease current / p.d. / voltage / resistance

accept to change / control the current / p.d. / voltage / resistance

to provide resistance is insufficient

a variable resistor is insufficient

*do **not** accept electricity for current*

1

(ii) temperature of the bulb increases

accept bulb gets hot(ter)

accept answers correctly

expressed in terms of collisions between (free) electrons and ions / atoms

bulb gets brighter is insufficient

1

(iii) 36

*allow **1** mark for correct substitution, ie 12 × 3 provided no subsequent step shown*

2

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watt(s) / W

accept joules per second / J/s

*do **not** accept w*

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance, and apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1-2 marks)
There is a basic comparison of either a cost aspect or an energy efficiency aspect.

Level 2 (3-4 marks)
There is a clear comparison of either the cost aspect or energy efficiency aspect
OR
a basic comparison of both cost and energy efficiency aspects.

Level 3 (5-6 marks)
There is a detailed comparison of both the cost aspect and the energy efficiency aspect.

For full marks the comparisons made should support a conclusion as to which type of bulb is preferable.

Examples of the points made in the response:

cost

- halogen are cheaper to buy

  simply giving cost figures is insufficient

- 6 halogen lamps cost the same as one LED
- LEDs last longer
- need to buy 18 / more halogen lamps to last the same time as one LED
- 18 halogens cost £35.10
- costs more to run a halogen than LED
- LED has lower maintenance cost (where many used, eg large departmental store lighting)

energy efficiency

- LED works using a smaller current
- LED wastes less energy
- LEDs are more efficient

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- LED is 22% more energy efficient
- LED produces less heat
- LED requires smaller input (power) for same output (power)

6

[11]

Q30.

(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^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

1

a 2.5 mm^2 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]

Q31.

(a) 25(Ω)

1

(b) (i) 2(V)

*allow **1** mark for showing a correct method, ie 6 / 3*

2

(ii) equal to

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1

[4]

Q32.

(a) (i) 50 (Hz)

1

(ii) 2760 (W)

1

(b) 12

*allow **1** mark for correct substitution, ie 2400/200*

or

*allow **1** mark for 2760/230 provided no subsequent step shown*

2

amps

1

(c) the charge is directly proportional to the time switched on for

*accept for **1** mark the longer time (to boil), the greater amount of charge*

***or** positive correlation*

***or** they are proportional*

2

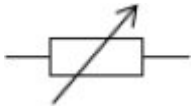
[7]

Q33.

(a) (i) symbol for a diode 

accept 

1

symbol for a variable resistor 

1

(ii) voltmeter is in series **or** voltmeter is not in parallel

1

ammeter is in parallel **or** ammeter is not in series

accept an answer in terms of how the circuit should be corrected

voltmeter and ammeter are wrong way around is insufficient

1

(b) (i) 0.2 (V)

accept any value between 0.20 and 0.21 inclusive

1

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(ii) 37.5

*allow **1** mark for I = 0.008*
or
*allow **2** marks for correct substitution, ie 0.3 = 0.008 × R*
or
*allow **1** mark for a correct substitution using I = 0.8 **or** I = 0.08*
***or** I = 0.009*
or
*allow **2** marks for answers of 0.375 **or** 3.75 **or** 33(.3)*

3

(c) (i) 25

*allow **1** mark for obtaining period = 0.04(s)*

2

(ii) diode has large resistance in reverse / one direction

1

so stops current flow in that / one direction

allow diodes only let current flow one way / direction
*allow **1** mark for the diode has half-rectified the (a.c. power) supply*

1

[12]

Q34.

(a) (i) 50(Hz)

ignore any unit given

1

(ii) any **two** from:

- (some) current flows to Earth
  accept ground for Earth
- current flows through copper braid
  accept current flows through the earth wire
  accept electricity for current in either the first or second marking point but not both
- RCCB detects difference between <u>current</u> in live and neutral wire

2

(iii) can be reset

accept does not need replacing

or

faster acting

accept switches circuit off faster

1

(b) (i) 79 200

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*allow **1** mark for correct substitution, ie* $11 = \frac{Q}{2 \times 3600}$

*an answer 22 gains **1** mark*

2

coulombs / C

*do **not** accept c*

1

(ii) 18 216 000

*accept for **2** marks 18 216 kJ **or** 18.216 MJ*

or

230 × their (b)(i) correctly calculated

*allow **1** mark for correct substitution, ie 230 × their (b)(i) **or** allow **1** mark for power calculated as 2530(W)*

2

(c) increases temperature of thermistor

1

changes resistance (of thermistor)

*do **not** accept increases resistance (of thermistor)*

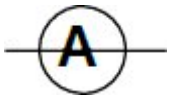
*an answer decreases resistance (of thermistor) gains **2** marks*

1

[11]

Q35.

(a) (i) ammeter symbol correct and drawn in series

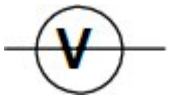


accept

*do **not** accept lower case a*

1

voltmeter symbol correct and drawn in parallel with the material



*do **not** accept*

1

(ii) adjust / use the variable resistor

accept change the resistance

or

change the number of cells

accept battery for cell

accept change the pd / accept change the voltage

accept increase / decrease for change

1

(b) (i) 37.5 (Ω)

accept answer between 36 and 39 inclusive

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1

(ii) 5.6(25) **or** their (b)(i) × 0.15

*allow **1** mark for correct substitution ie 37.5 **or** their (b)(i) × 0.15 provided no subsequent step shown*

2

(c) (i) the thicker the putty the lower the resistance

answer must be comparative
accept the converse

1

(ii) any **one** from:

- measuring length incorrectly
  accept may be different length
- measuring current incorrectly
  *do **not** accept different currents*
- measuring voltage incorrectly
  *do **not** accept different voltage*
- ammeter / voltmeter incorrectly calibrated
- thickness of putty not uniform
  *do **not** accept pieces of putty not the same unless qualified*
- meter has a zero error
  *do **not** accept systematic / random error*
  accept any sensible source of error eg putty at different temperatures
  *do **not** accept human error without an explanation*
  *do **not** accept amount of putty not same*

1

[8]

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