MARK SCHEME

GCSE
PHYSICS
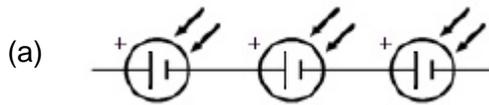## AQA - TRIPLE SCIENCE

P2 - TEST 4
ELECTRICITY
Intermediate

Mark schemes

1. (a)

1

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

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) $\text{efficiency} = \dfrac{\text{useful power output}}{\text{total power input}}$

1

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

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]

2. (a) brown

1

(b) outside / case is plastic / an insulator

accept is double insulated
accept non-conductor for plastic
*do **not** accept it / hairdryer is plastic*

1

(c) (i) (1) S$_1$

and no other

1

(2) S$_1$ and S$_3$

both required, either order

1

(ii) S_1 must be ON (for either heater to work)

        *do **not** accept reference to 'fan' switch*

1

    S_1 switches the fan on

1

(d)   1495

        *allow **1** mark for correct substitution*

        ie, 6.5 × 230

2

watt(s) or W

        *an answer of 1.495 kW gains **3** marks*

        although the unit is an independent mark for full credit

        the unit and numerical value must be consistent

        accept joules per second or J/s

1

[9]

3.   (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
- 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]

4. (a) electrons transfer / removed

*do **not** accept negatively charged atoms for electrons*

this only scores if first mark given

1

to the rod / from the cloth

this does not score if there is reference to any original charge on cloth or rod

'it' refers to the rod

*accept negative charge transfer to rod / removed from cloth for **1** mark*

transfer of positive charge / positive electrons scores zero

1

(b) (i) rods / charges repel

1

creating downward / extra force (on the balance)

accept pushing (bottom) rod downwards

do not accept increasing the weight / mass

charges attracting scores zero

1

(ii) the (repulsion) force increases as the distance between the <u>charges</u> decreases

accept there is a negative correlation between (repulsion) force and distance between <u>charges</u>

or

(repulsion) force and distance between <u>charges</u> are inversely proportional

for both marks

*examples of **1** mark answers*

force increases as distance decreases

force and distance are inversely proportional

negative correlation between force and distance

repels more as distance decreases

if given in terms of attracting or attraction force this mark does not score

2

[6]

5. (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

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

- LED is 22% more energy efficient

- LED produces less heat

- LED requires smaller input (power) for same output (power)

6

[11]

6. (a) (i) friction between the beads and pipe

    accept beads rub against the pipe

1

(cause) <u>electrons</u> to transfer

    accept electrons are lost/gained

    *do **not** accept negatively charged atoms for electrons*

    3rd mark point only scores if 2nd mark scores

1

from the pipe

> *do **not** accept from the (negatively) charged pipe*

or

to the beads

> *do **not** accept to the (positively) charged beads*
>
> *accept negative charge transfer to the beads for **1** mark provided 2nd or 3rd marking point not awarded*
>
> *mention of positive charge transfer negates last 2 marking points*

1

(ii) <u>volume</u> of beads

> *accept (75)cm^3*

or

<u>leng</u>th of pipe

> *accept use the same pipe*

or

speed the beads are poured

> *poured the same way is insufficient*

or

angle of pipe

1

(b) (i) the larger the beads the less charge

> *do **not** accept inversely proportional*
>
> *negative correlation is insufficient*

1

(ii) (total) charge decrease

> *results would be lower/smaller would be insufficient*

1

beads in contact with pipe (walls) for less time

> *accept less contact (between beads and pipe)*
>
> *accept beads in pipe for less time*

or

smaller surface area (to rub against)

> *accept less pipe to rub against*
>
> *less friction is insufficient*

1

(c) (i) (pumping very) fine powders

reason only scores if (very) fine powders given

greater charge (build up)

accept more static (electricity)

accept an answer that correctly relates back to the experimental data

or

higher pd/voltage

or

greater energy

accept larger surface area to volume (ratio)

1

(ii) idea of earthing (the pipe)

accept use metal pipes

*do **not** accept use larger particles*

1

(d) to compare (the relative risks)

fair test is insufficient

you can only have one

independent variable is insufficient

or

different conditions change the MIE value

accept different conditions change the results

*do **not** accept avoid bias*

1

[10]

7. (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
- $\text{resistance} = \dfrac{\text{potential difference}}{\text{current}}$
- 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

the resolution of the length measurement would be higher

1

[12]

8.   (a)   filament bulb

1

(b)   (i)   6 V

1

(ii)   3 Ω or their $\dfrac{(i)}{2}$ 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]

9. (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
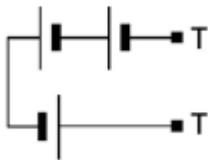
(d)   reduce chance of an electric shock

                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

                accept an electric shock can kill you

                accept it can kill you

                accept so you can use it safely

                                                          1

                                                          [9]

10. (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

their (c)(i) = I × 200

or

alternative method using the graph

V = 3 V (1)

3 = I × 200 (1)

3

[9]

11.   (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]