

- M1. (a) (i)** 150 1
- (ii) transferred to the surroundings by heating
reference to sound negates mark 1
- (iii) 0.75
450 / 600 gains 1 mark
accept 75% for 2 marks
maximum of 1 mark awarded if a unit is given 2
- (iv) 20 (s)
correct answer with or without working gains 2 marks
correct substitution of 600 / 30 gains 1 mark 2
- (b) (i) to avoid bias 1
- (ii) use less power and last longer 1
- 1 LED costs £16, 40 filament bulbs cost £80
- or**
- filament costs (5 times) more in energy consumption 1
- (iii) any **one** from:
- availability of bulbs

- colour output
- temperature of bulb surface

1
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M2. (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

M3. (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 marksNo 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)

M4. (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:

- 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

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- M5.**
- (a) (black) is a good absorber of (infrared) radiation 1
- (b) (i) amount of energy required to change (the state of a substance) from solid to liquid (with no change in temperature)
melt is insufficient 1
- unit mass / 1kg 1
- (ii) 5.1×10^6 (J)
accept 5×10^6
allow 1 mark for correct substitution ie $E = 15 \times 3.4 \times 10^5$ 2
- (c) (i) mass of ice
allow volume / weight / amount / quantity of ice 1
- (ii) to distribute the salt throughout the ice 1
- to keep all the ice at the same temperature 1
- (iii) melting point decreases as the mass of salt is increased
allow concentration for mass
accept negative correlation
*do **not** accept inversely proportional* 1
- (d) 60 000 (J)
accept 60 KJ
allow 2 marks for correct substitution ie $E = 500 \times 2.0 \times 60$

allow 2 marks for an answer of 1000 or 60
allow 1 mark for correct substitution ie
 $E = 500 \times 2.0$ or $0.50 \times 2.0 \times 60$
allow 1 mark for an answer of 1

3

- (e) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks

No relevant content

Level 1 (1–2 marks)

There is an attempt at a description of some advantages or disadvantages.

Level 2 (3–4 marks)

*There is a basic description of some advantages **and** / **or** disadvantages for some of the methods*

Level 3 (5–6 marks)

There is a clear description of the advantages and disadvantages of all the methods.

examples of the points made in the response

extra information

energy storage

advantages:

- no fuel costs
- no environmental effects

disadvantages:

- expensive to set up and maintain
- need to dig deep under road
- dependent on (summer) weather
- digging up earth and disrupting habitats

salt spreading

advantages:

- easily available
- cheap

disadvantages:

- can damage trees / plants / drinking water / cars
- needs to be cleaned away

undersoil heating

advantages:

- not dependent on weather
- can be switched on and off

disadvantages:

- costly
- bad for environment

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