

- M1.** (a) (i) kinetic
*do **not** accept movement* 1
- (ii) thermal sound
accept heat for thermal
*do **not** accept noise for sound*
***both** answers required in either order* 1
- (b) transferred to surroundings / surrounding molecules / atmosphere
'it escapes' is insufficient
or becomes dissipated / spread out
accept warms the surroundings
accept degraded / diluted
accept a correct description for surroundings eg to the washing machine
*do **not** accept transformed into heat on its own* 1
- (c) (i) 3 (.0 p)
allow 1 mark for correct substitution of correct values ie 0.2 x 15
allow 1 mark for calculating cost at 40°C (16.5p)
or
cost at 30°C (13.5p) 2
- (ii) any **two** from:
- less electricity needed
ignore answers in terms of the washing machine releasing less energy
an answer in terms of the washing machine releasing CO₂ negates mark
*do **not** accept less energy is produced*
 - fewer power stations needed

- less fuel is burned
accept a correctly named fuel
*do **not** accept less fuel is needed*

2

[7]

M2. (a) (i) food processor
hairdryer
*both required and no other
either order*

1

(ii) TV
Table lamp
Food processor
*all required and no other
any order*

1

(b) any **two** from:

- transfers / requires / uses more energy / power
*accept more electricity used
accept higher power*
- more electricity needs to be generated
- more (fossil) fuels (likely) to be burnt
accept a named fossil fuel

2

(c) (i) precise
this answer only

1

(ii) any **three** from:

- can look for trends / patterns
- help reduce energy use / consumption
- reduce bills
accept save money
- identify appliances which use a lot of energy
- replace appliances with more efficient ones
- see effect of leaving appliances on (standby)

*to monitor usage is insufficient
answers in terms of environment are insufficient*

3

[8]

M3. (a) $E = P \times t$

91 (p)

an answer £0.91 gains 3 marks

an answer 0.91 gains 2 marks

allow 2 marks for energy transferred = 18.2 (kWh)

or

substitution into 2 equations combined, ie $2.6 \times 7 \times 5$

allow 1 mark for correct substitution into $E = P \times t$, ie $E = 2.6 \times 7$

or

allow 1 mark for multiplying and correctly calculating an incorrect energy transfer value by 5

3

(b) answers should be in terms of supply exceeding demand

accept there is a surplus / excess of electricity (at night)

1

(c) reduce (rate of) energy transfer (from ceramic bricks)

accept heat for energy

do not accept no energy / heat escapes

do not accept answers in terms of lost / losing heat if this implies heat is wasted energy

1

so keeping the (ceramic) bricks hot for longer

accept increase time that energy is transferred to the room

accept keep room warm for longer

or

to stop the casing getting too hot

accept so you do not get burnt (on the casing)

1

(d) $E = m \times c \times \theta$

120

allow 1 mark for correct substitution

ie $9\,000\,000 = m \times 750 \times 100$

2

[8]

- M4.** (a) (i) conduction 1
- convection 1
- correct order only*
- (ii) to keep the ceramic bricks hot for a longer time 1
- (b) (i) $E = P \times t$
- 18.2
- allow 1 mark for correct substitution ie 2.6×7 provided that no subsequent step is shown* 2
- (ii) 91 (p)
- or** their (b)(i) $\times 5$ correctly calculated
- accept £0.91*
- do **not** accept 0.91 without £ sign* 1
- (c) $E = m \times c \times \theta$
- 2 250 000
- allow 1 mark for correct substitution ie $120 \times 750 \times 25$ provided that no subsequent step is shown*
- answers 2250 kJ or 2.25 MJ gain both marks* 2

[8]

M5. (a) advantage

any **one** from:

- produce no / little greenhouse gases / carbon dioxide
allow produces no / little polluting gases
allow doesn't contribute to global warming / climate change
allow produce no acid rain / sulphur dioxide
reference to atmospheric pollution is insufficient
produce no harmful gases is insufficient
- high(er) energy density in fuel
accept one nuclear power station produces as much power as several gas power stations
nuclear power stations can supply a lot of or more energy is insufficient
- long(er) operating life
allow saves using reserves of fossil fuels or gas

1

disadvantage

any **one** from:

- produce (long term) radioactive waste
accept waste is toxic
accept nuclear for radioactive
- accidents at nuclear power stations may have far reaching or long term consequences
- high(er) decommissioning costs
accept high(er) building costs
- long(er) start up time

1

(b) (i) 12 000 (kWh)

allow 1 mark for correct substitution eg

$$2000 \times 6$$

or

$$2\,000\,000 \times 6$$

or

$$\frac{12\,000\,000}{1000}$$

an answer of 12 000 000 scores 1 mark

2

(ii) any idea of unreliability, eg

- wind is unreliable
reference to weather alone is insufficient
- shut down if wind too strong / weak
- wind is variable

1

(c) any **one** from:

- cannot be seen
- no hazard to (low flying) aircraft / helicopters
- unlikely to be or not damaged / affected by (severe) weather
unlikely to be damaged is insufficient
- (normally) no / reduced shock hazard
safer is insufficient
less maintenance is insufficient
installed in urban areas is insufficient

1

[6]

M6. (a) water moves (from a higher level to a lower level) 1

transferring GPE to KE 1

rotating a turbine to turn a generator
*accept driving or turning or spinning for rotating
moving is insufficient* 1

transferring KE to electrical energy
*transferring GPE to electrical energy gains 1 mark of the 2
marks available for energy transfers* 1

(b) (TVs in stand-by) use electricity
accept power / energy 1

generating electricity (from fossil fuels) produces CO₂
*accept greenhouse gas
accept sulfur dioxide* 1

(CO₂) contributes to global warming
*accept climate change for global warming
accept greenhouse effect if CO₂ given
accept acid rain if linked to sulfur dioxide* 1

(c) a factor other than scientific is given, eg economic, political or legal
personal choice is insufficient 1

[8]

M7. (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)