M1. (a) (i) kinetic

\[ \text{do not accept movement} \]

(ii) thermal sound

\[ \text{accept heat for thermal} \]
\[ \text{do not accept noise for sound} \]
\[ \text{both answers required in either order} \]

(b) transferred to surroundings / surrounding molecules / atmosphere

'it escapes' is insufficient

or becomes dissipated / spread out

\[ \text{accept warms the surroundings} \]
\[ \text{accept degraded / diluted} \]
\[ \text{accept a correct description for surroundings eg to the washing machine} \]
\[ \text{do not accept transformed into heat on its own} \]

(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)

(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 CO\textsubscript{2}
  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
M2. (a) (i) food processor
hairdryer
both required and no other
either order

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

(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

(c) (i) precise
this answer only

(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
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 \( 9000000 = m \times 750 \times 100 \)

2
M4. (a)  

(i) conduction  

convection  

*correct order only*  

(ii) to keep the ceramic bricks hot for a longer time  

(b)  

(i) \[ E = P \times t \]  

18.2  

*allow 1 mark for correct substitution ie 2.6 \times 7 provided that no subsequent step is shown*  

(ii) 91 (p)  

or their (b)(i) \times 5 correctly calculated  

*accept £0.91*  

*do not accept 0.91 without £ sign*  

(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*
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 × 6

or

2 000 000 × 6

or

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

(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
M6. 

(a) water moves (from a higher level to a lower level)  
transferring GPE to KE  
rotating a turbine to turn a generator  
accept driving or turning or spinning for rotating  
moving is insufficient  
transferring KE to electrical energy  
accept driving or turning or spinning for rotating  
transferring GPE to electrical energy gains 1 mark of the 2  
marks available for energy transfers  

(b) (TVs in stand-by) use electricity  
accept power / energy  
generating electricity (from fossil fuels) produces CO\(_2\)  
accept greenhouse gas  
accept sulfur dioxide  
(CO\(_2\)) contributes to global warming  
accept climate change for global warming  
accept greenhouse effect if CO\(_2\) given  
accept acid rain if linked to sulfur dioxide  

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

[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 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)