M1. (a) any **two** from:

- black is a good emitter of (infrared radiation)
  accept heat for radiation
  ignore reference to absorbing radiation
- large surface (area)
- matt surfaces are better emitters (than shiny surfaces)
  accept matt surfaces are good emitters
  ignore reference to good conductor

2

(b) 90% or 0.9(0)

$$efficiency = \frac{useful\ energy\ out\ (\times 100\%)}{total\ energy\ in}$$

allow 1 mark for correct substitution, ie $\frac{13.5}{15}$
provided no subsequent step shown
*an answer of 90 scores **1** mark*
*an answer of 90 / 0.90 with a unit scores **1** mark*

2

(c) (producing) light
allow (producing) sound

1

(d) any **two** from:

- wood is renewable
  accept wood grows again / quickly
  accept wood can be replanted
- (using wood) conserves fossil fuels
  accept doesn't use fossil fuels
- wood is carbon neutral
  accept a description

cheaper / saves money is insufficient

2

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

2 550 000

*allow **1** mark for correct substitution*
ie 100 × 510 × 50
provided no subsequent step shown
*answers of 1 020 000, 3 570 000 gain **1** mark*

2

joules /J

accept kJ / MJ
*do **not** accept j*
for full credit the unit and numerical answer must be consistent

1

[10]

M2. (a) (i) radiation

ignore thermal / infrared

1

(ii) black is a better / good absorber (of heat / radiation)

ignore reference to black being a good emitter
black absorbs heat is insufficient
*do **not** accept black attracts / absorbs the Sun*
*do **not** accept black attracts heat*

1

(so) temperature rises faster

must be an indication of heating up quicker
orwhite is a worse / poor absorber (of heat / radiation) (1)

accept white is a better / good reflector (of heat / radiation)

(so if white faces) temperature would rise slower (1)

ignore any reference to light

1

(b) (i) 1.2 (hours) **or** 1 hour 12 minutes

no tolerance

1

(ii) increases (rapidly at first then increases at a slower rate)

*do **not** accept increases at a steady rate*

1

(c) (i) any **two** from:

- (fill with) same mass / volume / amount of water
- same level of (sun)light / sunshine
  accept same heat / light source
  accept same place
- outside for the same (length of) time
- outside at same time (of day / year)

- initial water temperature
- the side of the bag facing the Sun

  *do **not** accept any factors to do with the construction of plastic bags eg thickness*

2

(ii) curved line drawn above given line

both lines must start from the same point

ignore if continues beyond one hour or levels off after 1 hour

*do **not** accept a straight line*

1

[8]

M3. (a) dark matt

1

light shiny

1

(b) B A C

1

biggest temperature difference (80 °C)
dependent on first mark

1

(c) (i) (the can that is) dark matt

1

best absorber (of infrared radiation)

1

(ii) any **three** from:

- same area / shape of can
- surrounding temperature is the same for all cans
- same surface underneath cans
- same position in the room

3

(d) fox A

smaller ears

1

thicker fur

1

these minimise energy transfer

dependent on first 2 marks

1

[12]

M4. (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 × 2.0 × 60*
*allow **2** marks for an answer of 1000 **or** 60*
*allow **1** mark for correct substitution ie*
*E = 500 × 2.0 **or** 0.50 × 2.0 × 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

6

[18]

M5. (a) infrared / IR

correct answer only

1

(b) any **two** from:

- increase the power / watts

  allow increase the temperature of the oven or make the oven hotter
- decrease the speed

  allow leave the biscuits in for longer
- put biscuits through again

  increase radiation is insufficient

  ignore changes to the design of the oven

2

(c) (inside) surface is a (good) reflector or poor absorber (of IR)

Ignore bounce for reflect

surface is a (good) reflector of light does not score

surface is a (good) reflector of light and infrared / heat does score

1

(and) outside surface is poor emitter (of IR)

1

(so) increases the energy reaching the biscuits

allow reduces energy loss or makes oven more efficient

*do **not** accept no energy losses*

keeps oven hotter is insufficient

1

[6]