

<b>M1.</b>	(a) solid	1
	(b) decreased <i>correct order only</i>	1
	decreased	1
	increased	1
	(c) (i) A <i>reason only scores if A chosen</i>	1
	uses least / less energy (in 1 year) <i>a comparison is required</i> <i>accept uses least power</i> <i>accept uses least kWh</i>	1
	(ii) greater the volume the greater the energy it uses (in 1 year)	1
	(iii) a very small number sampled <i>accept only tested 3</i> <i>accept insufficient evidence / data</i> <i>allow not all fridges have the same efficiency or a correct</i> <i>description implying different efficiencies</i> <i>only tested each fridge once is insufficient</i> <i>there are lots of different makes is insufficient</i>	1

- M2.** (a) (i) random distribution of circles in the box with at least 50 % of circles touching 1
- random distribution of circles occupies more than 50 % of the space  
*judged by eye* 1
- (ii) (large) gaps between particles  
*accept particles do not touch*  
*accept particles are spread out* 1
- (so) easy to push particles closer (together)  
**or**  
forces between particles are negligible / none  
*an answer in terms of number of particles is insufficient* 1
- (b) (i) (both are) random  
*accept a correct description of random eg unpredictable or*  
*move around freely or in all directions*  
*they take up all the space is insufficient*  
*they are spread out is insufficient*  
*they move in straight lines is insufficient* 1
- (ii) (speed also) increases 1

[6]

- M3.** (a) (i) 7pm  
*accept 19.00 / 1900* 1
- (ii) 8pm  
*accept 20.00 / 2000* 1
- temperature drops more slowly  
*accept heat for temperature accept line is less steep* 1
- (b) insulator 1
- conduction \* 1
- convection \*  
*\* answers can be either way around* 1
- (c) (i) 4 (years) 1
- (ii) it is the cheapest / cheaper / cheap  
*do not accept answers in terms of heat rising or DIY* 1
- has the shortest / shorter payback time  
*do not accept short payback time* 1

[9]

**M4.** (a) the bigger the surface area, the faster the water cools down / temperature falls  
*answers must imply rate*  
*accept heat for temperature provided rate is implied*  
*do **not** accept cools down more unless qualified*

1

(b) any **two** from:

the ears:

- have large surface / area  
*not just has large ears*
- radiate heat  
*accept loses heat, but does not score*  
*if the reason given for heat loss is wrong*
- keep blood cooler

2

(c) (i) radiation

1

(ii) conduction

1

**[5]**

**M5.** (a) to reflect (the infrared)  
*accept (shiny surfaces) are good reflectors*  
*ignore reference to incorrect type of wave* 1

(b) black 1

best absorber (of infrared)  
*answer should be comparative black absorbs (infrared) is insufficient*  
*accept good absorber (of infrared)*  
*ignore reference to emitter*  
*ignore attracts heat ignore reference to conduction* 1

(c) to reduce energy loss  
*accept to stop energy loss*  
*accept heat for energy*  
*accept to stop / reduce convection*  
  
or so temperature of water increases faster  
*accept to heat water faster*  
*accept cooks food faster*  
  
or reduces loss of water (by evaporation) 1

(d) 672 000  
*allow 1 mark for correct substitution, ie  $2 \times 4200 \times 80$*   
*provided no subsequent step shown* 2

[6]

M6.(a) (i) Z 1

(ii) X 1

(b) (i) moving randomly 1

(ii) stronger than 1

(c) (i) evaporation 1

(ii) any **one** from:  
• becomes windy  
• temperature increases  
*accept (becomes) sunny "the sun" alone is insufficient*  
• less humid 1

[6]

M7. (a) (i) any **two** from:

- mass (of block)  
*accept weight for mass*
- starting temperature
- final / increase in temperature  
*temperature is insufficient*
- voltage / p.d.  
*same power supply insufficient*
- power (supplied to each block)
- type / thickness of insulation  
*same insulation insufficient*

2

- (ii) one of variables is categoric  
**or**  
(type of) material is categoric  
*accept the data is categoric*  
*accept a description of categoric*  
*do **not** accept temp rise is categoric*

1

- (iii) concrete  
*reason only scores if concrete chosen*

1

(heater on for) longest / longer time  
*a long time or quoting a time is insufficient*  
*do **not** accept it is the highest bar*

1

- (iv) 4500 (J)  
*allow **1** mark for correct substitution ie*  
 *$2 \times 450 \times 5$  provided no subsequent step shown*

2

- (b) (i) point at 10 minutes identified

1

(ii) line through all points except anomalous  
*line must go from at least first to last point*

1

(iii) 20 (°C)  
*if 20°C is given, award the mark.*  
*If an answer other than 20°C is given, look at the graph. If the graph shows a correct extrapolation of the candidate's best-fit line and the intercept value has been correctly stated, allow 1 mark.*

1

(iv) 2 (minutes)

1

**[11]**

**M8.(a)** (i) temperature (increase) and time switched on are directly proportional  
*accept the idea of equal increases in time giving equal increases in temperature*

*answers such as:*

- *as time increases, temperature increases*
- *positive correlation*
- *linear relationship*
- *temperature and time are proportional*

*score 1 mark*

2

(ii) any **one** from:

*“it” refers to the metal block*

- *energy transfer (from the block) to the surroundings*  
*accept lost for transfer*  
*accept air for surroundings*
- *(some) energy used to warm the heater / thermometer (itself)*  
*accept takes time for heater to warm up*
- *(metal) block is not insulated*

1

(iii) 15 000

*allow 1 mark for correct substitution, ie  $50 \times 300$  provided no subsequent step shown*

2

(b) lead

*reason only scores if lead is chosen*

1

needs least energy to raise temperature by 1°C

*accept needs less energy to heat it (by the same amount)*  
*lowest specific heat capacity is insufficient*

1

[7]