**M1.** (a) (i) walls

*accept sides (of house)*

**1**

(ii) fit double glazing

**or**

close / fit curtains / fit shutters

*accept close windows*

*accept keep house at a lower temperature*

*accept fit (foam) draft excluders around the windows / in the jams*

*accept put plastic (film) across the windows*

*do **not** accept fit thicker glass*

**1**

(b) (i) cavity (wall insulation)

*accept the middle one*

**1**

(ii) fit hot water jacket **and** draught-proofing

*both required*

**1**

(together) saves most money

*only scores if first mark scores*

*accept saves more than fitting (energy efficient) light bulbs*

*accept saves £40*

*accept gives the shortest payback time*

*an answer fit energy efficient light bulbs (on its own) gains **1** mark only*

**1**

**[5]**

**M2.** (a) (i) any **one** from:

water to the mug
water to the air
mug to the air
mug to the table

***both*** *required*

*direction of transfer must be correct*

**1**

(ii) when <u>temperatures</u> are the same

*accept a specific example eg when the <u>temperature</u> of the water and mug are the same*

*accept radiant heat transfer will never stop*

**1**

(b) wood

**1**

(c) (i) conduction

*accept convection if not given as 3rd answer*

**1**

insulator

**1**

convection

**1**

(ii) any **one** from:

*do **not** accept any rebuilding of house*

double glazing

loft insulation

*accept roof for loft*

**1**

carpets

(cavity) wall insulation

*do **not** accept closing doors and windows*

draft excluders

foil behind radiators

*accept blocking chimney*

paint inside walls white

**[7]**

**M3.** (a) (i) (insulate it) with **fibre** glass **or** foam **or** felt **or** polystyrene beads **or** rockwool **or** (aluminium) foil

*an example must be included*

*do not credit loft insulation*

**1**

(ii) fill the cavity with fibre glass **or** foam **or** mineral wool **or** polystyrene **or** named liner inside wall **or** making walls thicker

*an example must be included*

*do not credit cavity wall insulation*

**1**

(iii) double glaze **or** draw the curtains **or** blinds **or** thicker glass **or** secondary glazing described

*do not credit fit smaller windows*

**1**

(iv) put in draught excluder (or described) **or** strip **or** description of filling gaps **or** seal gaps **or** double glazed doors **or** build porch **or** curtains inside door **or** mat under door

*do not credit just carpet*

*accept buy new doors*

*accept premise that gap is between frame and wall as well as between frame and door*

**1**

(b) windy **or** stormy **or** wet **or** snow **or** rain **or** sleet **or** hail **or** fog **or** mist

*do not credit frosty*

**1**

**[5]**

**M4.**(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 × 450 × 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]**

**M5.** (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]**

**M6.** (a) (i) 2(.0)

*accept 2000 W or 2000 watt(s)*
*accept answer given in table*
*do **not** accept 2000*

**1**

(ii) 4.5

*allow **1** mark for correct substitution*
*ie 1.5 × 3*
*allow **1** mark for the answers 1.5 or 6(.0)*

**2**

(iii) 54**or**
their (a)(ii) × 12 correctly calculated

*allow **1** mark for correct substitution*
*ie 4.5 × 12**or***
*their (a)(ii) × 12*
*allow **1** mark if correct answer is given in pounds eg £54*

**2**

(b) (i) 6 pm

**1**

temperature starts to rise faster

*only scores if 6 pm given*

**or**graph (line) is steeper / steepest

*it refers to graph gradient or temperature*
*accept answers in terms of relative temperature rise*
*eg 5 to 6 pm 2 °C rise, 6 to 7 pm 6 °C rise*
*accept temperature rises sharply / rapidly / quickly*
*do **not** accept temperature starts to rise*

***1***

*(ii) middle box ticked*

***1***

***[8]***

***M7.****(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 × 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]***

***M8.****(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 comparativeblack absorbs (infrared) is insufficient*
*accept good absorber (of infrared)*
*ignore reference to emitter*
*ignore attracts heatignore 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 × 4200 × 80*
*provided no subsequent step shown*

***2***

***[6]***