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

orgraph (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]