**M1.** (a) (i) £150

*gets 2*

Else 1000 – (250 + 350 + 100 + 150) or 1000 – 850

*gets 1*

**2**

(ii) (Named) floor covering
**OR** Insulation under floor

*for 1 mark*

**1**

(b) (i) Draught proof doors or fibre glass in loft or in cavity
**For draught proofing**

*gains 1 mark*

Very low cost/easy to install
Repays for itself quickly/cost recuperated quickly
Reasonable energy saving

*any 2 for 1 mark each*

For loft insulation

Second lowest installation cost/easy to install
Reasonable large energy savings for this cost
Reasonable payback time

*gains 1 mark*

**For foam filled cavity**
Biggest energy/cash saving
Cost effective

*any 2 for 1 mark each*

**3**

(ii) **Double glazing**

*gains 1 mark*

Costs most

Saves least energy
Least cost effective

*any 2 for 1 mark each*

**3**

**[9]**

**M2.** (a) conduction

*do **not** accept conductor*

**1**

(b) the freezer

*both parts needed*

greater <u>temperature</u> difference (between freezer and room)

*do **not** accept because it is the coldest*

**1**

(c) any **two** from:

- poor absorber of heat / radiation

  *accept does not absorb heat poor emitter of heat / radiation is neutral*

- reflects heat / radiation (from room away from fridge-freezer)
- reduces heat transfer <u>into</u> the fridge-freezer
- reduces power consumption of fridge-freezer

  *do **not** accept it is a bad conductor / good insulator*

**2**

**[4]**

**M3.** (i) currents of moving liquids/gases/fluids carrying/transferring energy
(can name fluid)

**1**

(ii) liquids/gases **expand** when their temperature rises/when they are heated

the **density** of the heated liquid/gas is then **less** than that of the colder liquid/gas which has not been heated

the warmer/less dense liquid/gas **then rises** through the colder/denser liquid/gas

the **colder/denser liquid/gas falls** to replace the liquid/gas which has risen, and in turn becomes heated

*for 1 mark each*

**4**

**[5]**

**M4.** (a) ions / electrons gain (kinetic) energy

*accept atom / particles / molecules for ion*
*accept ions vibrate faster*
*accept ions vibrate with a bigger amplitude*
*accept ions vibrate more*
*do not accept ions move faster*

**1**

(free) electrons transfer energy by collision with ions
**or** energy transferred by collisions between vibrating ions

**1**

(b) move faster or take up more space

*do **not** accept start to move / vibrate*

**1**

(warmer) water expands **or** becomes less dense (than cooler water)

*do **not** accept answers in terms of particles expanding*

**1**

warm water rises (through colder water) **or** colder water falls to take its place

**1**

(c) transfer of energy by waves / infrared (radiation)

*accept rays for waves*
*do **not** accept transfer of energy by electromagnetic waves*
*ignore reference to heat*

**1**

**[6]**

**M5.** (a) there are strong forces (of attraction) between the particles in a solid

*accept molecules / atoms for particles throughout*
*accept bonds for forces*

**1**

(holding) the particles close together

*particles in a solid are less spread out is insufficient*

**1**

**or**

(holding) the particles in a fixed pattern / positions

but in a gas the forces between the particles are negligible

*accept very small / zero for negligible*
*accept bonds for forces*

**1**

so the particles spread out (to fill their container)

*accept particles are not close together*
*gas particles are not in a fixed position is insufficient*

**1**

(b) (i) particles are (shown) leaving (the liquid / container)

*accept molecules / atoms for particles throughout*
*accept particles are escapingparticles are getting further apart is insufficient*

**1**

(ii) *accept molecules / atoms for particles throughout*
*accept speed / velocity for energy throughout*

particles with most energy leave the (surface of the) liquid

*accept fastest particles leave the liquid*

**1**

so the <u>mean / average</u> energy of the remaining particles goes down

**1**

and the lower the average energy (of the particles) the lower the temperature (of the liquid)

1

**[8]**

**M6.** (a) any **two** from:

- (air) particles / molecules / atoms gain energy
- (air) particles / molecules / atoms move faster
  *do **not** accept move more*
  *do **not** accept move with a bigger amplitude / vibrate more*
- (air) particles / molecules / atoms move apart
- air expands
  *ignore particles expand*
- air becomes less dense
  *ignore particles become less dense*
- warm / hot air / gases / particles rise
  *do **not** accept heat rises*
  *answers in terms of heat particles negates any of the mark points that includes particles*

**2**

(b) (i) any **two** from

- free / mobile electrons gain (kinetic) energy
  *accept free / mobile electrons move faster*
  *accept vibrate faster for gain energy*
- free electrons collide with other (free) electrons / ions / atoms / particles
- atoms / ions / particles collide with other atoms / ions / particles
  *answers in terms of heat particles negates this mark point*

**2**

(ii) (faster) energy / heat transfer to room(s) / house
*accept room(s) / house gets warm(er)*
*accept lounge / bedroom / loft for rooms*

**1**

**[5]**

**M7.** (a) air near freezer compartment is cooled or loses energy

*accept air at the top is cold*

**1**

cool air is (more) dense or particles close(r) together (than warmer air)

*do **not** allow the particles get smaller / condense*

**1**

so (cooler) air falls

**1**

air (at bottom) is displaced / moves upwards / rises

*do **not** allow heat rises*

*accept warm air (at the bottom) rises*

**1**

(b) if volume is doubled, energy use is not doubled

**or**

volume ÷ energy not a constant ratio

**1**

correct reference to data, eg 500 is 2×250 but 630 not 2×300

**1**

(c) accept suitable examples, eg

advantage:

- reduces emissions into atmosphere
- lower input power or uses less energy or wastes less energy
- costs less to run

*cost of buying or installing new fridge is insufficient*

*ignore reference to size of fridge*

**1**

disadvantage:

- land fill
- energy waste in production
- cost or difficulty of disposal
- transport costs

1

**[8]**

**M8.** (a) conduction

**1**

(b) 35 000

**1**

(c) 500

*their (b) = 2 x c x 35 correctly calculated scores **2** marks*

*allow **1** mark for correct substitution,*

*ie 35000 = 2 x c x 35*

***or***

*their (b) = 2 x c x 35*

**2**

J / kg°C

**1**

(d) energy lost to surroundings

**or**

energy needed to warm heater

*accept there is no insulation (on the copper block)*

*do **not** accept answers in terms of human error or poor results or defective equipment*

**1**

**[6]**

**M9.** (a) conduction

**1**

(b) (i) there is a bigger temperature difference between the water and the surrounding air

*accept the water is hottest / hotter*

**1**

so the transfer of energy (from hot water) is faster

*accept heat for energy*

*ignore temperature falls the fastest*

**1**

(ii) 120

*allow **1** mark for converting kJ to J correctly, ie 4 032 000*

**or**

correctly calculating temperature fall as 8°C

**or**

allow **2** marks for correct substitution, ie 4 032 000 = m × 4200 × 8

answers of 0.12, 19.2 **or** 16.6 gain **2** marks

answers of 0.019 **or** 0.017 gain **1** mark

**3**

(iii) water stays hot for longer

**1**

so heater is on for less time

*accept so less energy needed to heat water*

**1**

so cost of the jacket is soon recovered from) lower energy costs / bills

*accept short payback time*

**1**

**[9]**