Internal energy and energy transfers

Mark Scheme

Name: _____

Class: _____

Date: _____

Time: **66 minutes**

Marks: **66 marks**

Comments:

Mark schemes

1 (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]

2 (a) (i) £190

nb mention idea of cost per J in £ will come to an approx figure full credit given

*allow **1** mark for showing that the energy loss through the roof is ¼ of the total energy loss ie 150 / 600*

2

(ii) £142.50

allow ecf 50 % of their (a)(i) × 1.5 ie their (a)(i) × 0.75

1

(b) transferred to surroundings / atmosphere

or becomes spread out

1

[4]

3 (a) loft insulation

1

energy saved in 10 years £600

1

net saving (600 – 110) £490

1

OR

hot water jacket

1

energy saved in 10 years £140

1

This is the highest percentage saving on cost

1

(b) transferred to environment / surroundings

1

as heat / thermal energy

1

[5]

4 (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]

5

(a) four calculations correctly shown
200 × 10 – 1800 = £200
100 × 10 – 2400 = –£1400
50 × 10 – 600 = –£100
20 × 10 – 75 = 125
*accept four final answers only **or** obvious rejection of solar water heater and underfloor heating, with other two calculations completed any 1 complete calculation correctly*
*shown **or** showing each saving × 10 of all four calculations = 1 mark*
*answers in terms of savings as a percentage of installation cost **may** score savings mark only*

2

hot water boiler
correct answers only

1

(b) less electricity / energy to be generated / needed from power stations
accept less demand

1

reduction in (fossil) fuels being burnt
accept correctly named fuel
accept answer in terms of:
fewer light bulbs required because they last longer (1 mark)
less energy used / fuels burnt in production / transport etc. (1 mark)
ignore reference to CO_2 or global warming
ignore reference to conservation of energy

1

[5]

6

(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]

7 (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]

8 (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

2

(ii) **Double glazing**

gains 1 mark

Costs most
Saves least energy
Least cost effective

any 2 for 1 mark each

3

[9]

9 (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]

10 (a) surface area
or
duration of experiment

accept shape of beaker

size of beaker is insufficient

1

(b) any **two** from:

- takes readings automatically

  *ignore easier **or** takes readings for you*

- takes readings more frequently
- reduces / no instrument reading error

  ignore human error

- higher resolution

  allow better resolution

- don't need to remove probe to take reading
- more accurate

2

(c) (i) 0.07 (°C/s)

*allow **1** mark for obtaining a temperature drop of 7 (°C)*

*allow **1** mark for an answer between 0.068 and 0.069 (°C/s)*

2

(ii) rate of temperature change is greater at the start

accept rate of evaporation is greater at the start

or
rate of temperature change decreases

allow rate of evaporation decreases

allow temperature decreases faster at the start

1

(iii) A

reason only scores if A is chosen

lower temperature decrease (over 200 seconds)

accept lower gradient

1

(iv) no effect (as rate of evaporation is unchanged)

allow larger temperature change (per second as mass of liquid is lower)

1

(d) particles with more energy

accept particles with higher speeds

1

leave the (surface of the) liquid

1

(which) reduces the average (kinetic) energy (of the remaining particles)

allow reference to the total energy of the liquid reducing

1

[11]