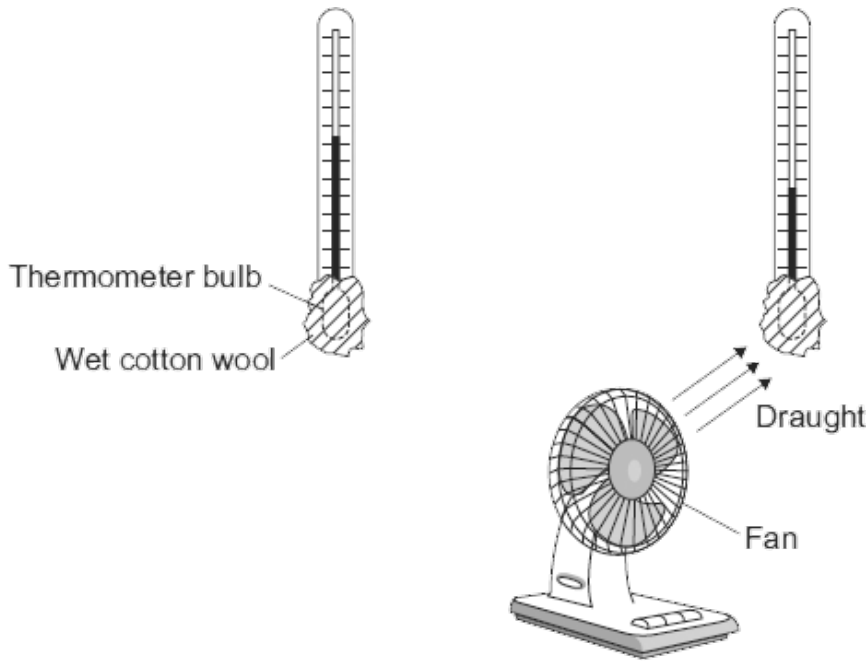
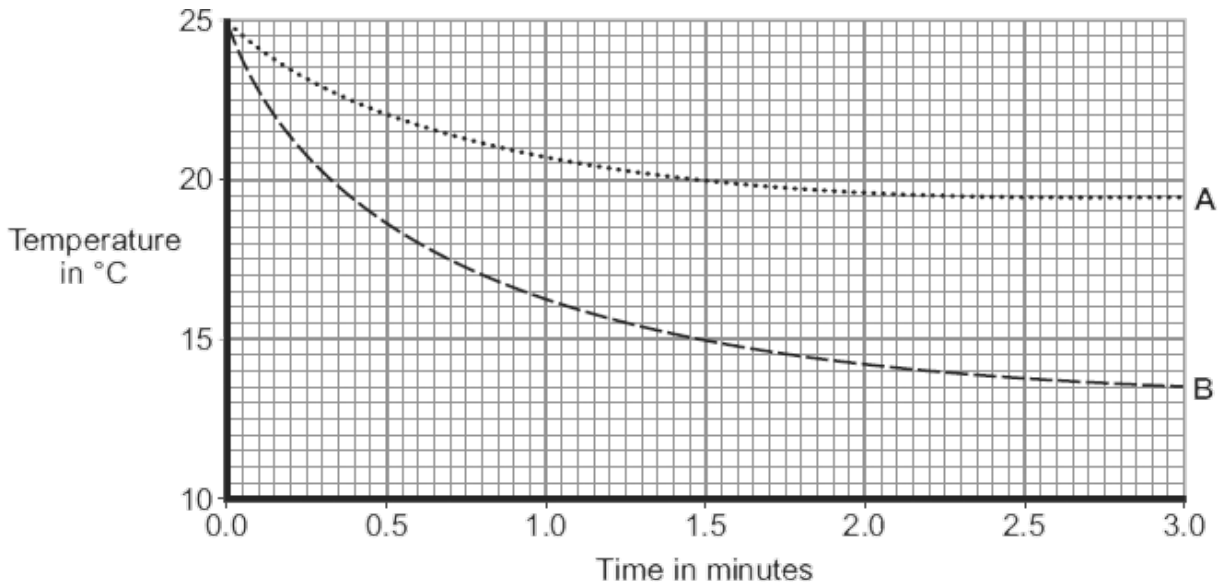


**Q1.** The diagram shows two thermometers. The bulb of each thermometer is covered with a piece of wet cotton wool. One of the thermometers is placed in the draught from a fan.



The graph shows how the temperature of each thermometer changes with time.



- (a) Which of the graph lines, **A** or **B**, shows the temperature of the thermometer placed in the draught?

Write the correct answer in the box.

Explain, in terms of evaporation, the reason for your answer.

.....  
.....  
.....  
.....  
.....  
.....

(3)

- (b) A wet towel spread out and hung outside on a day without wind dries faster than an identical wet towel left rolled up in a plastic bag.

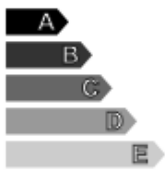

Explain why.

.....  
.....  
.....  
.....

(2)

(Total 5 marks)

**Q2.** The diagram shows the label from a new freezer.

<b>Model</b> <b>Energy A</b>	<b>SALE</b> See inside for details
More efficient  Less efficient	
Energy consumption per year	225 kWh

(a) An old freezer has an energy consumption per year of 350 kWh.

Use the equation in the box to calculate the extra cost of using the old freezer for one year compared with using a new 'A' rated freezer.

$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$
--

Assume 1 kilowatt-hour (kWh) of energy costs 12 p.

Show clearly how you work out your answer.

.....  
 .....

Extra cost per year = £ .....

(2)

(b) The price of the new freezer was reduced in a sale.

Reducing the price reduces the payback time for replacing the old freezer from 12 years to 9 years.

Calculate, in pounds, how much the new freezer was reduced in the sale.

Show clearly how you work out your answer.

.....  
 .....

Price reduced by = £ .....

(2)

(c) An advertisement in a shop claims that:

'Replacing an old freezer with a new 'A' rated freezer will benefit the environment.'

Do you agree that replacing the freezer will benefit the environment?

Answer yes or no. ....

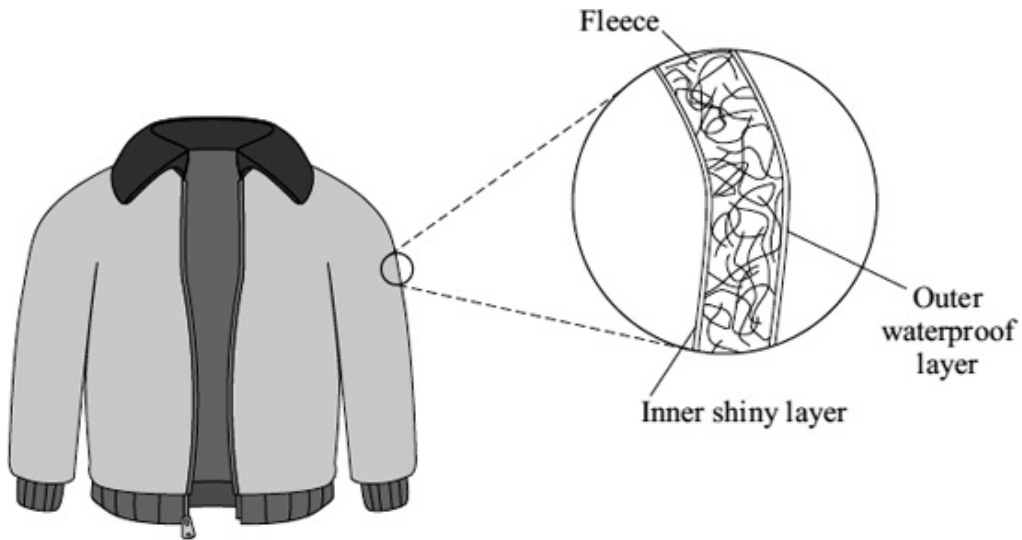
Explain the reasons for your answer.

.....  
.....  
.....  
.....

(2)  
(Total 6 marks)

**Q3.**

(a) The diagram shows a ski jacket that has been designed to keep a skier warm. The jacket is made from layers of different materials.



(i) The inner layer is shiny to reduce heat transfer.

Which process of heat transfer will it reduce?

.....

(1)

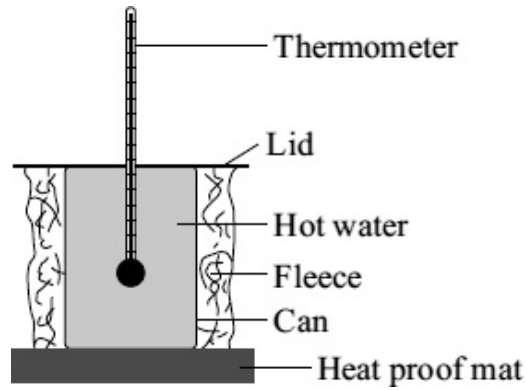
(ii) Why is the layer of fleece good at reducing the transfer of heat from a skier's body?

.....

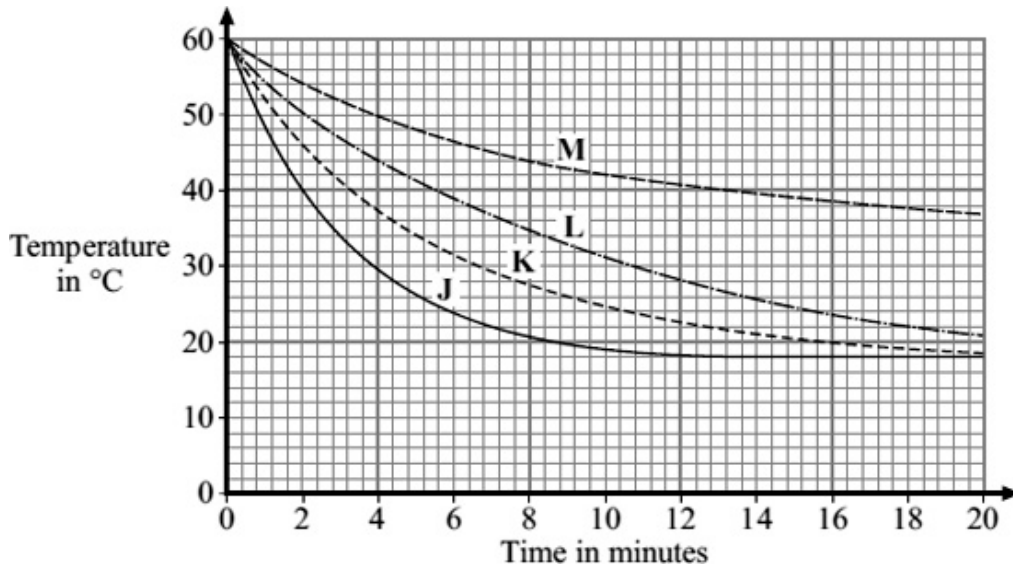
.....

(1)

- (b) A student tested four different types of fleece, **J**, **K**, **L** and **M**, to find which would make the warmest jacket. Each type of fleece was wrapped around a can which was then filled with hot water. The temperature of the water was taken every two minutes for 20 minutes.



The graph shows the student's results.



- (i) In each test, the water cooled faster during the first five minutes than during the last five minutes. Why?

.....  
 .....

(1)

- (ii) To be able to compare the results, it was important to use the same volume of water in each test.

Give **one** other quantity that was the same in each test.

.....  
 .....

(1)

(iii) Look at the graph line for fleece **K**.

Estimate what the temperature of the water in the can wrapped in fleece **K** would be after 40 minutes.

.....

(1)

(iv) Which type of fleece, **J**, **K**, **L** or **M**, should the student recommend to be used in the ski jacket?

.....

Give a reason for your answer.

.....

.....

.....

.....

(2)

(Total 7 marks)

**Q4.** Electricity can be generated using various energy sources.

(a) Give **one** advantage and **one** disadvantage of using nuclear power stations rather than gas-fired power stations to generate electricity.

Advantage .....

.....

Disadvantage .....

.....

(2)

(b) (i) A single wind turbine has a maximum power output of 2 000 000 W.

The wind turbine operated continuously at maximum power for 6 hours.

Calculate the energy output in kilowatt-hours of the wind turbine.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Energy output = ..... kWh

(2)

(ii) Why, on average, do wind turbines operate at maximum power output for only 30% of the time?

.....  
.....

(1)

(c) An on-shore wind farm is made up of many individual wind turbines.

They are connected to the National Grid using underground power cables.

Give **one** advantage of using underground power cables rather than overhead power cables.

.....  
.....

(1)

(Total 6 marks)

**Q5.** The table gives information about some methods of conserving energy in a house.

Conservation method	Installation cost in £	Annual saving on energy bills in £
Cavity wall insulation	500	60
Hot water tank jacket	10	15
Loft insulation	110	60
Thermostatic radiator valves	75	20

(a) Explain which of the methods in the table is the most cost effective way of saving energy over a 10 year period. To obtain full marks you must support your answer with calculations.

.....  
.....  
.....  
.....

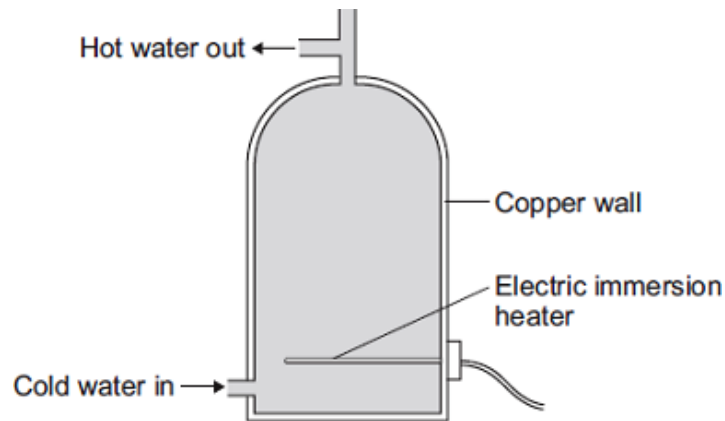
(3)

(b) Describe what happens to the energy which is 'wasted' in a house.

.....  
.....  
.....  
.....

(2)  
(Total 5 marks)

**Q6.** An electric immersion heater is used to heat the water in a domestic hot water tank. When the immersion heater is switched on the water at the bottom of the tank gets hot.



(a) Energy is transferred by the process of convection from the hot water at the bottom of the tank to the cooler water at the top.

Explain how.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

(4)

(b) Complete the following sentence.

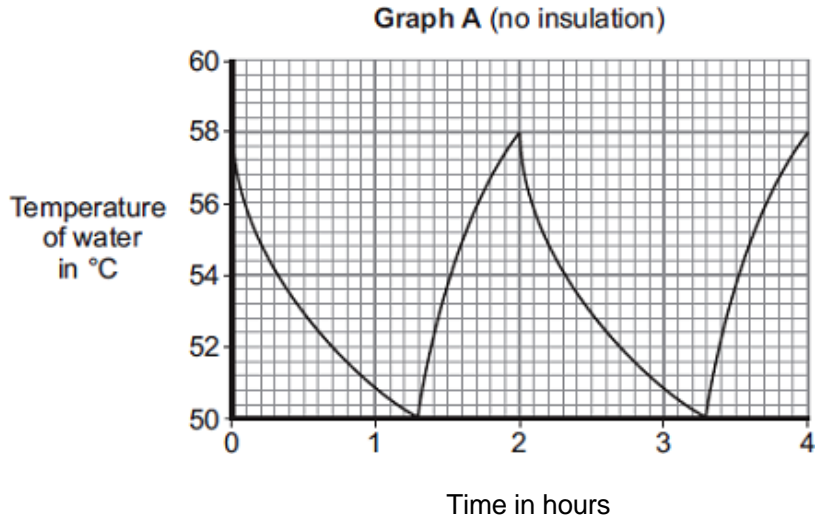
The main way the energy is transferred through the copper wall of the water tank is by the process of .....

(1)

- (c) The immersion heater has a thermostat to control the water temperature.

When the temperature of the water inside the tank reaches 58°C the thermostat switches the heater off. The thermostat switches the heater back on when the temperature of the water falls to 50°C.

**Graph A** shows how the temperature of the water inside a hot water tank changes with time. The tank is **not** insulated.



- (i) The temperature of the water falls at the fastest rate just after the heater switches off.

Explain why.

.....

.....

.....

.....

(2)

- (ii) To heat the water in the tank from 50°C to 58°C the immersion heater transfers 4032 kJ of energy to the water.

Calculate the mass of water in the tank.

Specific heat capacity of water = 4200 J/kg°C

Use the correct equation from the Physics Equations Sheet.

.....

.....

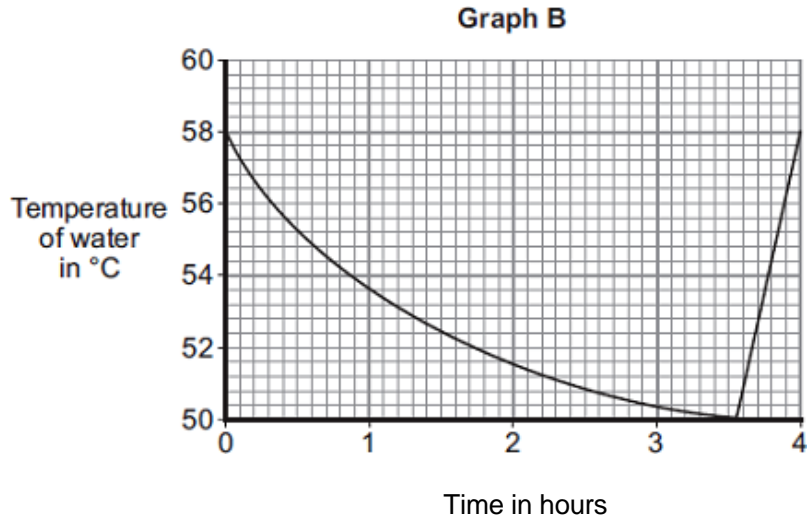
.....

Mass = ..... kg

(3)

(iii) An insulating jacket is fitted to the hot water tank.

**Graph B** shows how the temperature of the water inside the insulated hot water tank changes with time.



An insulating jacket only costs £12.

By comparing **Graph A** with **Graph B**, explain why fitting an insulating jacket to a hot water tank saves money.

.....

.....

.....

.....

.....

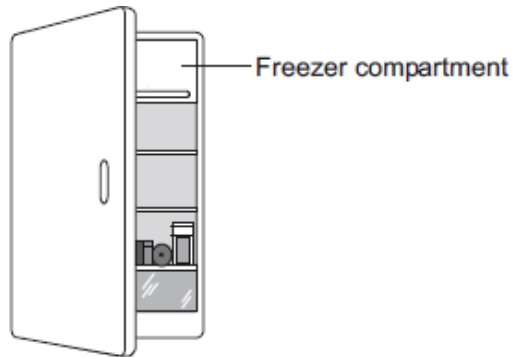
.....

.....

(3)  
(Total 13 marks)

**Q7.** (a) The figure below shows a fridge with a freezer compartment.

The temperature of the air inside the freezer compartment is  $-5\text{ }^{\circ}\text{C}$ .



The air inside the fridge forms a convection current when the fridge door is closed.

Explain why.

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(b) The table below shows information about four fridges.

Fridge	Volume in litres	Energy used in one year in kWh
A	250	300
B	375	480
C	500	630
D	750	750

A householder concludes that the energy used in one year is directly proportional to the volume of the fridge.

Explain why her conclusion is **not** correct.

Use data from the table in your answer.

.....

.....

.....

.....

(2)

(c) New fridges are more efficient than fridges made twenty years ago.

Give **one** advantage and **one** disadvantage of replacing an old fridge with a new fridge.

Ignore the cost of buying a new fridge.

Advantage .....

.....

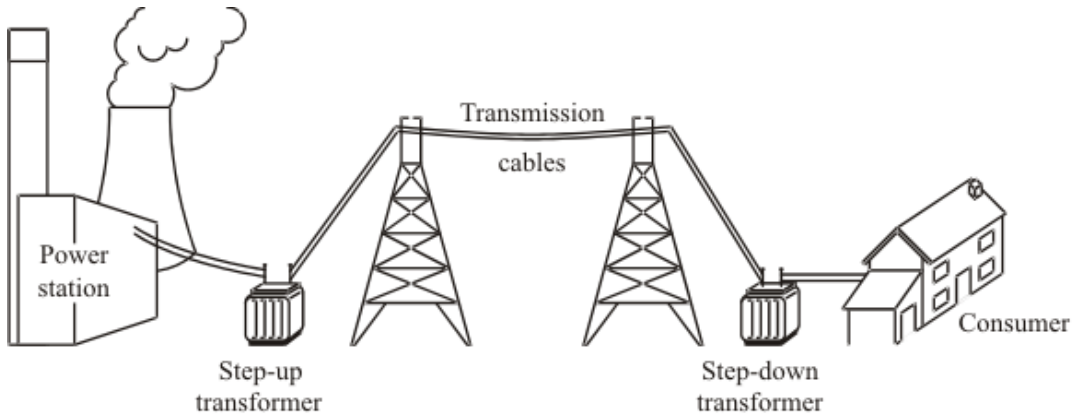
Disadvantage .....

.....

(2)

(Total 8 marks)

**Q8.** The diagram shows how electricity is distributed from power stations to consumers.



(a) (i) What name is given to the network of cables and transformers that links power stations to consumers?

.....

(1)

(ii) What does a step-up transformer do?

.....

(1)

(iii) Explain why step-up transformers are used in the electricity distribution system.

.....

.....

.....

.....

(2)

(b) Most of the world's electricity is generated in power stations that burn fossil fuels.

State **one** environmental problem that burning fossil fuels produces.

.....

.....

(1)

- (c) Electricity can be generated using energy from the wind. A company wants to build a new wind farm. Not everyone thinks that this is a good idea.



- (i) What arguments could the company give to persuade people that a wind farm is a good idea?

.....  
.....  
.....  
.....

(2)

- (ii) What reasons may be given by the people who think that wind farms are **not** a good idea?

.....  
.....  
.....  
.....

(2)

(Total 9 marks)

M1. (a) B

*no mark for B - marks are for the explanation  
first two mark points can score even if A is chosen*

draught increases (the rate of) evaporation

*accept more evaporation happens*

*accept draught removes (evaporated) particles faster*

*do not accept answers in terms of particles gaining energy from  
the fan / draught*

1

evaporation has a cooling effect

*accept (average) kinetic energy of (remaining) particles decreases*

1

so temperature will fall faster / further

1

(b) larger surface area

1

increasing the (rate of) evaporation

*accept more / faster evaporation*

*accept easier for particles to evaporate*

**or**

for water to evaporate from

*accept more particles can evaporate*

*accept water / particles which have evaporated are trapped  
(in the bag)*

*answers in terms of exposure to the Sun are insufficient*

1

[5]

M2. (a) £15

*allow 1 mark for use of 125 (kWh)*

*allow 1 mark for an answer 1500*

*allow both marks for 1500 pence / p*

*allow 1 mark for correct calculation of annual cost for either freezer  
(£27 and £42)*

2

(b) £45

**or** their (a)  $\times 3$

*allow 1 mark for correct use of 3*

*allow 1 mark for  $12 - 9 = 3$*

2

- (c) any two from:  
*the marks are for the explanation*

yes **plus** explanation

- less electricity / energy needed / used  
*accept less energy wasted*
- less (fossil) fuels burned  
*accept a named fossil fuel*  
*do **not** accept conserving (fossil) fuels*
- less polluting gases emitted  
*accept a named polluting gas / greenhouse gases / carbon emissions / reduce global warming*  
*accept an answer in terms of nuclear fuel*  
*eg less nuclear fuel required (1)*  
*less nuclear waste (1)*

2

or no plus explanation

- old freezer must be disposed of
- hazardous chemicals inside freezer  
*accept CFC gases*
- (lot of) energy used in producing new freezer

[6]

**M3.** (a) (i) radiation

1

- (ii) traps (small pockets of) air  
*do **not** accept it's an insulator*  
*do **not** accept reduces conduction and / or convection*  
*do **not** allow it doesn't allow heat to escape*

1

- (b) (i) bigger temperature difference (between the water and surroundings)  
at the start (than at the end)  
*do **not** accept water is hotter*

1

- (ii) starting temperature (of the water)  
*accept thickness of fleece*  
*do **not** accept same amount of fleece*  
*do **not** accept thermometer / can*  
*do **not** accept time is the same*

1

(iii) 18 (°C)

*correct answer only*

1

(iv) **M**

1

smallest temperature drop (after 20 mins)

*cannot score if **M** is not chosen*

*accept it's the best insulator*

*accept smallest loss in heat*

*accept keeps heat / warmth in for longer*

1

[7]

**M4.** (a) advantage

any **one** from:

- produce no / little greenhouse gases / carbon dioxide  
*allow produces no / little polluting gases*  
*allow doesn't contribute to global warming / climate change*  
*allow produce no acid rain / sulphur dioxide*  
*reference to atmospheric pollution is insufficient*  
*produce no harmful gases is insufficient*
- high(er) energy density in fuel  
*accept one nuclear power station produces as much power as several gas power stations*  
*nuclear power stations can supply a lot of or more energy is insufficient*
- long(er) operating life  
*allow saves using reserves of fossil fuels or gas*

1

disadvantage

any **one** from:

- produce (long term) radioactive waste  
*accept waste is toxic*  
*accept nuclear for radioactive*
- accidents at nuclear power stations may have far reaching or long term consequences
- high(er) decommissioning costs  
*accept high(er) building costs*
- long(er) start up time

1

- (b) (i) 12 000 (kWh)  
*allow 1 mark for correct substitution eg*  
 $2000 \times 6$   
**or**  
 $2\,000\,000 \times 6$   
**or**  

$$\frac{12\,000\,000}{1000}$$

*an answer of 12 000 000 scores 1 mark*

2

- (ii) any idea of unreliability, eg
- wind is unreliable  
*reference to weather alone is insufficient*
  - shut down if wind too strong / weak
  - wind is variable

1

- (c) any **one** from:
- cannot be seen
  - no hazard to (low flying) aircraft / helicopters
  - unlikely to be or not damaged / affected by (severe) weather  
*unlikely to be damaged is insufficient*
  - (normally) no / reduced shock hazard  
*safer is insufficient*  
*less maintenance is insufficient*  
*installed in urban areas is insufficient*

1

[6]

**M5.** (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]

- M6.** (a) (water) particles / molecules gain energy / move faster  
*accept atoms for molecules*  
*ignore move more*  
*do **not** accept move with a bigger amplitude / vibrate more* 1
- and (the particles / molecules) move apart 1
- this causes the water to become less dense  
*accept water expands*  
*ignore particles become less dense* 1
- and the warm / hot water rises (through the tank)  
*accept (more energetic water) particles rise to the top*  
*ignore heat rises* 1
- (b) conduction 1
- (c) (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  $4\,032\,000 = m \times 4200 \times 8$   
 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

[13]

**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) (i) national grid

1

(ii) increases voltage / potential difference

*accept decrease current*

*accept step-up / boosts the voltage*

*do **not** accept increases energy / power / current*

*ignore reference to voltage going through*

1

(iii) any **two** from:

- reduce current  
*ignore increased voltage / pd*
- reduces energy loss / power loss (from cables)  
*accept reduces heat loss*  
*do **not** accept stops energy loss*
- increases efficiency (of distribution)

2

(b) any **one** from:

- produces pollutant gases  
*accept produces carbon dioxide / sulfur dioxide / nitrogen oxides*  
*accept global warming / greenhouse effect / carbon emissions / air pollution / acid rain*  
*ignore ozone layer*  
*do **not** accept carbon monoxide*
- produces solid waste / ash / smoke  
*accept global dimming*  
*ignore produces pollution*

1

(c) (i) any **two** from:

*any two valid points gains the marks*

- using renewable energy  
*accept don't use up non-renewable / fossil fuels*  
*accept named fuels*
- non-renewable fuels can be used for other processes
- no pollutant gases produced  
*accept the opposite of (b)*  
*ignore no pollution*
- land can still be used for farming  
*ignore economic issues*

2

(ii) any **two** from:

- cause noise pollution
- cause visual pollution  
*accept spoils the landscape*  
*accept sunlight flicker*
- may interfere with TV / radio / mobile phone signals
- need to put in new infrastructure  
*accept new roads needed*
- not reliable owtte
- dangerous to birds
- lots of concrete needed for the bases  
**or**  
producing cement is environmentally damaging  
*accept reduces house prices*  
*ignore any references to cost / jobs / number required*  
*ignore takes up a lot of land*  
*accept reference to obstruction of shipping etc. if clear reference*  
*to offshore wind farm*

2

[9]

