1 Water molecules evaporate from a puddle and escape to the atmosphere. Water molecules also escape to the atmosphere from water boiling in a kettle.

(a) State two ways in which *evaporation* differs from *boiling*.

1. .....

.....

2. .....

.....

[2]

(b) This part of the question is about an experiment to determine the specific latent heat of vaporisation of water.

(i) Suggest apparatus that will provide thermal energy (heat) and state the readings needed to determine the amount of thermal energy provided.

apparatus .....

.....

readings .....

.....

.....

[2]

(ii) Suggest apparatus required for determining the mass of liquid vaporised and state the readings needed to determine that mass.

apparatus .....

.....

readings .....

.....

.....

[2]

[Total: 6]

2 Fig. 5.1 shows a saucepan of boiling water on an electric hotplate.

Fig. 5.1

As time passes, thermal energy (heat) is constantly supplied to the water but its temperature remains at 100 °C.

(a) State two ways in which boiling differs from evaporation.

1. .....

.....

2. .....

.....

[2]

(b) Explain, in terms of the water molecules, what happens to the thermal energy supplied to the water as it boils.

.....

.....

.....

..... [2]

(c) Describe an experiment to measure the specific latent heat of steam. You may include a diagram.

.....

.....

.....

.....

.....

..... [4]

[Total: 8]

3 **(a)** State the energy changes that take place when

(i) a cyclist rides down a hill without pedalling,

.....

.....

(ii) a cyclist pedals up a hill at a constant speed.

.....

.....

[3]

(b) A car of mass 940 kg is travelling at 16 m/s.

(i) Calculate the kinetic energy of the car.

kinetic energy = ... [2]

(ii) The car is brought to rest by applying the brakes.

The total mass of the brakes is 4.5 kg. The average specific heat capacity of the brake material is 520 J/(kg °C).

Calculate the rise in temperature of the brakes. Assume there is no loss of thermal energy from the brakes.

rise in temperature = ... [3]

[Total: 8]

4 **(a)** Four identical metal plates, at the same temperature, are laid side by side on the ground. The rays from the Sun fall on the plates.

One plate has a matt black surface.

One plate has a shiny black surface.

One plate has a matt silver surface.

One plate has a shiny silver surface.

State which plate has the fastest-rising temperature when the sunlight first falls on the plates.

..... [1]

(b) The apparatus shown in Fig. 4.1 is known as Leslie's Differential Air Thermometer.

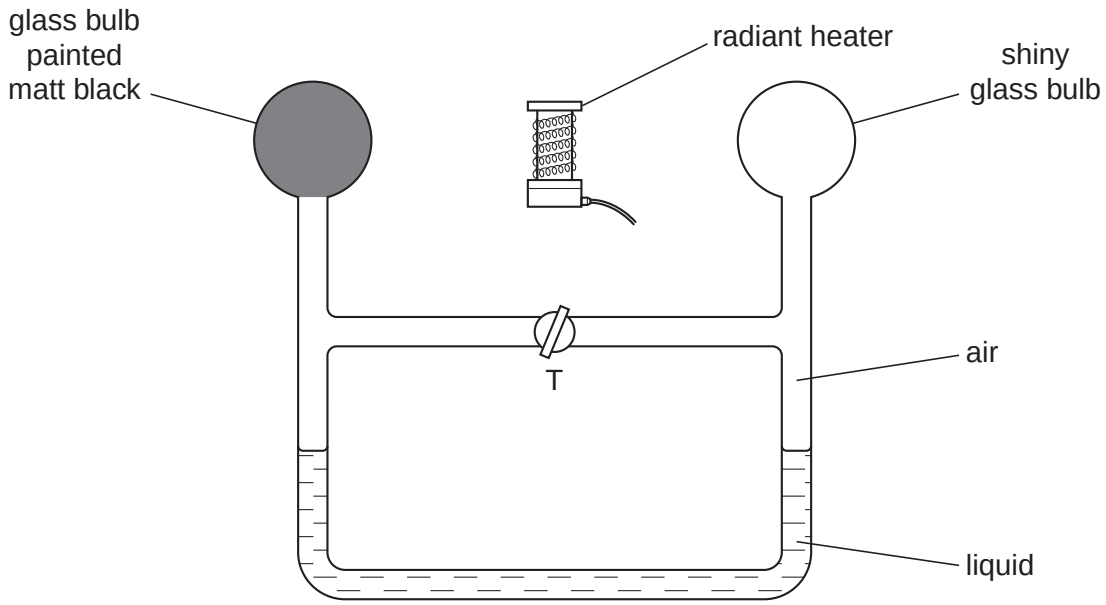

Fig. 4.1

The heater is switched off. Tap T is opened so that the air on the two sides of T has the same pressure. Tap T is then closed.

(i) The heater is switched on. On Fig. 4.1, mark clearly where the two liquid levels might be a short time later. [1]

(ii) Explain your answer to **(b)(i)**.

.....

.....

..... [2]

[Total: 4]

5 A solar panel is mounted on the roof of a house. Fig. 4.1 shows a section through part of the solar panel.

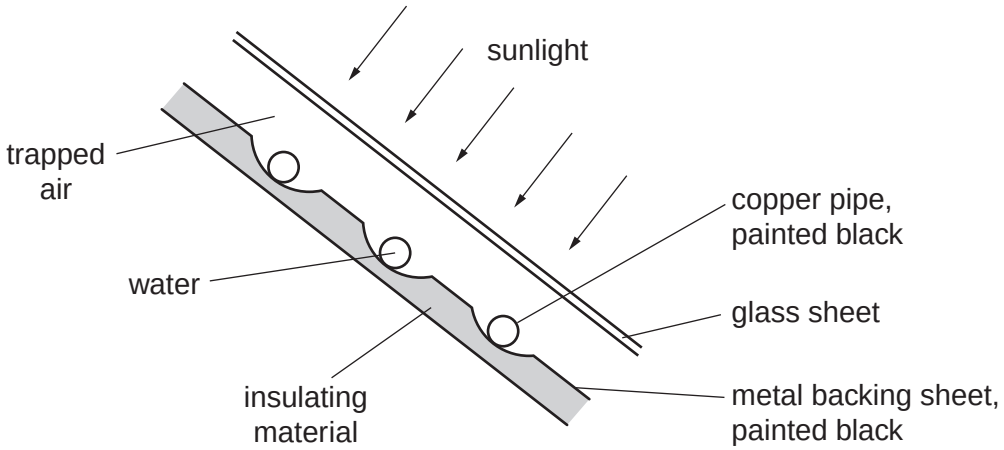

Fig. 4.1

A pump makes water circulate through the copper pipes. The water is heated by passing through the solar panel.

(a) Suggest why

(i) the pipes are made of copper,

.....

..... [1]

(ii) the pipes and the metal backing sheet are painted black,

.....

..... [1]

(iii) an insulating material is attached to the metal backing sheet,

.....

..... [1]

(iv) the presence of the glass sheet increases the energy collected by the water.

.....

..... [1]

(b) During one day, 250 kg of water is pumped through the solar panel. The temperature of this water rises from 16 °C to 38 °C.

The water absorbs 25% of the energy falling on the solar panel, and the specific heat capacity of water is 4200 J/(kg °C).

Calculate the energy falling on the solar panel during that day.

energy = ... [4]

[Total: 8]

6 **(a)** Some water is poured onto a plastic table-top, forming a puddle. The same volume of water is poured into a plastic dish, which is placed alongside the puddle. This is illustrated in Fig. 7.1.

Fig. 7.1

Both lots of water begin to evaporate.

(i) In terms of the behaviour of molecules, describe what happens during the process of evaporation.

.....

.....

.....

..... [2]

(ii) Explain why the puddle dries out more rapidly than the water in the dish.

.....

.....

.....

..... [2]

(iii) State two changes that would make both lots of water evaporate more rapidly.

1. .....

2. ..... [2]

(b) In a place where refrigeration is not possible, a person attempts to keep a bottle of milk cool by using the procedure illustrated in Fig. 7.2.

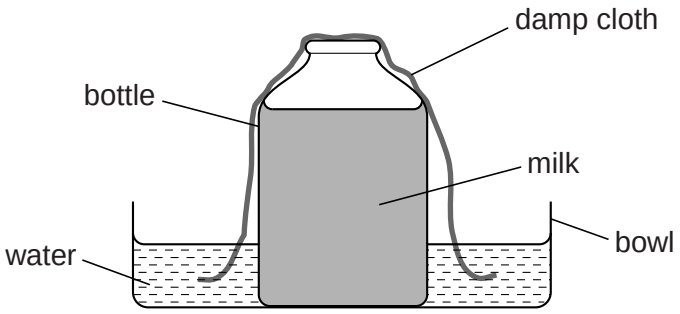

Fig. 7.2

Explain in terms of molecules why this procedure would be successful.

.....

.....

..... [3]

[Total: 9]

7 Fig. 4.1 shows a sealed steel cylinder filled with high pressure steam.

Fig. 4.1

Fig. 4.2 shows the same cylinder much later when all the steam has condensed.

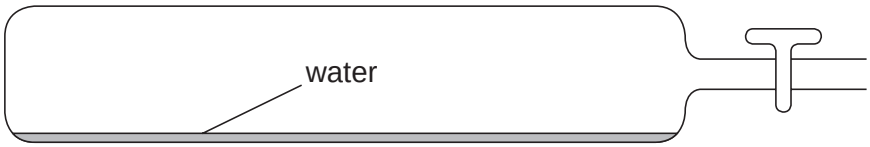

Fig. 4.2

(a) (i) Describe the movement of the molecules in the high pressure steam.

.....

.....

..... [2]

(ii) Explain how the molecules in the steam exert a high pressure on the inside walls of the cylinder.

.....

.....

..... [2]

(b) Describe, in terms of particles, the process by which heat is transferred through the cylinder wall.

.....

.....

..... [2]

(c) When all the steam has condensed, 75 g of water is in the cylinder.

Under these high pressure conditions, the specific latent heat of vaporisation of steam is 3200 J / g.

Calculate the heat lost by the steam as it condenses.

heat = ... [2]

[Total: 8]

8 **(a)** Two identical open boxes originally contain the same volume of water.
One is kept at 15 °C and the other at 85 °C for the same length of time.

Fig. 4.1 shows the final water levels.

Fig. 4.1

With reference to the energies of the water molecules, explain why the levels are different.

.....

.....

.....

.....[3]

(b) In an experiment to find the specific latent heat of vaporisation of water, it took 34 500 J of energy to evaporate 15 g of water that was originally at 100 °C.

A second experiment showed that 600 J of energy was lost to the atmosphere from the apparatus during the time it took to evaporate 15 g of water.

Calculate the specific latent heat of vaporisation of water that would be obtained from this experiment.

specific latent heat = ……[3]

[Total : 6]