1 **(a)** Explain

(i) how gas molecules exert a force on a solid surface,

.....

.....

..... [1]

(ii) the increase in pressure of a gas when its volume is decreased at constant temperature.

.....

.....

.....

..... [3]

(b) A cylinder of volume $5.0 \times 10^3\,cm^3$ contains air at a pressure of 8.0×10^5 Pa.

A leak develops so that air gradually escapes from the cylinder until the air in the cylinder is at atmospheric pressure. The pressure of the atmosphere is 1.0×10^5 Pa.

Calculate the volume of the escaped air, now at atmospheric pressure. Assume that the temperature stays constant.

volume = ...cm^3 [4]

[Total: 8]

2 **(a)** Fig. 4.1 shows some gas contained in a cylinder by a heavy piston. The piston can move up and down in the cylinder with negligible friction.

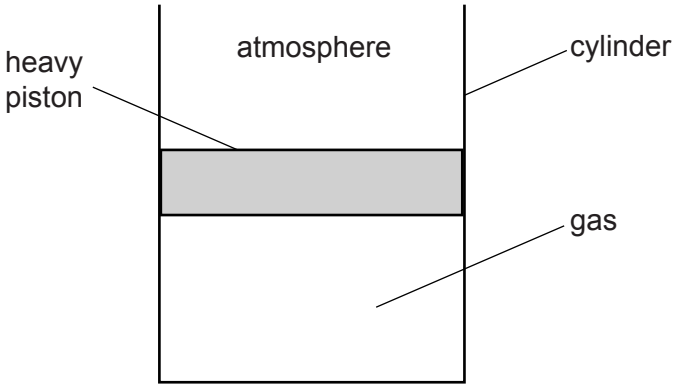

Fig. 4.1

There is a small increase in the pressure of the atmosphere above the piston.

(i) On Fig. 4.1, draw a possible new position for the lower face of the piston. [1]

(ii) Explain, in terms of the molecules of the gas and the molecules of the atmosphere, your answer to **(a)(i)**.

.....

.....

.....

.....

.....

..... [3]

(b) The pressure of the atmosphere above the piston returns to its original value, and the piston returns to its original position, as shown in Fig. 4.2.

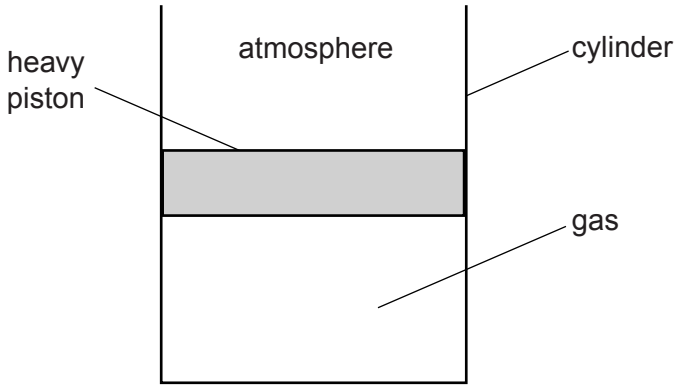

Fig. 4.2

The gas, piston and cylinder are now heated to a much higher temperature.

(i) On Fig. 4.2, draw a possible new position for the lower face of the piston. [1]

(ii) Explain, in terms of the molecules of the gas and the molecules of the atmosphere, your answer to **(b)(i)**.

.....

.....

.....

.....

..... [2]

[Total: 7]

3 Fig. 5.1 shows a gas contained in a cylinder enclosed by a piston.

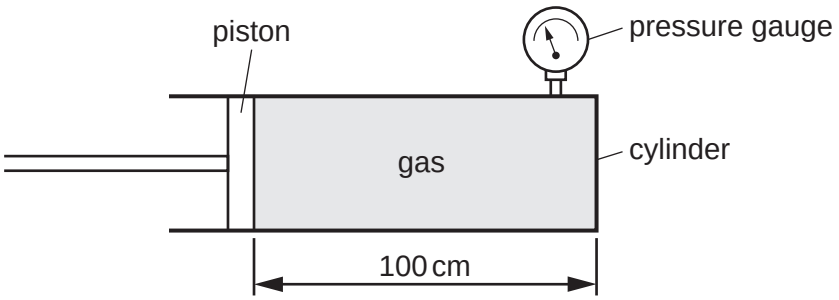

Fig. 5.1

At first, the length of cylinder containing the gas is 100 cm. The pressure of the gas, shown by the pressure gauge, is 300 kPa. The area of cross-section of the cylinder is 0.12 m^2.

(a) (i) Describe the motion of the molecules of the gas.

.....

.....

.....[1]

(ii) Explain how the molecules exert a force on the walls of the cylinder.

.....

.....[1]

(iii) Calculate the force exerted by the gas on the piston.

force = ...[2]

(b) The piston is moved so that the new length of cylinder occupied by the gas is 50 cm. The temperature of the gas is unchanged.

(i) Calculate the new pressure of the gas.

pressure = ...[2]

(ii) Explain, in terms of the behaviour of the molecules, why the pressure has changed.

.....

.....

.....[1]

[Total: 7]

4 A sealed balloon containing some helium gas is released and rises into the upper atmosphere. As the balloon rises the temperature of the helium falls and the balloon expands.

Explain, in terms of atoms,

(a) the effect of the fall in temperature on the helium pressure,

.....

.....

.....

.....

..... [3]

(b) the effect of the expansion of the balloon on the helium pressure.

.....

.....

.....

.....

..... [3]

[Total: 6]

5 **(a)** Fig. 3.1 represents the path taken in air by a smoke particle, as seen in a Brownian motion experiment. The smoke particles can be seen through a microscope, but the air molecules cannot.

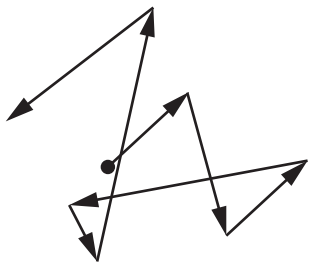

Fig. 3.1

(i) State what causes the smoke particles to move like this.

.....

..... [1]

(ii) What conclusions about air molecules can be drawn from this observation of the smoke particles?

.....

.....

.....

.....

..... [2]

(b) A can, containing only air, has its lid tightly screwed on and is left in strong sunlight.

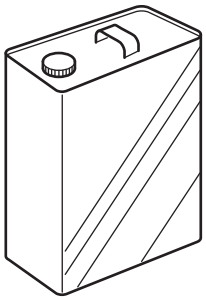

Fig. 3.2

(i) State what happens to the pressure of the air in the can when it gets hot.

..... [1]

(ii) In terms of molecules, explain your answer to **(b)(i)**.

.....

.....

.....

..... [3]

[Total: 7]

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.

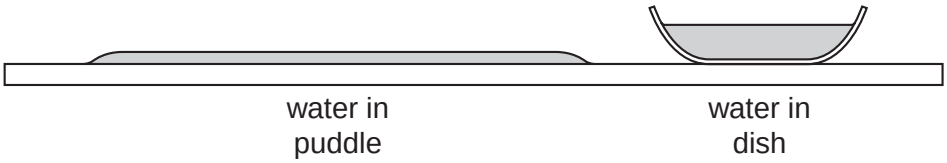

Fig. 7.1

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.

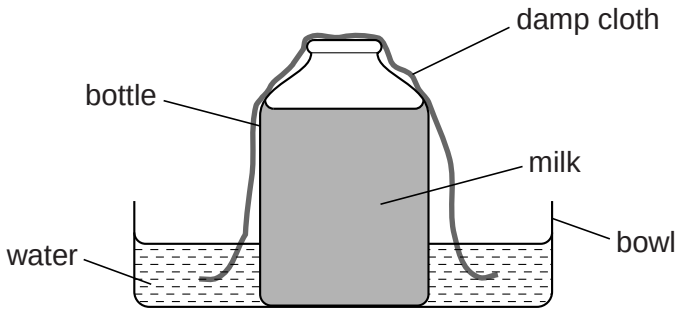

Fig. 7.2

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

.....

.....

..... [3]

[Total: 9]