1 **(a)** In the space below, draw a simple labelled diagram of the apparatus used to demonstrate Brownian motion.

[2]

(b) State what is observed.

....

....

....[2]

(c) Explain what is observed in terms of molecules.

....

....

....

....[2]

[Total: 6]

2 Fig. 6.1 shows a quantity of gas in a cylinder fitted with a piston P.

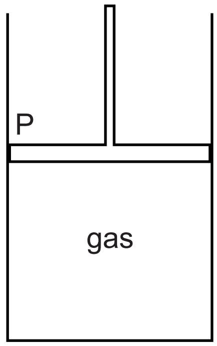


Fig. 6.1

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

....

....

....

....

.... [3]

(b) The piston is now slowly pushed down to decrease the volume of the gas. The temperature of the gas does not change.

(i) State and explain, in terms of molecules, what happens to the pressure of the gas.

....

....

.... [2]

(ii) Before pushing the piston down, the pressure of the gas was 1.0×10^5 Pa. Pushing the piston down reduces the volume of the gas from 500 cm^3 to 240 cm^3.

Calculate the final pressure of the gas.

pressure = ... [2]

[Total: 7]

3 **(a)** Puddles of water form on a path after rainfall on a windy day.

In terms of molecules, state and explain how the rate of evaporation of the puddles is affected by

(i) a reduction of wind speed,

....

....

....

.... [2]

(ii) an increase of water temperature.

....

....

....

.... [2]

(b) Fig. 5.1 shows two puddles.

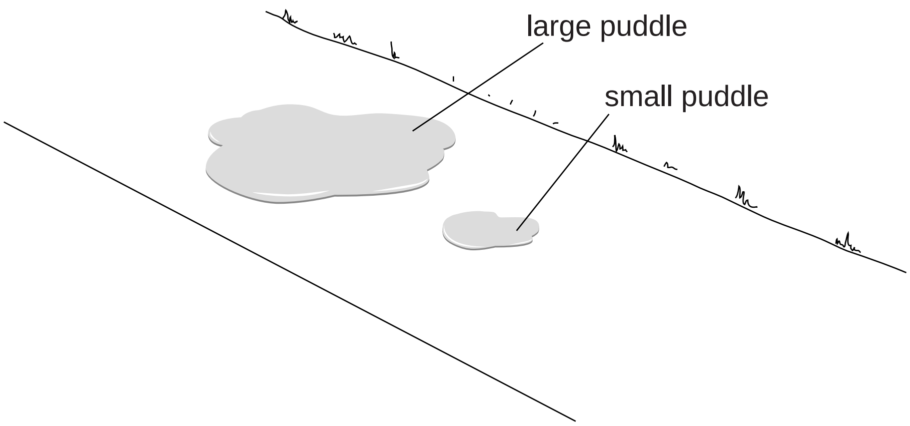


Fig. 5.1

State and explain how the rate of evaporation from the large puddle compares to that from the small puddle under the same conditions.

....

....

....

.... [2]

(c) Describe an experiment to demonstrate the difference between good and bad emitters of infra-red radiation. You may include a diagram to help your description. State what readings should be taken.

....

....

....

....

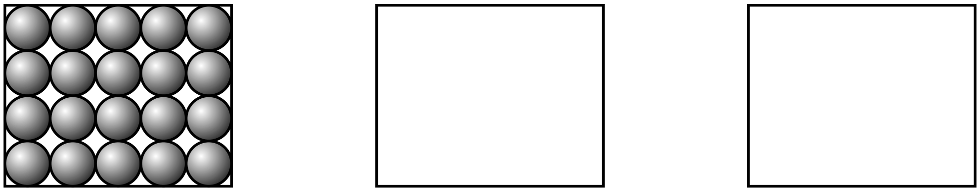
....

....[3]

[Total: 9]

4 A teacher shows a class examples of three states of matter. These are a solid metal block resting on the bench, a liquid in a glass beaker and a gas in a clear balloon in the laboratory.

Fig. 4.1a represents the arrangement of molecules in the solid.



solid | liquid | gas

Fig. 4.1a **Fig. 4.1b** **Fig. 4.1c**

(a) (i) Complete Fig. 4.1b, to show the arrangement of molecules in the liquid.

(ii) Complete Fig. 4.1c, to show the arrangement of molecules in the gas.

[3]

(b) (i) In the list below, draw a ring around the state of matter that is the easiest to compress.

the solid **t**

[1]

(ii) In terms of its molecules, explain why this state of matter is the easiest to compress.

....

....

.... [2]

[Total: 6]

5 A small cylinder of compressed helium gas is used to inflate balloons for a celebration.

(a) **(i)** In the box below, sketch a diagram to represent the arrangement of helium molecules in a balloon.

[2]

(ii) State and explain how the size of the attractive forces acting between the molecules of a gas compares with the size of the attractive forces between the molecules of a solid.

....

....

....[2]

(b) The helium in the cylinder has a volume of $6.0 \times 10^{-3}\,m^3$ ($0.0060\,m^3$) and is at a pressure of $2.75 \times 10^6\,Pa$.

(i) The pressure of helium in each balloon is $1.1 \times 10^5\,Pa$. The volume of helium in an inflated balloon is 3.0×10^{-3} ($0.0030\,m^3$). The temperature of the helium does not change.

Calculate the number of balloons that were inflated.

number of balloons = ...[3]

(ii) Later, the temperature increases and some of the balloons burst.

Suggest and explain why this happens.

....

....

....[2]

[Total: 9]

6 **(a)** In the box below, sketch a diagram to represent the molecular structure of a liquid. Show the molecules as small circles of equal size.

[2]

(b) A teacher in a school laboratory pours liquid ethanol from a bottle into a glass dish. The glass dish rests on an electronic balance. Although the temperature of the laboratory is below the boiling point of ethanol, the mass of ethanol in the dish quickly decreases as ethanol evaporates.

(i) State the effect of this evaporation on the temperature of the remaining ethanol.

.... [1]

(ii) Explain, in terms of the ethanol molecules, why this is happening.

....

.... [1]

(iii) The specific latent heat of vaporisation of ethanol is 850 J / g.

Calculate the thermal energy required to evaporate 3.4 g of ethanol.

thermal energy = ... [2]

(iv) Suggest **two** ways in which the rate of evaporation of ethanol from the dish can be reduced.

1. ....

2. ....

[2]

[Total: 8]

7 **(a)** Fig. 4.1 shows a syringe containing 100 cm^3 of air at atmospheric pressure. Atmospheric pressure is 1.0×10^5 Pa.

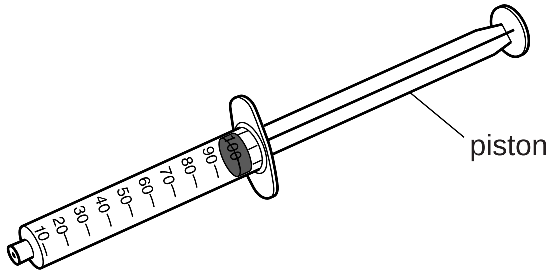


Fig. 4.1

The open end of the syringe is sealed and the piston is pushed inwards until the air occupies a volume of 40 cm^3. The temperature of the air remains constant.

Calculate the new pressure of the air in the syringe.

air pressure = ... [2]

(b) A syringe is used to transfer smokey air from above a flame to a small glass container.

Extremely small solid smoke particles are suspended in the air in the container.

The container is brightly illuminated from the side and viewed through a microscope.

(i) The movement of the suspended smoke particles is called Brownian motion. Describe this Brownian motion.

....

....

....[2]

(ii) Explain what causes the motion of the smoke particles.

....

....

....[2]

(c) In the space below, sketch a diagram to represent the molecular structure of a solid. Show the molecules as small circles of equal sizes.

[2]

[Total: 8]