Kinetic Particle Model of Matter

Question Paper

Course	CIE IGCSE Physics
Section	2. Thermal Physics
Topic	Kinetic Particle Model of Matter
Difficulty	Medium

Time Allowed 60

Score /42

Percentage /100

Question 1

Fig. 5.1 shows the apparatus used to observe the motion of smoke particles that are in the air in a box.

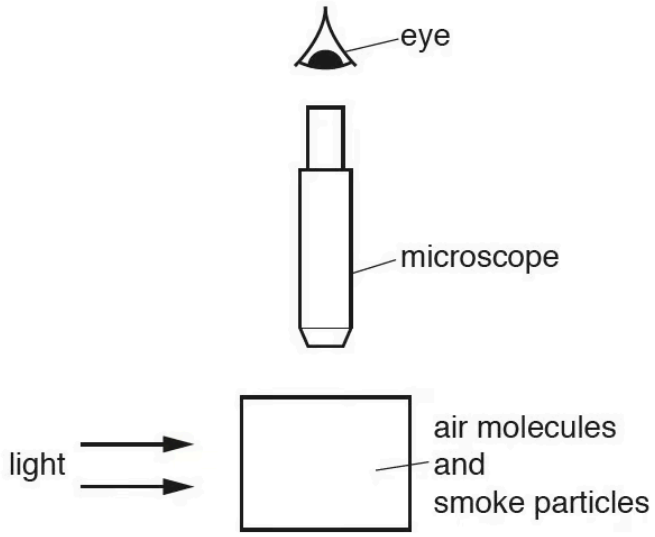
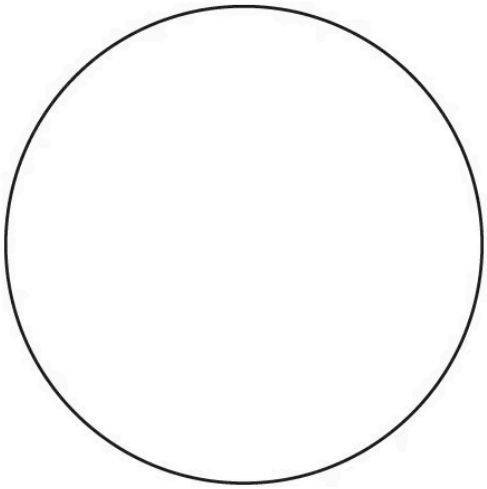


Fig. 5.1

Light from a lamp enters the box through a window in one side of the box. The smoke particles are observed using a microscope fixed above a window in the top of the box.

(i) The motion of a single smoke particle is observed through the microscope.

In the circle shown, sketch the path of this smoke particle.



[1]

(ii) Explain why the smoke particle follows the path that is observed.

[3]

[4 marks]

Question 2a

Fig. 4.1 shows a smoke cell. The cell contains smoke particles and air molecules. It is lit from the side. A student views the motion of smoke particles in the cell by using a microscope.

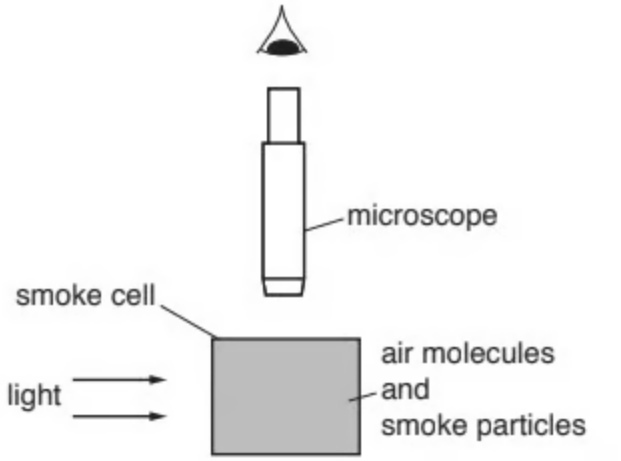


Fig. 4.1

Describe and explain what the student sees when viewing the smoke particles through the microscope.

[4 marks]

Question 2b

Drops of water on a warm surface disappear after a short time. State the term used to describe this process. Explain the process, using your ideas about molecules.

name of process: .....

explanation: .....

[3 marks]

Question 3a

Some gas molecules are in a box at room temperature.

Fig. 3.1 shows the position of some of the molecules and the direction of movement of each molecule.

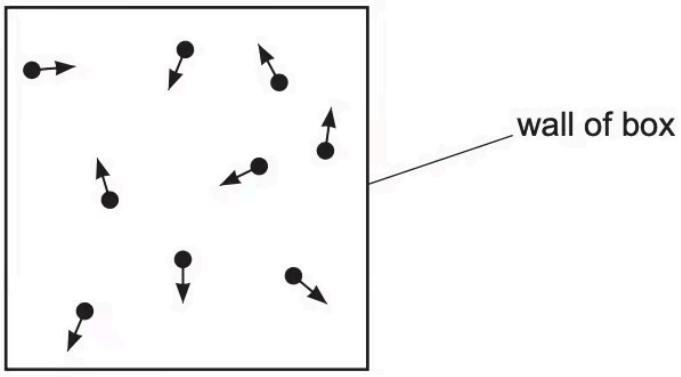


Fig. 3.1

(i) Describe the movement of the gas molecules.

[2]

(ii) Describe how the molecules exert a pressure on the walls of the box.

[2]

[4 marks]

Question 3b

The gas in Fig. 3.1 is cooled. The gas turns into a liquid then into a solid.

State how the average separation of molecules in the gas is different from the average separation of molecules in the solid.

[1 mark]

Question 4a

Describe the movement of the molecules in

(i) a solid.

[1]

(i) a gas.

[2]

[3 marks]

Question 4b

Extended

A closed box contains gas molecules.

Explain, in terms of momentum, how the molecules exert a pressure on the walls of the box.

[4 marks]

Question 5a

Fig. 5.1 shows a metal can containing air. The can is sealed with a lid.

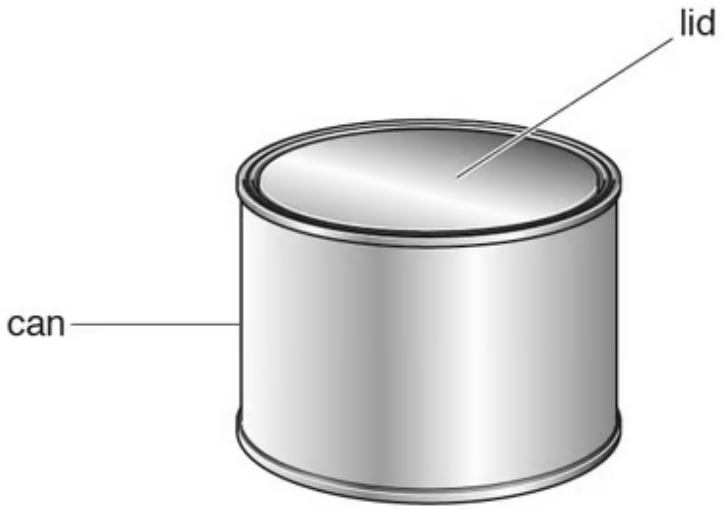


Fig. 5.1

The air in the can exerts a pressure of 20 000 N/m^2 on the lid. The area of the can lid is 0.09 m^2.

Calculate the force on the lid due to the air in the can.

force = ... N

[3 marks]

Question 5b

The air in the can becomes warmer.

State and explain what happens to the pressure of the air in the can. Use your ideas about gas molecules.

[3 marks]

Question 6a

Fig. 4.1 represents an atom.

Fig. 4.1

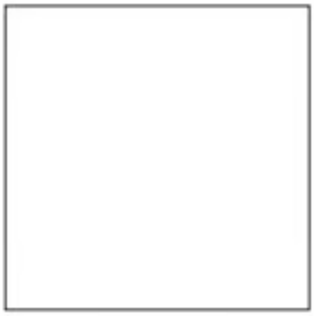
Representing atoms by circles approximately the same size as in Fig. 4.1, sketch

(i) on Fig. 4.2, the arrangement of atoms in a crystalline solid,

[1]

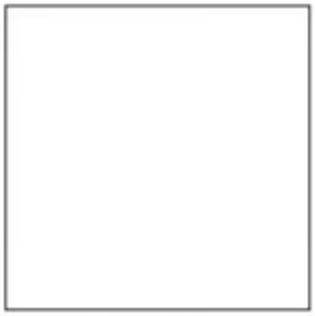
(ii) on Fig. 4.3, the arrangement of atoms in a gas.

[1]



solid

Fig. 4.2



gas

Fig. 4.3

[2 marks]

Question 6b

Extended

(i) Describe the motion of the atoms in a solid.

[1]

(ii) A sculptor makes a statue from a block of crystalline rock using a cutting tool. Explain why he must apply a large force to the tool to remove a small piece of rock.

[2]

[3 marks]

Question 6c

A helium-filled balloon in the room of a house suddenly bursts.

State and explain, in terms of atoms, what happens to the helium from the balloon after the balloon has burst.

[2 marks]

Question 7a

Match each description with the correct state of matter in Table 4.1.

Write the correct letter in Table 4.1.

A – Molecules move around freely and are far apart from each other.

B – Molecules vibrate about fixed positions.

C – Molecules move around randomly and are close to each other.

Table 4.1

state of matter	description
solids	
liquids	
gases	

[3 marks]

Question 7b

Some students heat water in a beaker. They measure the temperature every minute. They heat the water for 8 minutes until it boils, and then continue to heat it for a further 5 minutes.

Describe and explain how the temperature of the water changes during the 13 minutes.

[3 marks]