02 Kinetic Particle Theory

Set A Foundations

Name	Time 1 hour	Total 33 marks	Score ____ / 33

A From the lesson

10 MARKS

1 Which statement about the particles in a liquid is correct?

A They are packed in an orderly pattern and only vibrate.

B They are close together and slide past one another.

C They are far apart and move quickly in all directions.

D They are far apart and attract one another strongly.

/1

Answer ☐ [1]

Source: Learners' Alley, Kinetic Particle Theory slides

2 Which change of state releases energy to the surroundings?

A melting **B** boiling **C** condensation **D** sublimation

/1

Answer ☐ [1]

Source: Learners' Alley, Kinetic Particle Theory slides

3 Why can a gas be compressed, but a liquid cannot?

A The particles of a gas are lighter than those of a liquid.

B The particles of a gas are far apart, with a lot of empty space between them.

C The particles of a gas move faster than those of a liquid.

D The forces of attraction between gas particles are stronger.

/1

Answer ☐ [1]

Source: Learners' Alley, Kinetic Particle Theory slides

4 A bottle of perfume is opened at one side of a room. Which statement explains why a person on the other side soon smells it?

A Perfume particles are heavier than air and sink to the floor.

B Perfume particles move randomly and spread from a higher to a lower concentration.

C Perfume particles stop moving once they leave the bottle.

D Air in the room pushes the perfume particles across.

/1

Answer ☐ [1]

Source: Learners' Alley, Kinetic Particle Theory slides

5 State two differences between the particles in a solid and the particles in a gas.

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.....

..... **[2]**

/2

Source: Learners' Alley, Kinetic Particle Theory slides

6 A pure solid is heated steadily until it melts. The temperature stays the same while the solid is melting.

(a) Explain why the temperature does not rise during melting.

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..... **[2]**

(b) Explain, using the kinetic particle theory, why a solid expands when it is heated.

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..... **[2]**

/4

Source: Learners' Alley, Kinetic Particle Theory slides

B Practice

23 MARKS

7 "Particles moving very slowly from an area of higher concentration to an area of lower concentration." Which process is being described?

A a liquid freezing

B a solid melting

C a substance diffusing through a liquid

D a substance diffusing through a gas

Answer ☐ **[1]**

/1

Source: 2023 PLMGS Sec 3 End-of-Year P1 Q1

8 Which statement about evaporation and boiling is not true?

A Both evaporation and boiling involve the gain of energy by particles.

B Evaporation is a slow process while boiling is a rapid process.

C Evaporation occurs at the surface of the liquid while boiling occurs throughout the liquid.

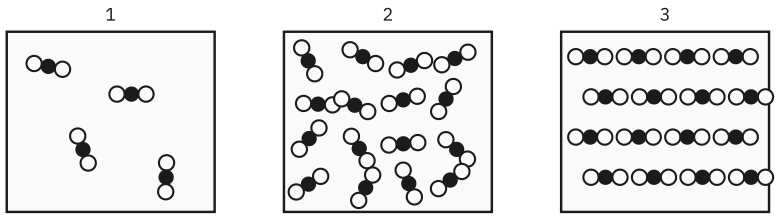
D Evaporation only occurs at room temperature, while boiling only occurs at the boiling point.

Answer ☐ **[1]**

/1

Source: 2026 XMS Sec 3 WA1 P1 Q2

9 Diagrams of the three states of matter for carbon dioxide are shown below. Which two diagrams show the states of matter before and after the sublimation of carbon dioxide?



A 2 to 1 **B** 3 to 1 **C** 2 to 3 **D** 3 to 2

/1

Answer [1]

Source: 2023 PLMGS Sec 3 End-of-Year P1 Q2

10 Substance L melts at −7 °C and is a brown liquid at room temperature (25 °C). Which value could be the boiling point of L?

A −77 °C **B** 0 °C **C** 7 °C **D** 59 °C

/1

Answer [1]

Source: 2023 XMS Sec 3 WA1 P1 Q3

11 Dry ice sublimes at −78 °C. Which statement describes what happens to dry ice at 0 °C?

A The carbon dioxide particles become closely packed.

B The carbon dioxide particles become far apart.

C The carbon dioxide particles become smaller.

D The carbon dioxide particles lose energy to the surroundings.

/1

Answer [1]

Source: 2024 SMSS Sec 3 End-of-Year P1 Q3

12 Air can be separated into different gases. The air is cooled in stages until it reaches −200 °C. The melting and boiling points of some gases in air are shown in the table.

gas	melting point / °C	boiling point / °C
nitrogen	−210	−196
oxygen	−219	−183
argon	−189	−186
carbon dioxide	sublimes at −79	

(a) Using the table, name two gases that will be in the solid state at −200 °C.

..... [1]

(b) In the box below, draw a particle diagram to represent nitrogen gas at −300 °C. Each particle can be shown as a circle.

[1]

(c) Describe, using the kinetic particle theory, the change in the movement and arrangement of oxygen particles as it is heated from −200 °C to −180 °C.

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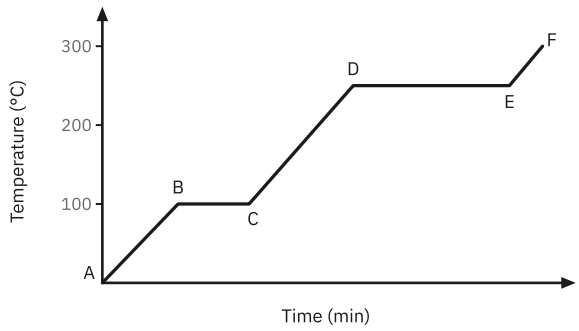
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..... **[2]**

/4

Source: 2026 XMS Sec 3 WA1 P2 Q7(a) to (c), adapted

13 The graph shows a heating curve of an unknown substance.



(a)

(i) What is the melting point of the unknown substance?

..... **[1]**

(ii) What is the boiling point of the unknown substance?

..... **[1]**

(b) Predict the physical state or states of the unknown substance when it is at the temperature of

(i) 50 °C:

..... **[1]**

(ii) 100 °C:

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[1]

(iii) 300 °C:

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[1]

(c) Using the kinetic particle theory, explain the process that is occurring in the region of DE.

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[4]

19

Source: 2020 XMS Sec 3 WA1 P2 B2

14 Fig. 1.1 shows an experimental set-up by a student to determine the rate of diffusion of gases. For this method to work, the gases must only diffuse through the diffusion plug. The time taken for 100 cm^3 of the different gases to diffuse through the diffusion plug is recorded in Table 1.2.

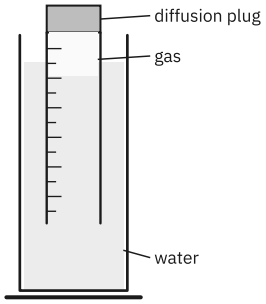


Fig. 1.1

gas	ammonia	argon	carbon monoxide	methane	nitrogen
relative molecular mass	17	40	28	16	28
time taken for 100 cm^3 of gas to diffuse / s	unable to determine	51	32	35	32

(a) The student made a mistake in the time taken for one of the gases. Identify the gas. Use the information in Table 1.2 to explain your reasoning.

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[2]

(b) Suggest why the rate of diffusion for ammonia cannot be determined.

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[1]

(c) In an industrial process, ammonia gas is condensed to the liquid state. Describe the arrangement and movement of ammonia in the liquid state.

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[2]

/5

Source: 2023 HYSS Sec 3 End-of-Year P2 Q1