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IGCSE PHYSICS 0625 · TOPICAL PAST PAPERS

Kinetic Particle Model of Matter

Paper 1 — Multiple-Choice Questions (topical compilation)

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2.1 Kinetic particle model of matter

PAPER 1

- 1 According to the kinetic theory, matter is made up of very small particles in a constant state of motion.

Which row best describes the particle behaviour in the liquid state?

	forces between particles	motion of particles
A	strong	move randomly at high speed
B	strong	vibrate but are free to move position
C	strong	vibrate to and fro around a fixed position
D	weak	move randomly at high speed

5054/11/M/J/11/Q15

- 2 A balloon filled with air is gently heated.

What happens to the mass and the density of the air inside the balloon?

	mass	density
A	decreases	decreases
B	decreases	stays the same
C	stays the same	decreases
D	stays the same	stays the same

5054/11/M/J/11/Q16

- 3 A gas is enclosed in a container of fixed volume. It gains heat energy from an external source.

What happens to the molecules of the gas?

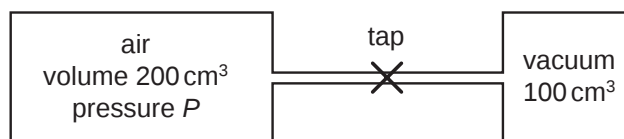
- A They expand.
- B They move faster inside the container.
- C They move further apart.
- D They vibrate with greater frequency.

5054/11/M/J/12/Q15

- 4 Two cylinders are connected by a thin pipe.

One cylinder has a volume of 200 cm^3 and contains air at pressure P .

The other cylinder has a volume of 100 cm^3 and contains a vacuum (no air).



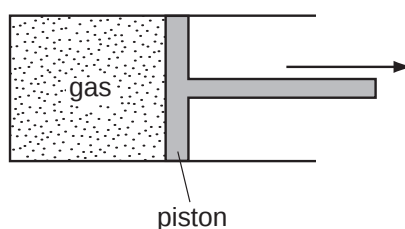
Initially, the tap is closed.

What is the final pressure of the air after the tap is opened?

- A $\frac{P}{2}$ B $\frac{2P}{3}$ C $\frac{3P}{2}$ D $2P$

5054/12/M/J/12/Q12

- 5 A fixed mass of gas is enclosed in a cylinder by a movable piston.



The piston is moved so that the volume occupied by the gas increases. The temperature remains constant.

What happens to the pressure of the gas and why does this happen?

	pressure	reason
A	decreases	the molecules move more slowly
B	decreases	the molecules collide with the piston less frequently
C	increases	the molecules move more quickly
D	increases	the molecules collide with the piston more frequently

5054/12/M/J/12/Q15

- 6 An airtight container holds a fixed mass of gas. Its pressure and volume are measured on four occasions when the temperature is 20°C .

The results are shown in the table. Three sets of readings are correct.

Which set of readings is **not** correct?

	pressure / kPa	volume / cm^3
A	120	36
B	100	48
C	80	60
D	60	80

5054/11/M/J/13/Q9

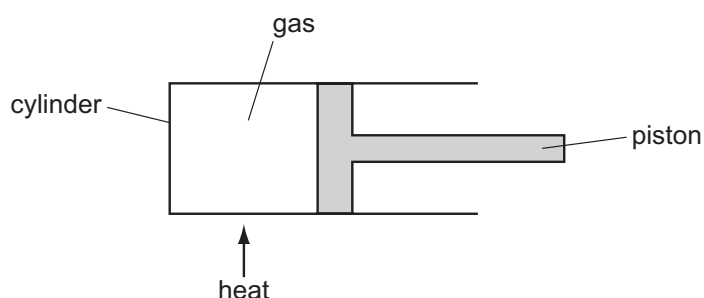
- 7 When a gas in a container of fixed volume is heated, the pressure of the gas increases.

Which statement explains this?

- A The molecules expand and get heavier, so they hit each other harder.
- B The molecules have less room to move, so they collide with each other more frequently.
- C The molecules hit the walls harder and less frequently.
- D The molecules move faster, so they collide with the walls more frequently.

5054/11/M/J/13/Q16

- 8 The diagram shows a fixed mass of gas in a cylinder fitted with a piston that can move easily.



What is the change, if any, in the pressure and volume of the gas after it is heated?

	pressure	volume
A	no change	increases
B	decreases	no change
C	decreases	increases
D	increases	decreases

5054/12/M/J/13/Q20

- 9 What happens to the molecules of a gas when the gas changes into a liquid?

- A** They move closer and lose energy.
- B** They move closer and gain energy.
- C** They move apart and lose energy.
- D** They move apart and gain energy.

5054/12/M/J/13/Q21

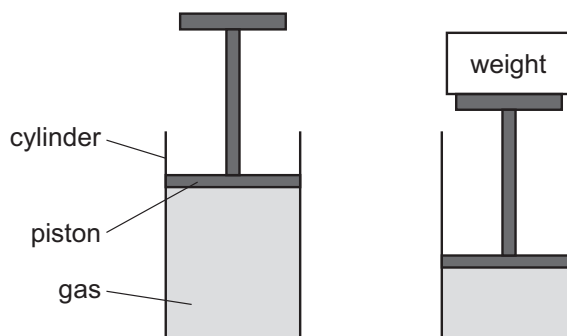
- 10 A gas occupies a volume of 2.0 m^3 in a cylinder at a pressure of 240 kPa . A piston compresses the gas until the volume is 0.50 m^3 , the temperature remaining constant.

What is the new pressure of the gas?

- A** 60 kPa **B** 240 kPa **C** 480 kPa **D** 960 kPa

5054/11/M/J/14/Q14

- 11 A piston is supported by gas trapped in a cylinder.



A weight is put on the piston. The volume of gas supporting the piston decreases but the temperature of the gas is unchanged.

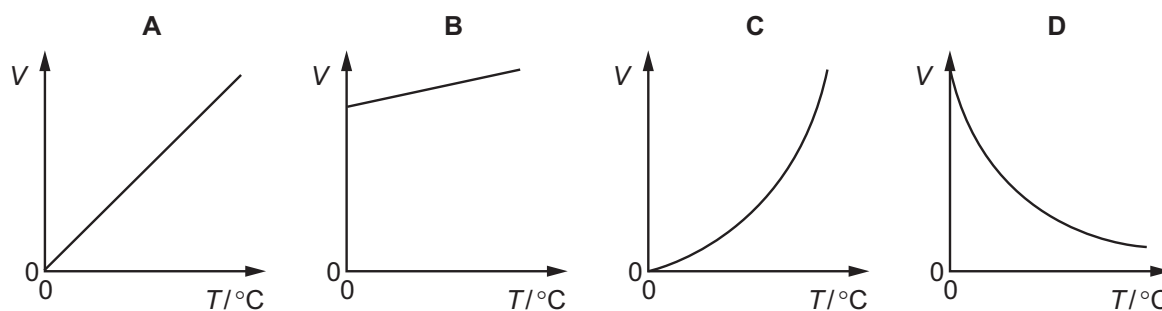
What happens to the molecules?

- A They hit the piston more frequently.
- B They move more slowly.
- C They have a smaller size.
- D They have more kinetic energy.

5054/11/M/J/14/Q18

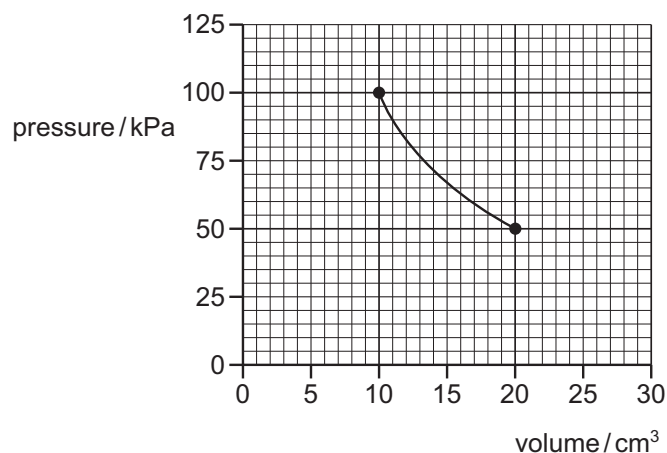
- 12 A fixed mass of gas in a syringe at 0°C is heated at constant pressure.

Which graph shows the variation of volume V with temperature T , measured in $^{\circ}\text{C}$?



5054/11/M/J/14/Q21

- 13 The graph shows how the pressure of a fixed mass of gas varies with volume at constant temperature.

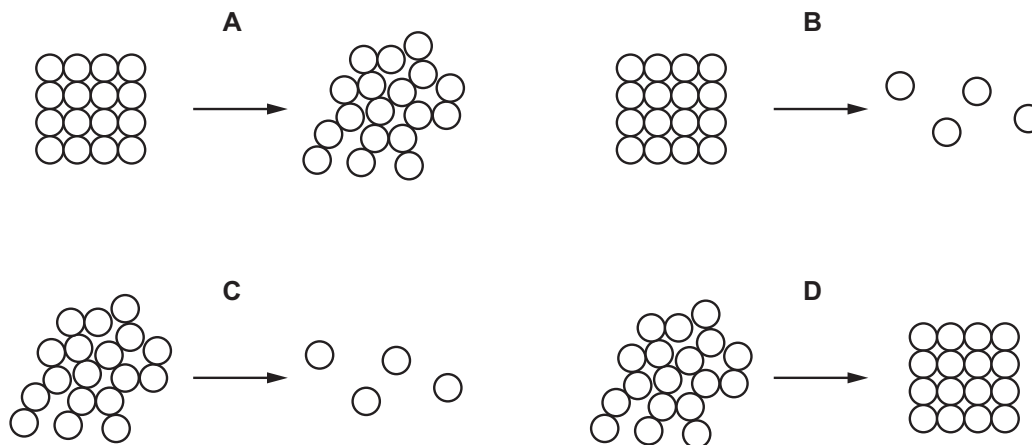


What is the volume of the gas when the pressure is 25 kPa?

- A** 2.5 cm³ **B** 10 cm³ **C** 30 cm³ **D** 40 cm³

5054/12/M/J/15/Q11

- 14 Which diagram represents the change in the arrangement of the molecules in a solid as the substance melts?



5054/12/M/J/15/Q19

- 15** Some gas is trapped in a closed container. The gas is cooled and the volume of the container is kept constant.

What happens to the gas molecules?

- A** They collide with the walls more often.
- B** They contract.
- C** They get closer together.
- D** They move more slowly.

5054/12/M/J/15/Q20

- 16** A gas in a container of fixed volume is heated.

What happens to the molecules of the gas?

- A** They collide less frequently.
- B** They expand.
- C** They move faster.
- D** They move further apart.

5054/11/M/J/16/Q17

- 17** Water of depth 10 m exerts a pressure equal to atmospheric pressure.

An air bubble rises to the surface of a lake which is 20 m deep. When the bubble reaches the surface, its volume is 6.0 cm^3 .

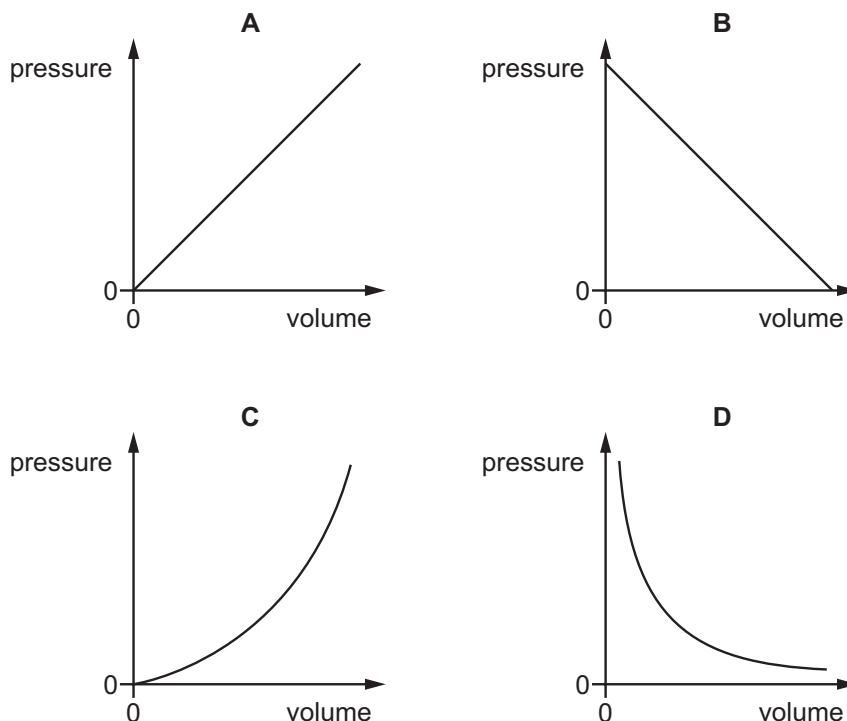
What is the volume of the air bubble at the bottom of the lake?

- A** 2.0 cm^3 **B** 3.0 cm^3 **C** 12 cm^3 **D** 18 cm^3

5054/12/M/J/16/Q12

- 18 A fixed mass of gas undergoes a change of volume at constant temperature.

Which diagram shows the relationship between the volume and the pressure of the gas?



5054/11/M/J/17/Q19

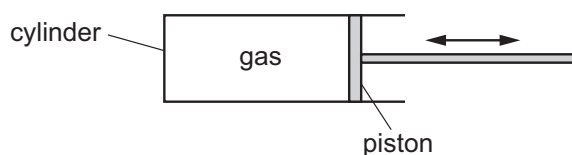
- 19 A substance consists of particles that are close together and moving past each other at random. The average speed of the particles is gradually increasing.

What best describes the substance?

- A a gas being heated
- B a liquid being heated
- C a liquid undergoing solidification
- D a solid being heated

5054/11/M/J/17/Q20

- 20 A fixed mass of gas is enclosed in a cylinder with a movable piston.



The gas is initially at pressure p_1 and has a volume V_1 .

The temperature is kept constant. The piston is moved so that the pressure becomes p_2 volume becomes V_2 .

Which equation is correct?

- A $\frac{p_1}{V_1} = \frac{p_2}{V_2}$
- B $\frac{p_1}{p_2} = \frac{V_1}{V_2}$
- C $p_1 V_1 = p_2 V_2$
- D $p_1 V_2 = p_2 V_1$

5054/12/M/J/17/Q20

- 21 A sealed container of gas is heated and the pressure inside increases.

What happens to the molecules of the gas to cause this increase in pressure?

- A Their kinetic energy decreases.
- B They become heavier.
- C They expand.
- D They hit the container more frequently.

5054/12/M/J/18/Q19

- 22 Which statement about particles in a liquid is correct?

- A They all have the same speed.
- B They are stationary.
- C They move at random.
- D They vibrate about a fixed point.

5054/11/M/J/19/Q21

- 23 A gas is enclosed in a container of fixed volume.
The gas gains heat energy from an external source.

What happens to the molecules of the gas?

- A They expand.
- B They move faster inside the container.
- C They move further apart.
- D They vibrate with greater frequency.

5054/11/M/J/19/Q22

- 24 In low-pressure hydrogen, there are no forces between the molecules except during collisions with each other.

Which statement describes the motion of a molecule between one collision and the next?

- A It moves with changing speed and continuously changes direction.
- B It moves with changing speed in a straight line.
- C It moves with constant speed and continuously changes direction.
- D It moves with constant speed in a straight line.

5054/12/M/J/19/Q23

- 25 Which row explains why a liquid has a fixed volume but does **not** have a fixed shape?

	force between molecules in the liquid	movement of molecules in the liquid
A	large	free to move within the liquid
B	large	vibrate at fixed positions
C	small	free to move within the liquid
D	small	vibrate at fixed positions

5054/11/M/J/20/Q24

- 26 A fixed mass of gas is enclosed in a cylinder by a piston which is free to move.

Which combination of changes to the pressure and to the temperature **must** increase the density of the gas?

	pressure	temperature
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

5054/11/M/J/20/Q25

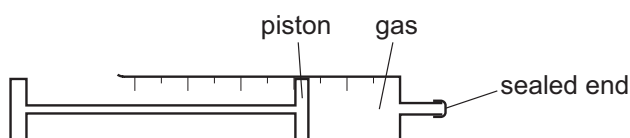
- 27 The air in a sealed can is heated.

Which statement explains the increase in pressure inside the can?

- A** The molecules collide with the walls of the can more frequently when the air is heated.
- B** The mass of the molecules is greater when the air is heated.
- C** There are more molecules per unit volume when the air is heated.
- D** The separation of molecules becomes greater when the air is heated.

5054/12/M/J/20/Q28

- 28 A sealed gas syringe contains a fixed mass of gas.



The piston is moved and the volume of the gas doubles. The temperature of the gas does not change.

What happens to the pressure of the gas?

- A** halves
- B** no change
- C** doubles
- D** triples

5054/11/M/J/21/Q10

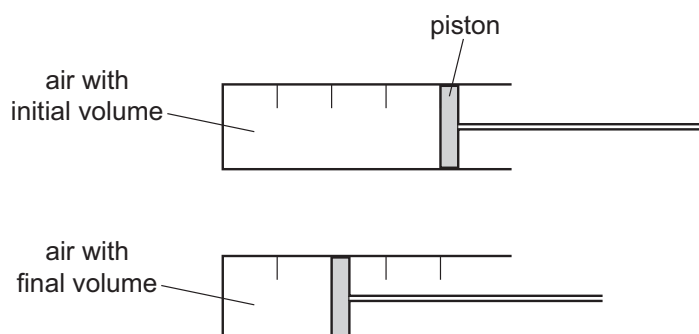
29 Which statement about water is correct?

- A At the boiling point, water vapour molecules have the same kinetic energy as liquid water molecules.
- B Evaporation occurs only at the boiling point.
- C Water molecules become heavier when water freezes.
- D Water molecules lose all of their kinetic energy when water freezes.

5054/11/M/J/21/Q19

30 Air is trapped in a cylinder by a piston.

The piston is moved inwards so that the volume of the air reduces.



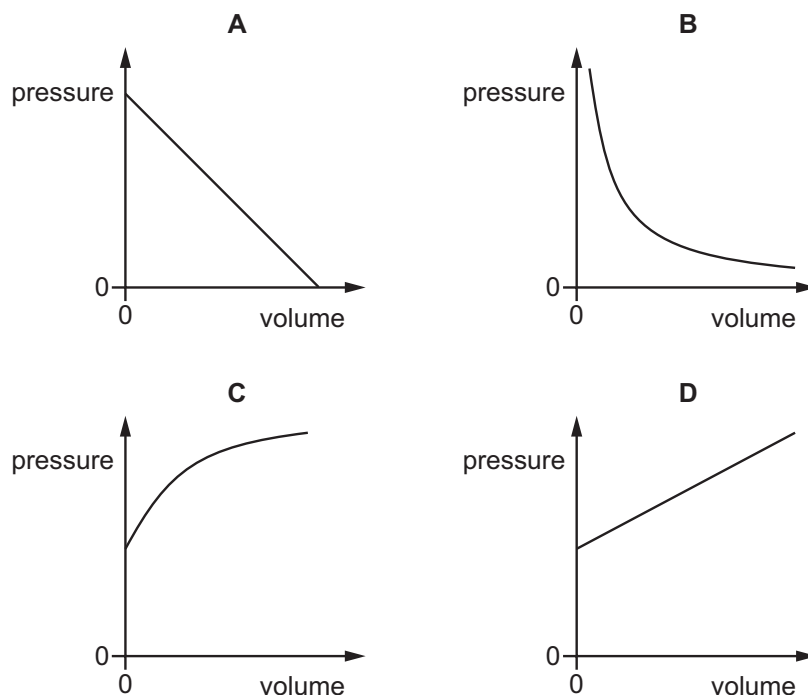
The density of the air in the syringe at the initial volume is 0.0012 g/cm^3 .

What is the density of the air in the syringe at the final volume?

- A 0.0006 g/cm^3
- B 0.0012 g/cm^3
- C 0.0024 g/cm^3
- D 0.0048 g/cm^3

5054/12/M/J/21/Q7

- 31 Which graph shows the relationship between the pressure and the volume of a fixed mass of gas at constant temperature?



5054/12/M/J/21/Q14

- 32 Which row describes the shape of a liquid and the arrangement of its molecules?

	shape	arrangement of molecules
A	fixed	not regular
B	fixed	regular
C	takes shape of container	not regular
D	takes shape of container	regular

5054/12/M/J/21/Q22

- 33** Air in a sealed container of fixed volume is heated.

The pressure of the air increases.

How do the molecules of air cause this increase in pressure?

- A** The molecules expand and push on the container with a greater force.
- B** The molecules move at the same speed and hit the container with a greater force.
- C** The molecules move faster and hit the container more often.
- D** The molecules move further apart and hit the container more often.

5054/12/M/J/21/Q23

- 34** Which row describes the arrangement of particles and the forces between particles in a solid?

	arrangement of particles	forces between particles
A	regular	strong
B	regular	weak
C	irregular	strong
D	irregular	weak

5054/11/M/J/22/Q18

- 35** Steam at 110 °C condenses on a surface to form water droplets at 100 °C.

What happens after the steam comes into contact with the surface?

- A** The molecules slow down and absorb energy from the surroundings.
- B** The molecules slow down and emit energy to the surroundings.
- C** The molecules stay at the same speed and absorb energy from the surroundings.
- D** The molecules stay at the same speed and emit energy to the surroundings.

5054/12/M/J/22/Q20

- 36 Which row explains why a liquid has a fixed volume but does **not** have a fixed shape?

	force between molecules in the liquid	movement of molecules in the liquid
A	large	move throughout the liquid
B	large	vibrate at fixed positions
C	small	move throughout the liquid
D	small	vibrate at fixed positions

5054/11/O/N/11/Q16

- 37 Four syringes contain air at atmospheric pressure.

The air in all four syringes is slowly compressed. The results are given in the table.

Which syringe shows the smallest pressure change?

	volume before compression / cm ³	volume after compression / cm ³
A	50	10
B	100	50
C	400	25
D	400	100

5054/11/O/N/12/Q12

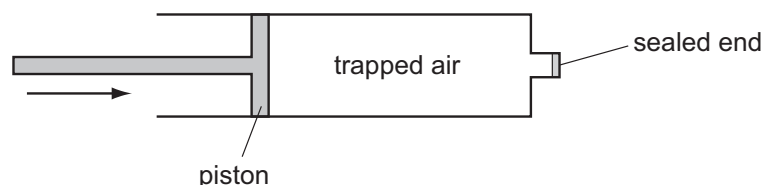
- 38 When a gas is rapidly compressed to a smaller volume, its temperature increases.

What happens to the gas molecules?

- A** They move closer together and their average speed decreases.
- B** They move closer together and their average speed increases.
- C** They move closer together and their average speed remains unchanged.
- D** They stay the same distance apart and their average speed increases.

5054/11/O/N/12 /Q15

- 39 The end of a bicycle pump is sealed.



The temperature of the air does not change as the piston is pushed in. The final volume of trapped air is $\frac{1}{4}$ of the original volume.

How does the pressure of the trapped air change?

- A It decreases to $\frac{1}{4}$ of the original value.
- B It decreases to $\frac{3}{4}$ of the original value.
- C It increases to 3 times the original value.
- D It increases to 4 times the original value.

5054/12/O/N/12/Q12

- 40 A gas in a container of fixed volume is heated.

What happens to the molecules of the gas?

- A They collide less frequently.
- B They expand.
- C They move faster.
- D They move further apart.

5054/12/O/N/12/Q15

- 41 Which row correctly describes the shape and volume of a gas?

	shape	volume
A	fixed	fixed
B	fixed	not fixed
C	not fixed	fixed
D	not fixed	not fixed

5054/11/O/N/13/Q18

- 42 The conditions at the bottom and at the surface of a lake are given in the table.

	bottom of lake	surface of lake
temperature	10 °C	10 °C
pressure	500 kPa	100 kPa

A bubble of volume 1.0 cm³ forms at the bottom of the lake.

What is the volume of the bubble as it reaches the surface?

- A** 0.20 cm³ **B** 0.25 cm³ **C** 4.0 cm³ **D** 5.0 cm³

5054/12/O/N/13/Q12

- 43 A fixed mass of gas is kept at constant pressure. Its temperature is raised.

What happens to the volume of the gas and to its molecules?

	volume	molecules
A	decreases	move more slowly
B	increases	stay the same distance apart
C	increases	move further apart
D	no change	move at the same speed

5054/12/O/N/13/Q19

- 44 Air is heated in a sealed container with constant volume.

Why does the air pressure increase when the temperature increases?

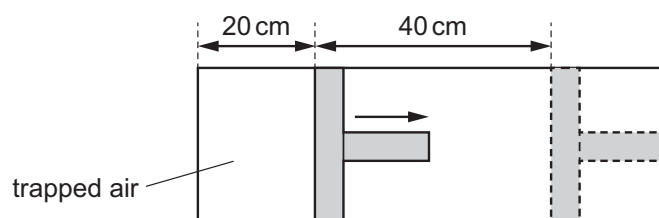
- A** The air molecules expand.
B The air molecules bounce off each other more frequently.
C The air molecules bounce off the walls more frequently.
D The number of air molecules increases.

5054/12/O/N/13/Q20

- 45** Air is trapped in a cylinder by a piston. The pressure of the air is p and the length of the air column is 20 cm.

The piston is moved outwards until the length of the air column has increased by 40 cm.

The temperature of the air remains constant.



What is the new air pressure?

- A** $\frac{p}{2}$ **B** $\frac{p}{3}$ **C** $2p$ **D** $3p$

5054/11/O/N/14/Q12

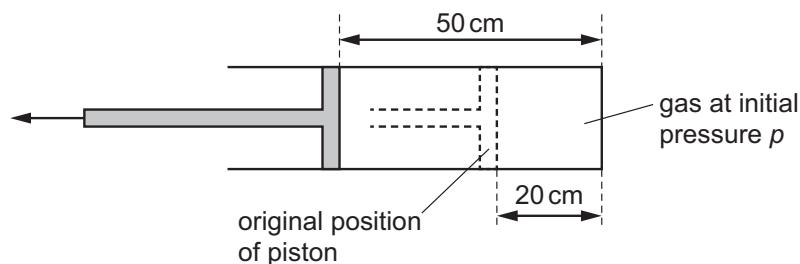
- 46** At a constant temperature, a solid has a fixed shape and a fixed volume.

Which row describes the shape and the volume of a liquid at constant temperature?

	shape	volume
A	fixed	fixed
B	fixed	not fixed
C	not fixed	fixed
D	not fixed	not fixed

5054/12/O/N/14/Q15

- 47 A gas is trapped inside a cylinder by a movable piston. The length of the gas column is 20 cm and the pressure inside the cylinder is p .



The piston is pulled out a distance of 30 cm, so that the length of the gas column is now 50 cm. The temperature of the gas does not change.

What is the new pressure of the gas?

- A** $0.40p$ **B** $0.60p$ **C** $1.5p$ **D** $2.5p$

5054/11/O/N/15/Q13

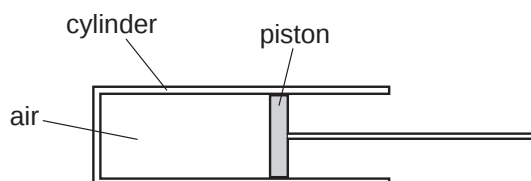
- 48 A gas is in a sealed container of constant volume. The gas is heated and the pressure of the gas on the walls of the container increases.

How do the particles of the gas cause this increase in pressure?

- A** They expand.
B They hit each other more frequently.
C They hit the container more frequently.
D They vibrate faster.

5054/12/O/N/15/Q16

- 49 Air is trapped in a cylinder by a piston.



The piston is pushed further into the cylinder.

How do the pressure and the volume of the air in the syringe change?

	pressure	volume
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

5054/11/O/N/16/Q14

- 50 Which statement explains how a pressure is exerted by a gas on a container?

- A** Gas molecules collide with other gas molecules in the container.
- B** Gas molecules collide with the walls of the container.
- C** Gas molecules exert strong attractive forces on each other.
- D** Gas molecules exert strong repulsive forces on each other.

5054/11/O/N/16/Q15

- 51 A gas expands slowly and its temperature remains constant.

What happens to the gas molecules?

- A** They move further apart and their average speed decreases.
- B** They move further apart and their average speed increases.
- C** They move further apart and their average speed remains unchanged.
- D** They stay the same distance apart and their average speed decreases.

5054/12/O/N/16 /Q18

- 52 A gas is heated in a closed container of constant volume.

What happens to the molecules of the gas?

- A They collide with the walls with less force.
- B They expand.
- C They move faster.
- D They move further apart.

5054/11/O/N/17/Q11

- 53 A gas syringe contains a fixed mass of air. The volume of the air is 240 cm^3 and it exerts a pressure of $5.0 \times 10^4\text{ Pa}$. The air is slowly compressed, keeping the temperature constant, until the pressure is $1.5 \times 10^5\text{ Pa}$.

What is the final volume of air?

- A 72 cm^3 B 80 cm^3 C 720 cm^3 D 800 cm^3

5054/12/O/N/17/Q11

- 54 An extremely large increase in pressure is needed to compress a liquid. A gas can be compressed by a much smaller increase in pressure.

Which statement explains this?

- A Molecules repel each other very strongly when very close.
- B The attractive forces between molecules are small at large distances.
- C The molecules in the gas collide with the walls of their container and rebound.
- D The molecules of a liquid are constantly moving at random.

5054/12/O/N/17/Q12

- 55 A dish of liquid is left on a laboratory bench. Some of the liquid evaporates.

What happens and why?

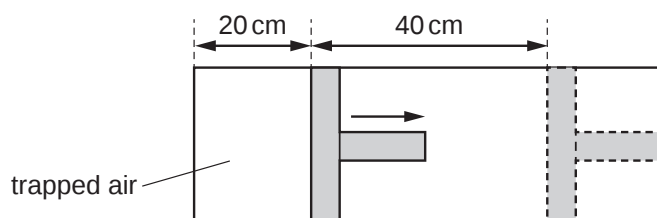
- A The liquid cools because liquid molecules have more potential energy than gas molecules.
- B The liquid cools because faster-moving molecules escape.
- C The liquid warms because liquid molecules have less potential energy than gas molecules.
- D The liquid warms because slower-moving molecules are left behind.

5054/12/O/N/17/Q13

- 56 Air is trapped in a cylinder by a piston. The pressure of the air is p and the length of the air column is 20 cm.

The piston is moved outwards until the length of the air column has increased by 40 cm.

The temperature of the air remains constant.



What is the new air pressure?

- A $\frac{p}{2}$ B $\frac{p}{3}$ C $2p$ D $3p$

5054/12/O/N/18/Q15

- 57 Some gas is trapped in a closed container. The gas is cooled and the volume of the container is kept constant.

What happens to the gas molecules?

- A They collide with the walls more often.
B They contract.
C They get closer together.
D They move more slowly.

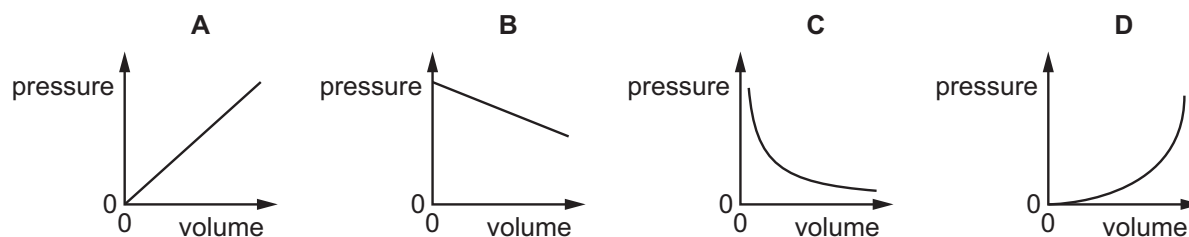
5054/12/O/N/18/Q18

- 58 What increases when a liquid becomes a gas at its boiling point?

- A the average kinetic energy of the molecules
B the molecular size
C the molecular spacing
D the total number of molecules

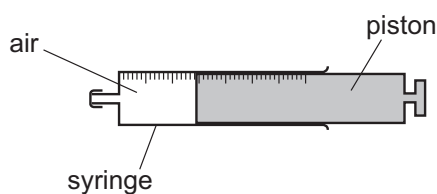
5054/12/O/N/18/Q20

- 59 Which graph shows the relationship between the pressure and the volume of a fixed mass of gas at constant temperature?



5054/12/O/N/19 /Q13

- 60 A syringe containing air is sealed at one end. The piston is free to move.



The air is heated.

What happens to the average distance between air molecules and the density of the air?

	average distance between air molecules	density of the air
A	increases	decreases
B	increases	stays the same
C	stays the same	decreases
D	stays the same	stays the same

5054/12/O/N/19/Q20

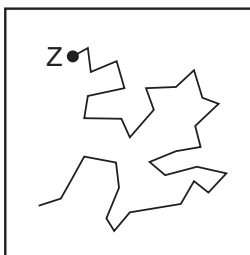
- 61 A block of aluminium is heated.

What happens to the kinetic energy and to the potential energy of the molecules?

	kinetic energy	potential energy
A	increase	increase
B	increase	decrease
C	decrease	increase
D	decrease	decrease

5054/11/O/N/20/Q22

- 62 A smoke particle Z is seen to move randomly when suspended in air as illustrated.



Which statement explains why Z moves randomly?

- A Air molecules are much larger than Z.
- B Air molecules are smaller than Z.
- C Air molecules hit Z from different directions.
- D Air molecules vibrate about a fixed position.

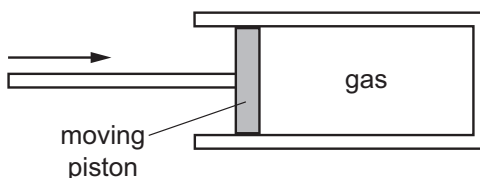
5054/11/O/N/20/Q25

- 63 Which description of a liquid is correct?

- A fixed shape, fixed volume
- B fixed shape, no fixed volume
- C no fixed shape, fixed volume
- D no fixed shape, no fixed volume

5054/12/O/N/20/Q21

- 64 A mass of gas is trapped inside a cylinder by a moving piston.



As the piston moves in, the volume of the gas decreases but the temperature stays the same.

What happens to the gas pressure, and why?

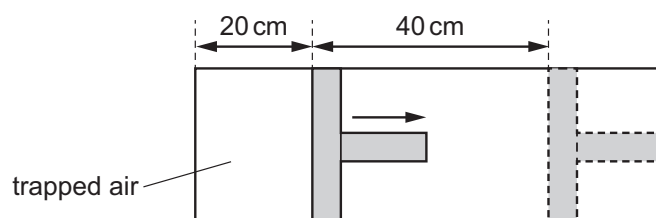
	pressure	reason
A	decreases	the molecules have less room to move in the cylinder
B	decreases	the molecules move more slowly between collisions
C	increases	the molecules collide more frequently with the piston
D	unchanged	the temperature of the gas is constant

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- 65 Air is trapped in a cylinder by a piston. The pressure of the air is p and the length of the air column is 20 cm.

The piston is moved outwards. The length of the air column increases by 40 cm.

The temperature of the air remains constant.

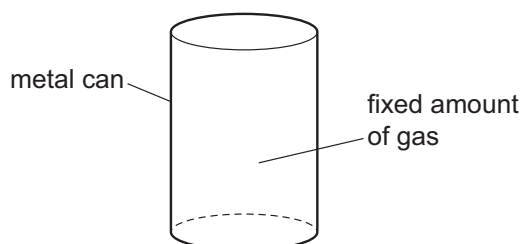


What is the new air pressure?

- A $\frac{p}{2}$ B $\frac{p}{3}$ C $2p$ D $3p$

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- 66 A fixed amount of gas is trapped inside a metal can.



The temperature of the gas decreases but the volume does not change.

How does this change affect the kinetic energy of the gas molecules and the pressure inside the metal can?

	kinetic energy	pressure
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	stays the same	decreases

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