Kinetic Particle Theory

Question Paper

Level	O Level
Subject	Chemistry
Exam Board	Cambridge International Examinations
Topic	The Particulate Nature of Matter
Sub-Topic	Kinetic particle theory
Booklet	Question Paper

Time Allowed: **35 minutes**

Score: **/29**

Percentage: **/100**

1 Which statement is **not** correct?

A Energy is released when a liquid changes into a solid.

B Particles move faster in the gaseous state than in the liquid state.

C The carbon atoms in gaseous methane are further apart than those in solid diamond.

D There is a large decrease in the volume of a solid metal when pressure is applied to it.

2 A gas cylinder is placed in each of the four corners of a square room. Each cylinder contains a different gas stored under the same pressure. The gases are released at exactly the same time.

Which gas will reach the centre of the room first?

A ammonia, NH_3

B argon, Ar

C carbon monoxide, CO

D chlorine, Cl_2

3 Two containers, one of methane and one of butane, are placed at the same distance from a naked flame.

Both gases are released at the same time. The methane gas reaches the flame and catches fire before the butane gas reaches the flame.

Which statement explains this?

A Each methane molecule has a higher proportion of hydrogen than each butane molecule.

B Methane does not have isomers, butane does have isomers.

C Methane has a higher boiling point than butane.

D Methane molecules have a smaller mass than butane molecules.

4 Which change in conditions increases the energy of particles in a reaction?

A increase in concentration

B increase in pressure

C increase in temperature

D presence of a catalyst

5 Why does ammonia gas diffuse faster than hydrogen chloride gas?

A Ammonia has a higher boiling point than hydrogen chloride.

B Ammonia is a base, hydrogen chloride is an acid.

C The ammonia molecule contains more atoms than a hydrogen chloride molecule.

D The relative molecular mass of ammonia is smaller than that of hydrogen chloride.

6 Which process provides the best evidence for the particle theory of matter?

A dehydration

B diffusion

C filtration

D neutralisation

7 Which statement about the four gases carbon dioxide, CO_2, hydrogen, H_2, oxygen, O_2 and ozone, O_3 is correct?

A One mole of each gas occupies the same volume at a given temperature and pressure.

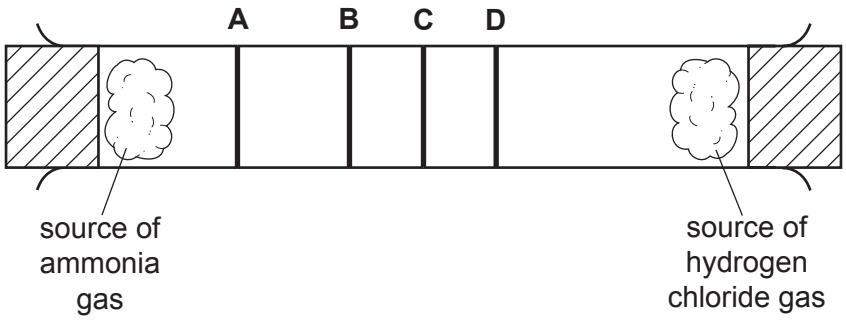
B Ozone has the fastest rate of diffusion at a given temperature and pressure.

C They are all denser than air.

D They are all elements.

8 The diagram shows an apparatus used to compare rates of diffusion.

At which labelled position did a white deposit of ammonium chloride form?



9 Which statement explains why the gases propane, C_3H_8, and carbon dioxide, CO_2, diffuse at the same rate at room temperature and pressure?

A Both are denser than air.

B Both compounds contain carbon.

C Both molecules contain covalent bonds.

D They have the same relative molecular mass, M_r.

10 A drop of liquid bromine is placed in the bottom of a gas jar. Brown fumes of bromine vapour slowly spread through the covered gas jar.

Why does this happen?

A Bromine vapour is less dense than air.

B Bromine molecules and the molecules in air are always moving around.

C Bromine molecules are smaller than the molecules in air.

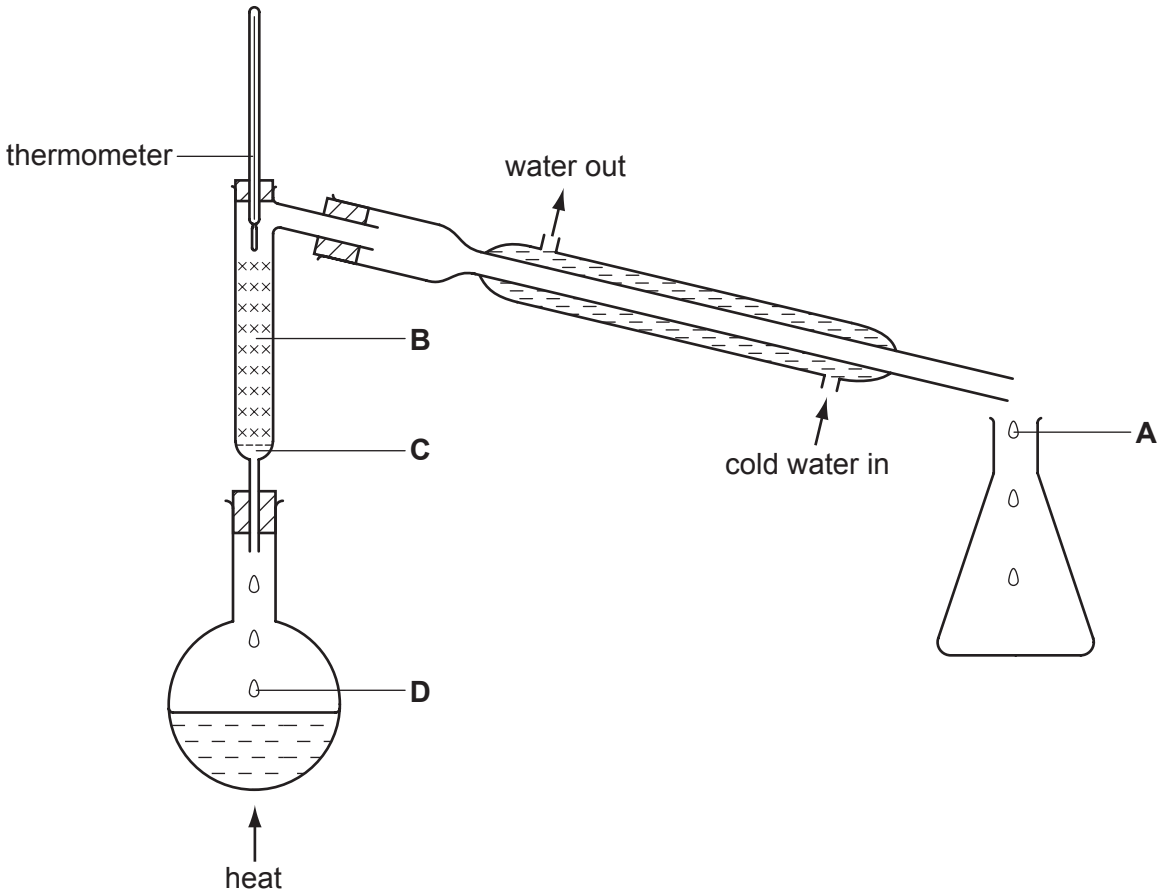
D Bromine molecules move faster than the molecules in air.

11 What correctly describes the molecules in **very dilute** sugar solution at room temperature?

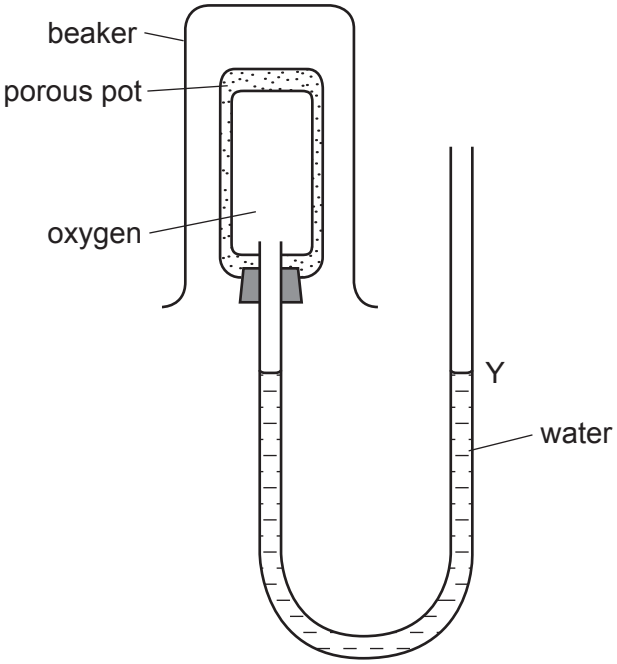
	sugar molecules	water molecules
A	close together, moving at random	close together, moving at random
B	widely separated, moving at random	close together, moving at random
C	widely separated, moving at random	close together, not moving
D	widely separated, not moving	widely separated, moving at random

12 A mixture containing equal volumes of two liquids that mix completely but do not react together is placed in the apparatus shown and heated until the thermometer first shows a steady reading.

At which position will there be the highest proportion of the liquid with the higher boiling point?



13 The diagram shows a diffusion experiment.



Which gas, when present in the beaker over the porous pot, will cause the water level at Y to rise?

A carbon dioxide, CO_2

B chlorine, Cl_2

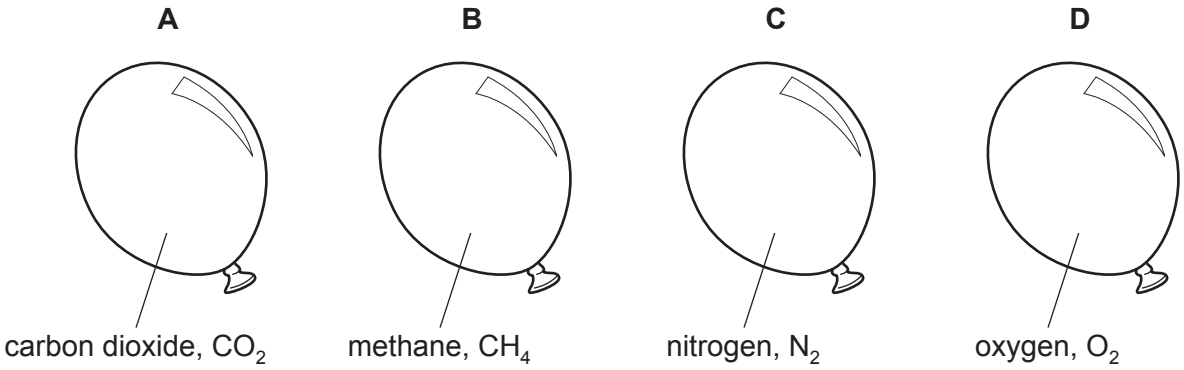
C methane, CH_4

D nitrogen dioxide, NO_2

14 An inflated balloon goes down because gas molecules can diffuse through the rubber.

Four balloons are filled with different gases at the same temperature and pressure.

Which balloon would go down quickest?



15 Why does neon gas, Ne, diffuse faster than carbon dioxide gas, CO_2?

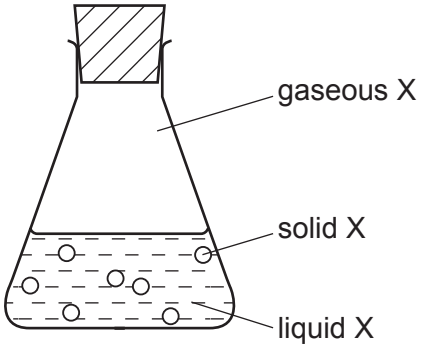
A Neon atoms have the lower mass.

B Neon does not form molecules.

C Neon is a noble gas.

D Neon is less dense than air.

16 The conical flask contains compound X which is present in solid, liquid and gaseous states.



Which statement is correct?

A A gaseous X molecule has a lower mass than a liquid X molecule.

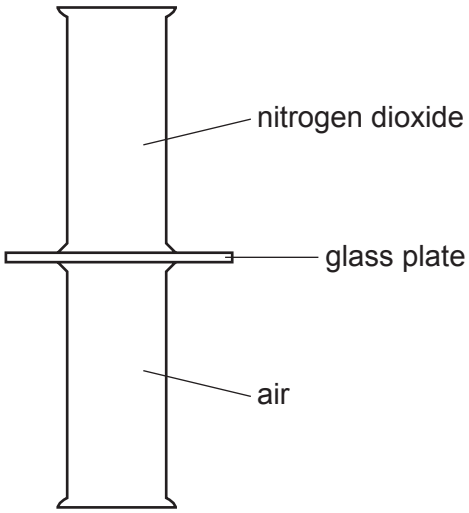
B Energy is released when X changes from liquid to solid.

C Liquid X is at a higher temperature than solid X.

D Liquid X molecules vibrate about fixed positions.

17 Nitrogen dioxide is a dark brown gas and is more dense than air.

A gas jar containing nitrogen dioxide is sealed with a glass plate and is then inverted on top of a gas jar containing air.



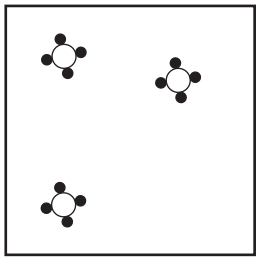
The glass plate is removed.

Which one of the following correctly describes the colours inside the gas jars after a long period of time?

	upper gas jar	lower gas jar
A	brown	brown
B	dark brown	light brown
C	colourless	dark brown
D	light brown	dark brown

18 Which diagram represents the arrangement of particles in a gas?

A



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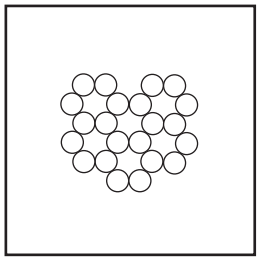

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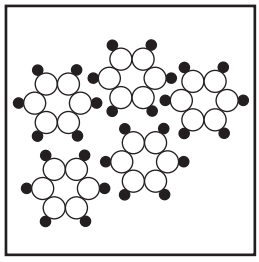

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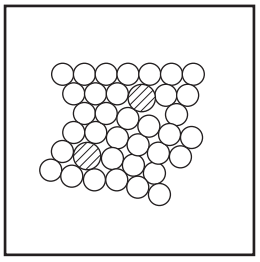


19 Which gas diffuses at the same rate as nitrogen gas?

A carbon dioxide

B carbon monoxide

C neon

D sulphur dioxide

20 Which property of a gas affects the rate at which it spreads throughout a laboratory?

A boiling point

B molecular mass

C reactivity

D solubility in water

21 The table gives data about four substances.

Which substance has particles in a disorderly arrangement at room temperature?

	melting point / °C	boiling point / °C
A	–114	–80
B	120	445
C	750	1407
D	1610	2230

22 Which gas has the slowest rate of diffusion?

A ammonia, NH_3

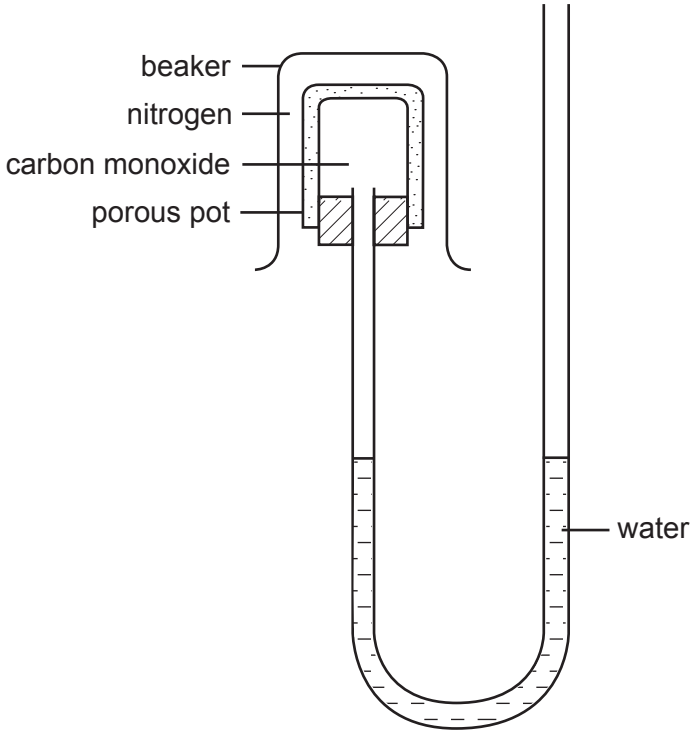
B methane, CH_4

C oxygen, O_2

D nitrogen, N_2

23 A beaker of nitrogen is inverted over a porous pot containing carbon monoxide as shown.

The water level does not change.



What is the reason for this?

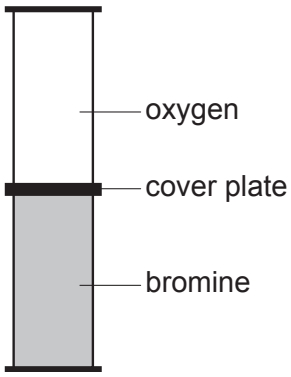
A Both gases are diatomic.

B Nitrogen is an unreactive gas.

C The gas particles are too large to pass through the porous pot.

D The two gases have the same relative molecular mass.

24 The coverplate is removed from the gas jars shown in the diagram. After several days, the colour of the gas is the same in both jars.



Which statement explains this change?

A Oxygen and bromine gases have equal densities.

B Oxygen and bromine molecules are in random motion.

C Oxygen and bromine molecules diffuse at the same rate.

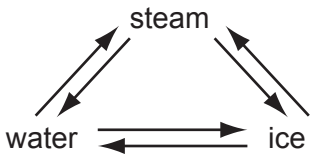
D Equal volumes of oxygen and bromine contain equal numbers of molecules.

25 In a sample of air at 25 °C, the molecules of oxygen, nitrogen and carbon dioxide all move with different average speeds.

Which of the following lists the molecules in order of decreasing average speed?

	fastest →		slowest
A	carbon dioxide	oxygen	nitrogen
B	nitrogen	oxygen	carbon dioxide
C	oxygen	carbon dioxide	nitrogen
D	oxygen	nitrogen	carbon dioxide

26 In which conversion do H_2O molecules lose speed?



A ice → water

B ice → steam

C steam → ice

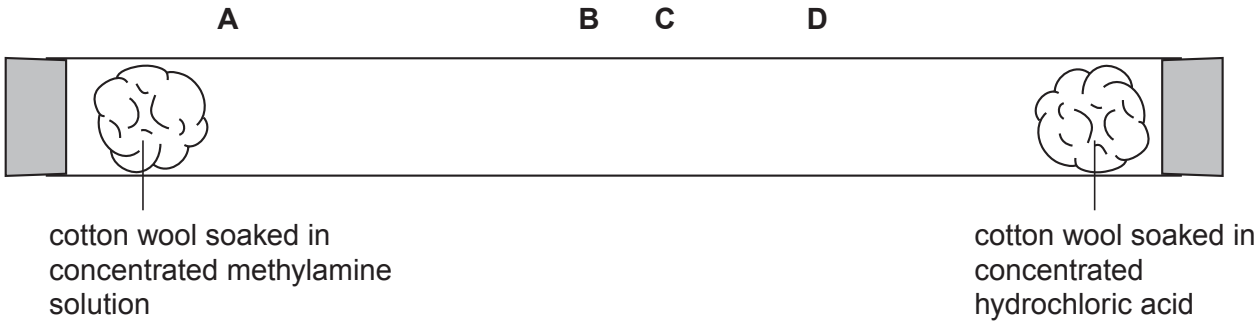
D water → steam

27 Methylamine, CH_3NH_2 (M_r = 31), and hydrogen chloride, HCl (M_r = 36.5) are both gases which are soluble in water.

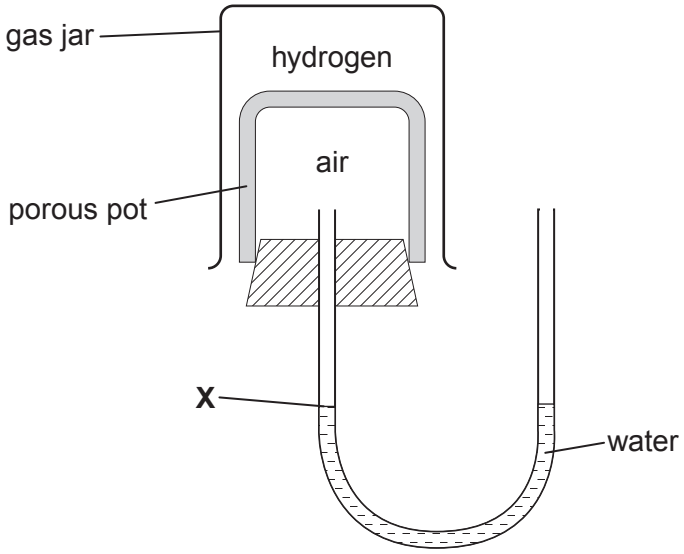
The gases react together to form a white solid, methylammonium chloride.

In an experiment to demonstrate rates of diffusion the following apparatus is set up.

Where will the white solid form?



28 The apparatus shown in the diagram was set up.



Over a period of time how will the water level at **X** change?

A It will fall, then rise and return to **X**.

B It will fall and remain at a lower level.

C It will rise, then fall then return to **X**.

D It will rise and remain at a higher level.

29 A researcher notices that atoms of an element **X** are releasing energy.

Why does this happen?

A The atoms are affected by light.

B The atoms are radioactive.

C The atoms react with argon in the air.

D The atoms are evaporating.