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

[J08/P1/Q3]

8. Which property shows that a liquid is pure?

A It turns anhydrous copper(II) sulphate blue.

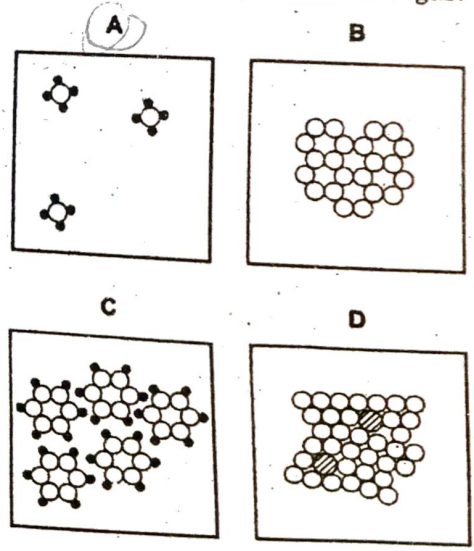
B It is colourless and odourless.

C It has no effect on red or blue litmus paper.

D It boils at a fixed temperature at a given pressure.

[N08/P1/Q5]

9. Which diagram represents the arrangement of particles in a gas?



[N08/P1/Q7]

10. Which gas diffuses at the same rate as nitrogen gas?

A carbon dioxide

B carbon monoxide

C neon

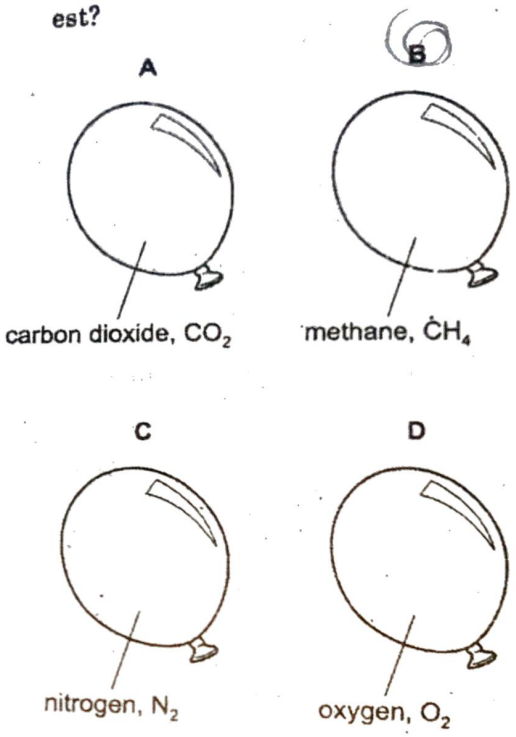
D sulphur dioxide

[N08/P1/Q8]

11. 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?



[J09/P1/Q1]

12. 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.

[N09/P1/Q2]

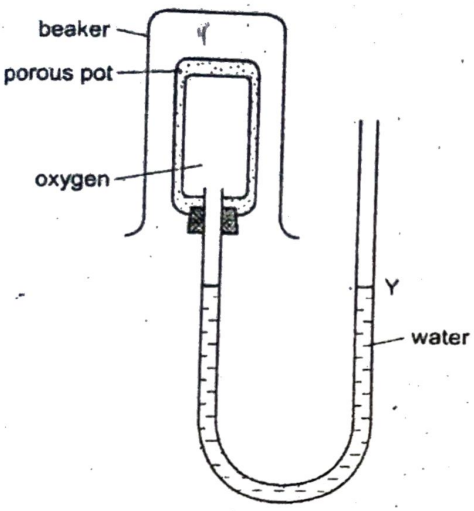
13. What correctly describes the molecules in **very dilute** sugar solution at room temperature?

	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

[J10/P1/Q2]

Topic 1 MCQ ⇨ page 3

14. 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

[N10/P1/Q4]

15. 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.

[J11/P1/Q1]

16. In which pair is each substance a mixture?

A air and water

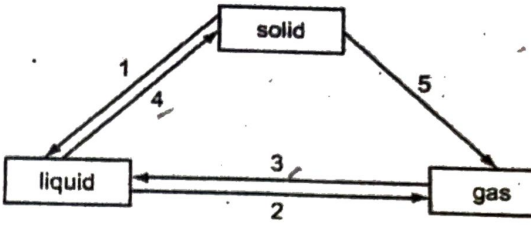
B limewater and water

C quicklime and limewater

D sea water and air

[N11/P1/Q4]

17. The diagram shows some of the changes of state.



Which statement is correct?

A Although the change is not shown on the diagram, a gas can change directly to a solid.

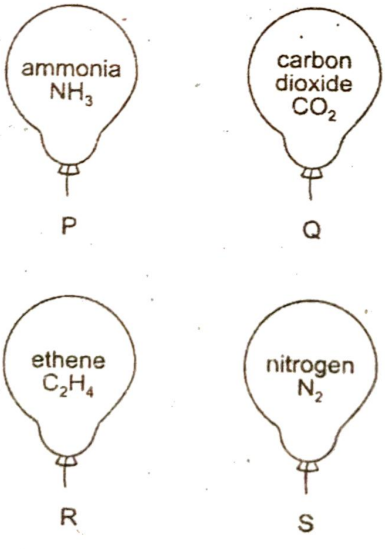
B The changes 1 and 3 involve particles moving closer together.

C The changes 2 and 4 involve particles moving further apart.

D The changes 3, 4 and 5 all involve the release of energy.

[J12/P1/Q1]

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



The gases gradually diffuse out of the balloons.

Which pair of balloons will deflate at the same rate?

A P and Q

B Q and R

C R and S

D S and P

[N12/P1/Q2]

19. What can be deduced about two gases that have the same relative molecular mass?

A They have the same boiling point.

B They have the same number of atoms in one molecule.

C They have the same rate of diffusion at room temperature and pressure.

D They have the same solubility in water at room temperature.

[J13/P1/Q7]

20. When drops of bromine are placed on a table-top at one side of a room, the smell of bromine can eventually be detected at the other side of the room.

What is **not** part of the explanation of this?

After evaporation, the bromine particles

A collide with air particles.

B move in a random way.

C spread out to occupy the total available space.

D vibrate from side to side.

[N13/P1/Q1]

21. 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.

[N14/P1/Q6]

22. Which row shows correct statements about the speed at which a gas diffuses?

	effect of molecular mass	effect of temperature
A	higher molecular mass diffuses faster	diffusion is faster at higher temperatures
B	higher molecular mass diffuses faster	diffusion is faster at lower temperatures
C	lower molecular mass diffuses faster	diffusion is faster at higher temperatures
D	lower molecular mass diffuses faster	diffusion is faster at lower temperatures

[J15/P1/Q8]

23. Which statements are correct?

1 The volume of a gas at constant pressure increases as the temperature increases.

2 The rate of diffusion of a gas increases as the temperature increases.

3 The pressure of a gas at constant volume decreases as the temperature increases.

A 1 and 2 only

B 1 and 3 only

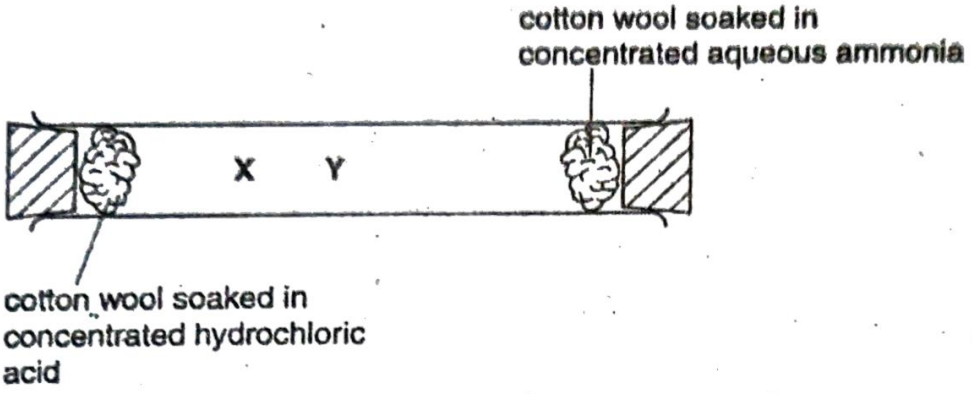
C 2 and 3 only

D 1, 2 and 3

[N15/P1/Q3]

Question 1

A student set up the apparatus shown below.



Colourless fumes of hydrogen chloride are given off by the hydrochloric acid. Colourless fumes of ammonia are given off by the aqueous ammonia.

(a) After a few seconds, white fumes were seen at point **X** in the tube.
Name the compound formed at point **X**. [1]

(b) Use the kinetic particle theory to explain this observation. [3]

(c) The student repeated the experiment using a solution of methylamine, CH_3NH_2, in place of ammonia, NH_3.
The white fumes were seen at point **Y** in the tube, rather than at point **X**.
Explain this difference. [2]

[N07/P2/Q2]

Solution

(a) Ammonium chloride

(b) Hydrogen chloride (Mr = 36.5) being heavy diffuses slower than ammonia (Mr = 17), that is why they meet at **X** and produce fumes of ammonium chloride.

(c) Methylamine (Mr = 31) has a similar RMM to hydrochloric acid (Mr = 36.5), therefore they diffuse at similar rates and fumes are produced at **Y**.

Question 2

Bromine is a halogen. It has two naturally-occurring isotopes.

(a) Define the term *isotopes*. [1]

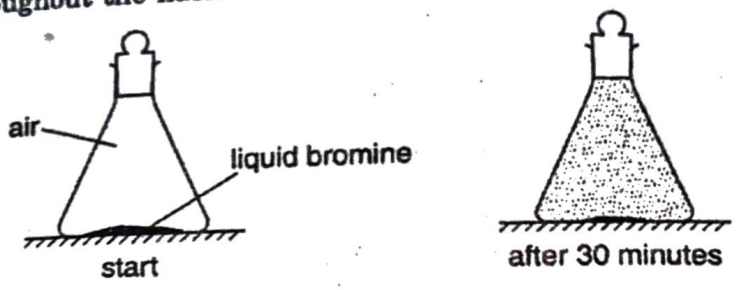
(b) One isotope of bromine has the symbol $^{81}_{35}Br$.
State the number of protons, neutrons and electrons in this isotope of bromine. [2]

(c) Bromine is a liquid at room temperature.

(i) Draw a diagram to show the arrangement of the molecules in liquid bromine.

Show a bromine molecule as ◯. [2]

(ii) A small amount of liquid bromine was placed in the bottom of a sealed flask. After thirty minutes the brown colour of the bromine had spread throughout the flask.



Use the kinetic particle theory to explain these observations. [3]

(d) Bromine forms a variety of compounds with other halogens.

(i) Bromine reacts with fluorine to form bromine(I) fluoride, BrF.
Write an equation for this reaction. [1]

(ii) Another compound of bromine and fluorine is bromine(V) fluoride, BrF_5.
Calculate the percentage of bromine by mass in bromine(V) fluoride. [2]

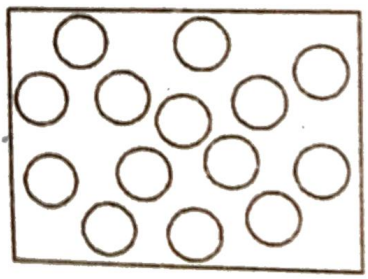
[N11/P2/Q5]

Solution

(a) Atoms of the same element having same number of protons and different number of neutrons are called isotopes.

(b) protons: 35, neutrons: 46, electrons: 35

(c) (i)



(ii) Molecules of bromine with higher energy will escape from liquid and mix with air molecules. Their random movement will help bromine molecules to diffuse into air. After 30 minutes bromine will diffuse completely giving uniform brown colour in the flask.

(d) (i) $Br_2 + F_2 \longrightarrow 2BrF$

(ii) M_r of $BrF_5 = 80 + (19 \times 5) = 175$

$$\text{Percentage} = \frac{80}{175} \times 100 = 45.7\%$$

Question 3

Alkenes are a homologous series of unsaturated hydrocarbons.
The table shows information about some alkenes.

alkene	molecular formula	melting point / °C	boiling point / °C
ethene	C_2H_4	–169	–105
butene	C_4H_8	–185	–6
hexene	C_6H_{12}	–140	63
decene	$C_{10}H_{20}$	–66	171
dodecene	$C_{12}H_{24}$	–35	214

(a) Decene is a liquid at 25 °C.
How can you make this deduction from the data in the table? **[2]**

(b) Butene boils at –6 °C.
Use the kinetic particle theory to explain what happens when butene boils. **[2]**

(c) A sample of ethene gas in a gas syringe is heated from 20 °C to 100 °C. The pressure remains constant.
Describe and explain, in terms of the kinetic particle theory, what happens to the volume of the gas. **[2]**

(d) At room temperature ethene diffuses faster than butene.
Explain why. **[1]**

[J15/P2/Q9(a,b,c,d)]

Solution

(a) The boiling point of decene is above 25 °C and the melting point of decene is below 25 °C.

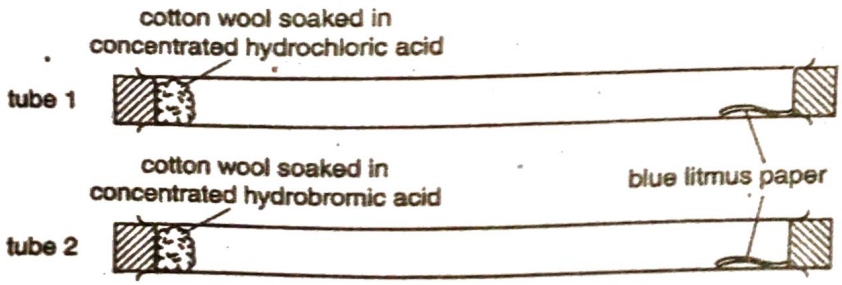
(b) When butene boils, the kinetic energy of molecules increases. Particles start moving faster and spread out.

(c) Increase in temperature increases the kinetic energy of particles due to which the particles start spreading out. As a result the volume of the gas increases.

(d) The rate of diffusion depends on the mass of the gas particles. Ethene diffuses faster than butene because it has lower relative molecular mass than butene. [Butene (M_r: 54) , (Ethene (M_r: 28)].

Question 4

(a) Two students set up tubes as shown.



Concentrated hydrochloric acid produces fumes of hydrogen chloride.
Concentrated hydrobromic acid produces fumes of hydrogen bromide.

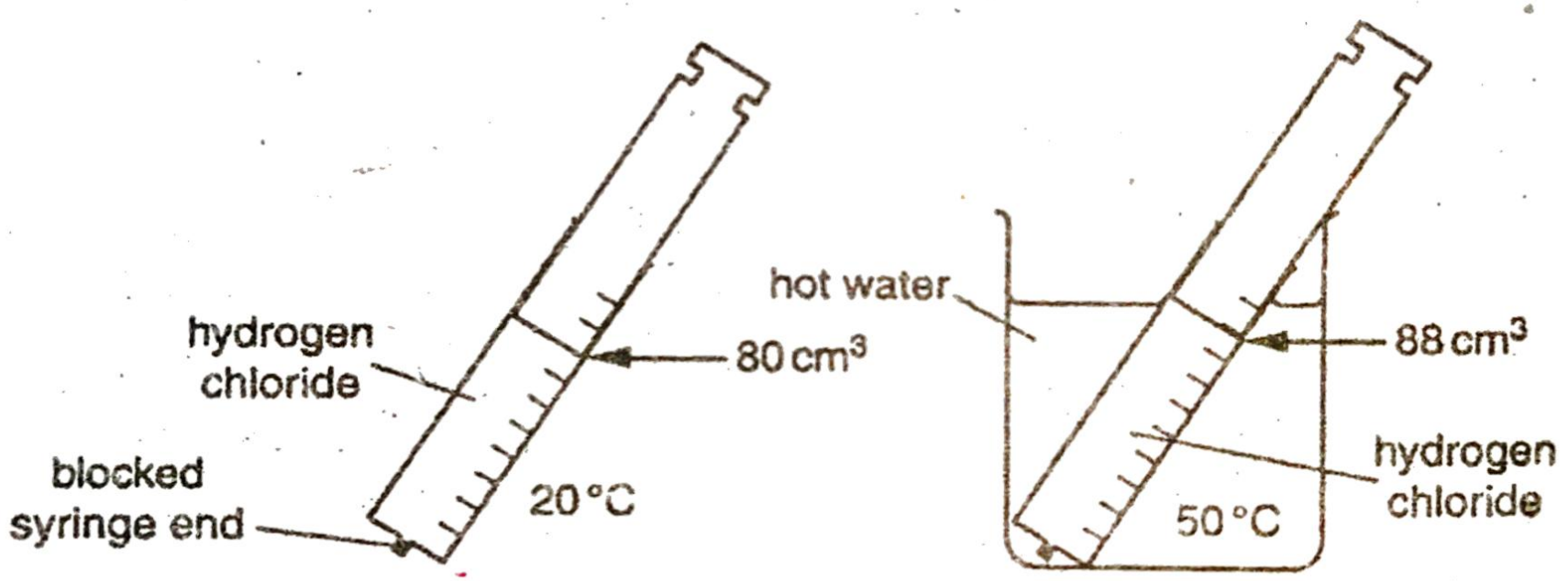
Four minutes after setting up the experiment, the litmus paper in tube 1 turns red.
Seven minutes after setting up the experiment, the litmus paper in tube 2 turns red.

Use the kinetic particle theory to explain

(i) how the gases move through the tubes, [2]

(ii) why the gases take different times to reach the litmus paper. [1]

(b) A gas syringe is filled with 80 cm^3 of hydrogen chloride gas at 20 °C.
The syringe is placed in some hot water at 50 °C.
The atmospheric pressure does not change but the volume of the gas in the syringe increases to 88 cm^3.



Use the kinetic particle theory to explain why the volume increases. [2]

[N15/P2/Q5]