

# Diffusion, Brownian Motion, Solid/Liquids/Gases

## Question Paper 2

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Level	IGCSE
Subject	Chemistry
ExamBoard	CIE
Topic	The Particulate nature of matter
Sub-Topic	Diffusion,Brownian Motion,Solid/Liquids/ Gases
Paper	(Extended) Theory
Booklet	Question Paper 2

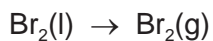
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**TimeAllowed:** 60 minutes

**Score:** /50

**Percentage:** /100

- 1 (a) A small amount of liquid bromine is added to a container which is then sealed.



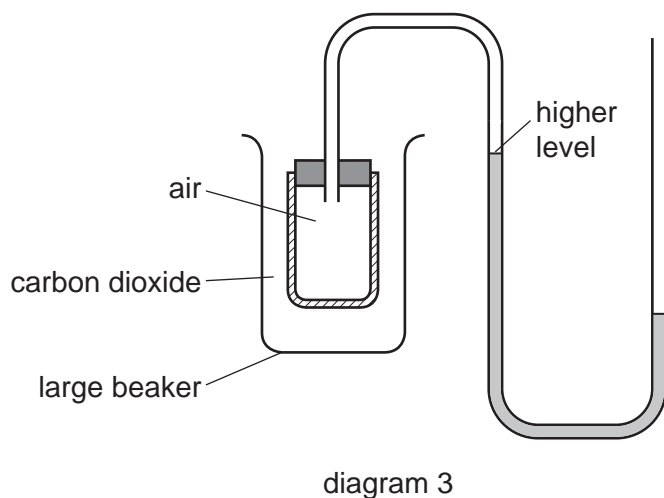
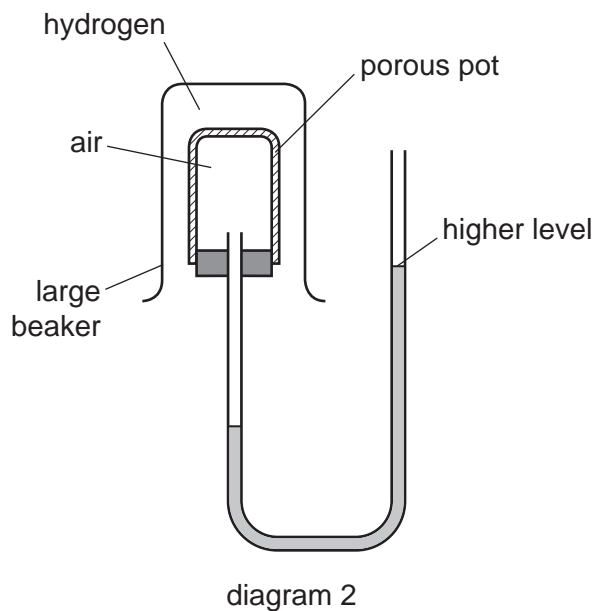
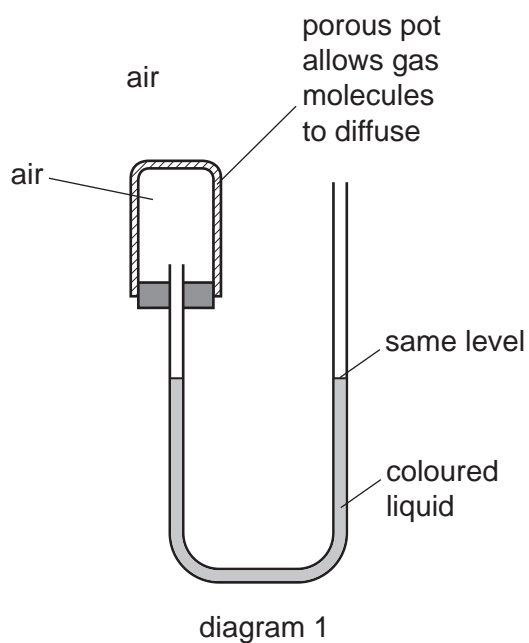
Use the ideas of the Kinetic Theory to explain why, after about an hour, the bromine molecules have spread uniformly to occupy the whole container.

.....

.....

..... [3]

- (b) The diagrams below show simple experiments on the speed of diffusion of gases.



Complete the following explanations. Diagram 1 has been done for you.

**Diagram 1**

There is air inside and outside the porous pot so the rate of diffusion of air into the pot is the same as the rate of diffusion of air out of the pot. The pressure inside and outside the pot is the same so the coloured liquid is at the same level on each side of the tube.

**Diagram 2**

.....  
.....  
.....  
..... [3]

**Diagram 3**

.....  
.....  
.....  
..... [3]

[Total: 9]

2 Cobalt is an element in Period 4 of the Periodic Table.

(a) Use your copy of the Periodic Table to help you complete the table below.

particle	number of protons	number of neutrons	number of electrons
Co			
Co <sup>2+</sup>			

[2]

(b) <sup>60</sup>Co is a cobalt isotope.

(i) Explain the term *isotope*.

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

(ii) Explain why two isotopes of the same element have identical chemical properties.

..... [1]

(iii) State **one** industrial use and **one** medical use of radioactive isotopes.

industrial use ..... [1]

medical use ..... [1]

[Total: 7]

3 The following table gives information about six substances.

substance	melting point /°C	boiling point /°C	electrical conductivity as a solid	electrical conductivity as a liquid
A	839	1484	good	good
B	-210	-196	poor	poor
C	776	1497	poor	good
D	-117	78	poor	poor
E	1607	2227	poor	poor
F	-5	102	poor	good

(a) Which substance could have a macromolecular structure, similar to that of silicon(IV) oxide?

..... [1]

(b) Which substances are solids at room temperature?

..... [1]

(c) Which substance could be a metal?

..... [1]

(d) Which substance could be aqueous sodium chloride?

..... [1]

(e) Which substance is an ionic compound?

..... [1]

(f) Which substances are liquids at room temperature?

..... [1]

[Total: 6]

4 The Kinetic Theory explains the properties of matter in terms of the arrangement and movement of particles.

(a) Nitrogen is a gas at room temperature. Nitrogen molecules,  $N_2$ , which are spread far apart move in a random manner at high speed.

(i) Draw a diagram showing the arrangement of the valency electrons in a nitrogen molecule.

Use  $\times$  to represent an electron from a nitrogen atom.

[2]

(ii) How does the movement and arrangement of the molecules in a crystal of nitrogen differ from those in gaseous nitrogen?

.....

.....

..... [3]

(b) Use the ideas of the Kinetic Theory to explain the following.

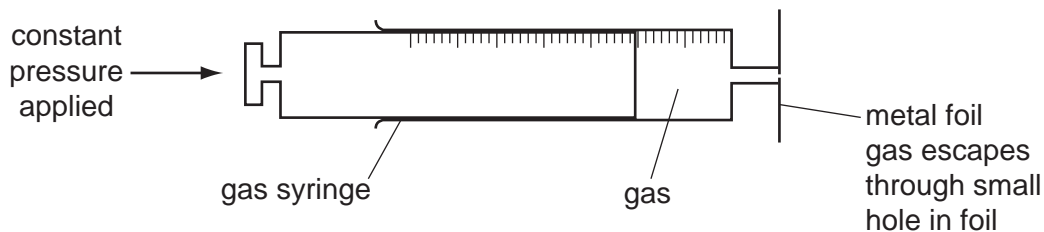
(i) A sealed container contains nitrogen gas. The pressure of a gas is due to the molecules of the gas hitting the walls of the container.

Explain why the pressure inside the container increases when the temperature is increased.

.....

..... [2]

(ii) The following apparatus can be used to measure the rate of diffusion of a gas.



The following results were obtained.

gas	temperature / °C	rate of diffusion in cm <sup>3</sup> /min
nitrogen	25	1.00
chlorine	25	0.63
nitrogen	50	1.05

Explain why nitrogen diffuses faster than chlorine.

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

Explain why the nitrogen diffuses faster at the higher temperature.

..... [1]

[Total: 10]

5 Three of the halogens in Group VII are:

chlorine  
bromine  
iodine

(a) How does their colour change down the Group?

..... [1]

(ii) How does their physical state (solid, liquid or gas) change down the Group?

..... [1]

(iii) Predict the colour and physical state of fluorine.

colour .....

physical state ..... [2]

(b) Describe how you could distinguish between aqueous potassium bromide and aqueous potassium iodide.

test .....

result with bromide .....

result with iodide ..... [3]

(c) 0.015 moles of iodine react with 0.045 moles of chlorine to form 0.030 moles of a single product. Complete the equation.



(d) Traces of chlorine can be separated from bromine vapour by diffusion.  
Which gas would diffuse the faster and why?

.....

..... [2]



- 6 Strontium and sulphur chlorides both have a formula of the type  $XCl_2$  but they have different properties.

property	strontium chloride	sulphur chloride
appearance	white crystalline solid	red liquid
melting point / °C	87	-8
particles present	ions	molecules
electrical conductivity of solid	poor	poor
electrical conductivity of liquid	good	poor

- (a) The formulae of the chlorides are similar because both elements have a valency of 2. Explain why Group II and Group VI elements both have a valency of 2.

[2]

- (b) Draw a diagram showing the arrangement of the valency electrons in one covalent molecule of sulphur chloride.  
Use x to represent an electron from a sulphur atom.  
Use o to represent an electron from a chlorine atom.

[3]

- (c) Explain the difference in electrical conductivity between the following.

- (i) solid and liquid strontium chloride

[1]

- (ii) liquid strontium chloride and liquid sulphur chloride

[1]