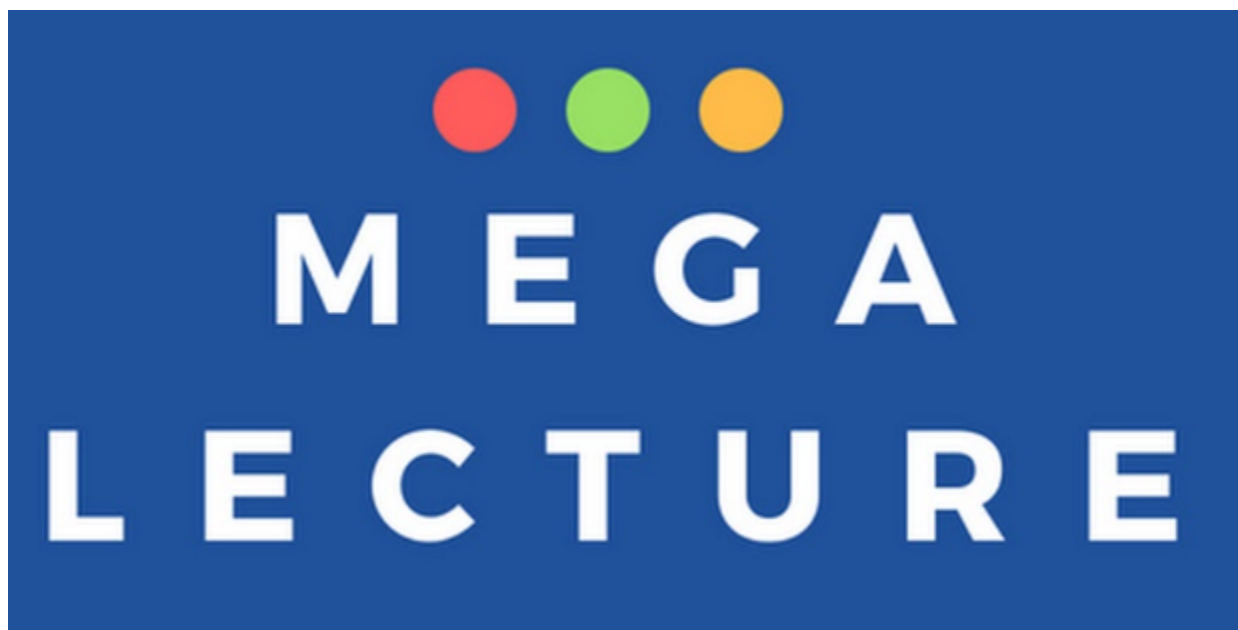




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# iGCSE & O levels

## Kinetic Particle Theory



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| Group                  |                         |                                                                                            |                         |                         |                          |                         |                          |                          |                            |                           |                           |                         |                         |                         |                           |                          |                       |                    |
|------------------------|-------------------------|--------------------------------------------------------------------------------------------|-------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|----------------------------|---------------------------|---------------------------|-------------------------|-------------------------|-------------------------|---------------------------|--------------------------|-----------------------|--------------------|
| I                      | II                      |                                                                                            |                         |                         |                          |                         |                          | III                      | IV                         | V                         | VI                        | VII                     | VIII                    |                         |                           |                          |                       |                    |
|                        |                         | <div>Key<div>atomic number<br/>atomic symbol<br/>name<br/>relative atomic mass</div></div> |                         |                         |                          |                         |                          |                          |                            |                           |                           | <div>1Hhydrogen1</div>  |                         |                         |                           |                          |                       |                    |
| 3Li<br>lithium<br>7    | 4Be<br>beryllium<br>9   |                                                                                            |                         |                         |                          |                         |                          |                          |                            |                           |                           | 5B<br>boron<br>11       | 6C<br>carbon<br>12      | 7N<br>nitrogen<br>14    | 8O<br>oxygen<br>16        | 9F<br>fluorine<br>19     | 10Ne<br>neon<br>20    | 2He<br>helium<br>4 |
| 11Na<br>sodium<br>23   | 12Mg<br>magnesium<br>24 |                                                                                            |                         |                         |                          |                         |                          |                          |                            |                           |                           | 13Al<br>aluminium<br>27 | 14Si<br>silicon<br>28   | 15P<br>phosphorus<br>31 | 16S<br>sulfur<br>32       | 17Cl<br>chlorine<br>35.5 | 18Ar<br>argon<br>40   |                    |
| 19K<br>potassium<br>39 | 20Ca<br>calcium<br>40   | 21Sc<br>scandium<br>45                                                                     | 22Ti<br>titanium<br>48  | 23V<br>vanadium<br>51   | 24Cr<br>chromium<br>52   | 25Mn<br>manganese<br>55 | 26Fe<br>iron<br>56       | 27Co<br>cobalt<br>59     | 28Ni<br>nickel<br>59       | 29Cu<br>copper<br>64      | 30Zn<br>zinc<br>65        | 31Ga<br>gallium<br>70   | 32Ge<br>germanium<br>73 | 33As<br>arsenic<br>75   | 34Se<br>selenium<br>79    | 35Br<br>bromine<br>80    | 36Kr<br>krypton<br>84 |                    |
| 37Rb<br>rubidium<br>85 | 38Sr<br>strontium<br>88 | 39Y<br>yttrium<br>89                                                                       | 40Zr<br>zirconium<br>91 | 41Nb<br>niobium<br>93   | 42Mo<br>molybdenum<br>96 | 43Tc<br>technetium<br>— | 44Ru<br>ruthenium<br>101 | 45Rh<br>rhodium<br>103   | 46Pd<br>palladium<br>106   | 47Ag<br>silver<br>108     | 48Cd<br>cadmium<br>112    | 49In<br>indium<br>115   | 50Sn<br>tin<br>119      | 51Sb<br>antimony<br>122 | 52Te<br>tellurium<br>128  | 53I<br>iodine<br>127     | 54Xe<br>xenon<br>131  |                    |
| 55Cs<br>caesium<br>133 | 56Ba<br>barium<br>137   | lanthanoids                                                                                |                         | 73Ta<br>tantalum<br>181 | 74W<br>tungsten<br>184   | 75Re<br>rhenium<br>186  | 76Os<br>osmium<br>190    | 77Ir<br>iridium<br>192   | 78Pt<br>platinum<br>195    | 79Au<br>gold<br>197       | 80Hg<br>mercury<br>201    | 81Tl<br>thallium<br>204 | 82Pb<br>lead<br>207     | 83Bi<br>bismuth<br>209  | 84Po<br>polonium<br>—     | 85At<br>astatine<br>—    | 86Rn<br>radon<br>—    |                    |
| 87Fr<br>francium<br>—  | 88Ra<br>radium<br>—     | actinoids                                                                                  |                         | 105Db<br>dubnium<br>—   | 106Sg<br>seaborgium<br>— | 107Bh<br>bohrium<br>—   | 108Hs<br>hassium<br>—    | 109Mt<br>meitnerium<br>— | 110Ds<br>darmstadtium<br>— | 111Rg<br>roentgenium<br>— | 112Cn<br>copernicium<br>— |                         | 114Fl<br>flerovium<br>— |                         | 116Lv<br>livermorium<br>— |                          |                       |                    |

The volume of one mole of any gas is  $24\text{ dm}^3$  at room temperature and pressure (r.t.p.).



# IGCSE Chemistry Topical Paper 4      Topic 1 : The Particulate Nature of Matter

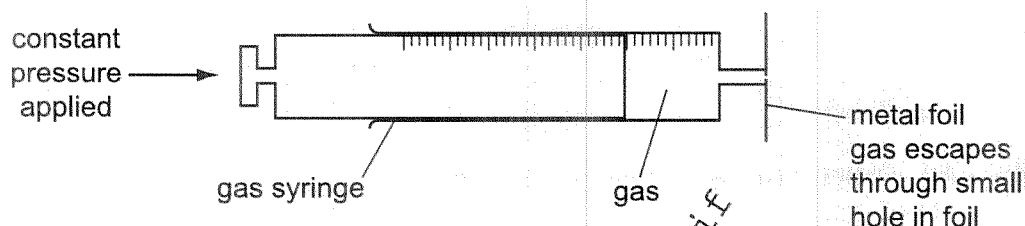
[0620/33/O/N/10/Q6-B]

**Q1. (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.

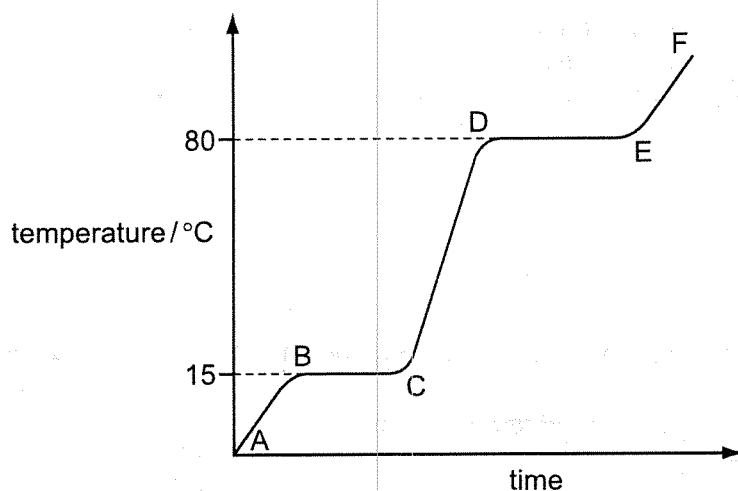
[1]



**IGCSE Chemistry Topical Paper 4      Topic 1 : The Particulate Nature of Matter**

[0620/32/O/N/12/Q2]

**Q2.** The diagram shows a heating curve for a sample of compound X.



(a) Is X a solid, a liquid or a gas at room temperature, 20°C?

..... [1]

(b) Write an equation for the equilibrium which exists in region BC.

..... [2]

(c) Name the change of state which occurs in region DE.

..... [1]

(d) Explain how the curve shows that a pure sample of compound X was used.

.....

..... [2]

[Total: 6]



IGCSE Chemistry Topical Paper 4      Topic 1 : The Particulate Nature of Matter

[0620/31/M/J/14/Q3-A-B]

Q3.

(a) Different gases diffuse at different speeds.

(i) What is meant by the term *diffusion*?

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

(ii) What property of a gas molecule affects the speed at which it diffuses?

..... [1]

(b) Helium is a gas used to fill balloons. It is present in the air in very small quantities. Diffusion can be used to separate it from the air.

Air at 1000 °C is on one side of a porous barrier. The air which passes through the barrier has a larger amount of helium in it.

(i) Why does the air on the other side of the barrier contain more helium?

..... [1]

(ii) Why is it an advantage to have the air at a high temperature?

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

Compiled By : Salim Attia



**IGCSE Chemistry Topical Paper 4      Topic 1 : The Particulate Nature of Matter**

[0620/33/M/J/14/Q2]

**Q4.**

Explain each of the following in terms of the kinetic particle theory.

- (a) The rate of most reactions increases at higher temperatures.

.....

.....

.....

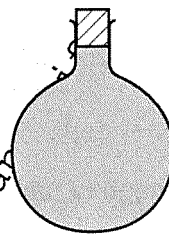
..... [3]

- (b) A liquid has a fixed volume but takes up the shape of the container. A gas takes up the shape of the container but it does not have a fixed volume.

liquid



gas



.....

.....

.....

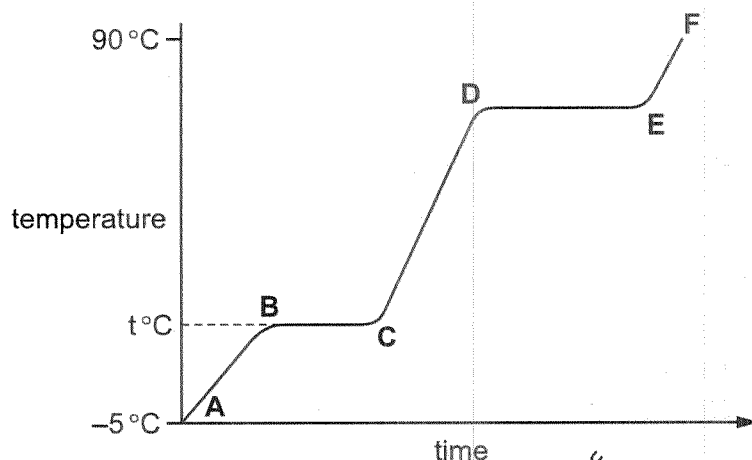
..... [3]

[Total: 6]

**Q5.**

Compound X is a colourless liquid at room temperature.

- (a) A sample of pure X was slowly heated from  $-5.0^{\circ}\text{C}$ , which is below its melting point, to  $90^{\circ}\text{C}$ , which is above its boiling point. Its temperature is measured every minute and the results are represented on the graph.



- (i) Complete the equation for the equilibrium present in the region **BC**.



[1]

- (ii) What is the significance of temperature  $t^{\circ}\text{C}$ ?

[1]

- (iii) What is the physical state of compound X in the region **EF**?

[1]

- (iv) What would be the difference in the region **BC** if an impure sample of X had been used?

[1]

**IGCSE Chemistry Topical Paper 4 Topic 1 : The Particulate Nature of Matter**

[0620/31/M/J/15/Q6-C]

**Q6.**

(c) Gases diffuse, which means that they move to occupy the total available volume.

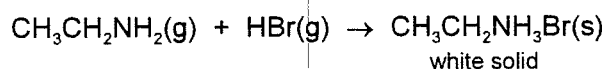
(i) Explain, using kinetic particle theory, why gases diffuse.

.....

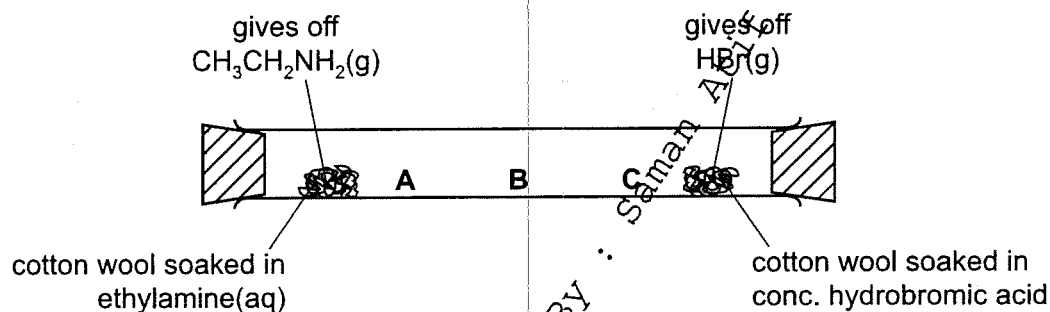
.....

..... [2]

(ii) When the colourless gases hydrogen bromide and ethylamine come into contact, a white solid is formed.



The following apparatus can be used to compare the rates of diffusion of the two gases ethylamine and hydrogen bromide.



Predict at which position, A, B or C, the white solid will form. Explain your choice.

.....

.....

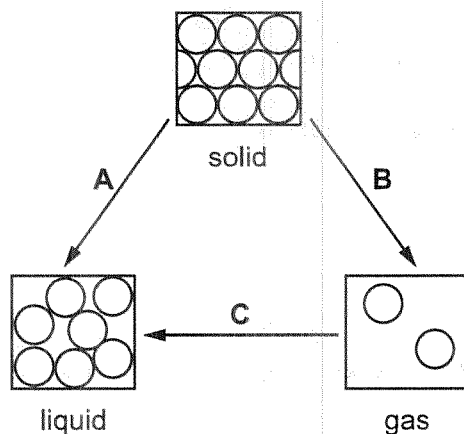
..... [3]



# IGCSE Chemistry Topical Paper 4      Topic 1 : The Particulate Nature of Matter

[0620/41/O/N/16/Q2]

**Q7.** Matter can exist as solid, liquid or gas. The arrows show some changes of state.



(a) Name the changes of state represented on the diagram.

(i) A ..... [1]

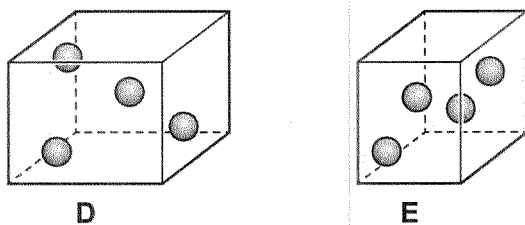
(ii) B ..... [1]

(iii) C ..... [1]

(b) Explain why energy has to be supplied to turn a liquid into a gas.

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

(c) The diagrams represent the same number of particles of a gas in two containers, D and E, which have different volumes. The two containers are at the same temperature.



In which container will the pressure be higher? Explain your answer.

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

[Total: 5]





Q8. Particles behave differently when in different physical states.

- (a) Solids have a fixed volume and a definite shape.  
Gases have no fixed volume and take the shape of the container.

Describe the volume and shape of liquids.

.....

..... [1]

- (b) Complete the table to show the separation, arrangement and movement of particles in each physical state.

| state  | separation of particles | arrangement of particles | movement of particles |
|--------|-------------------------|--------------------------|-----------------------|
| solid  |                         |                          |                       |
| liquid | touching one another    | randomly arranged        | move over one another |
| gas    |                         |                          |                       |

[6]

- (c) Name the following changes of state.

- (i) Ice turning into water.

..... [1]

- (ii) Solid carbon dioxide turning directly into gaseous carbon dioxide at room temperature.

..... [1]

[Total: 9]

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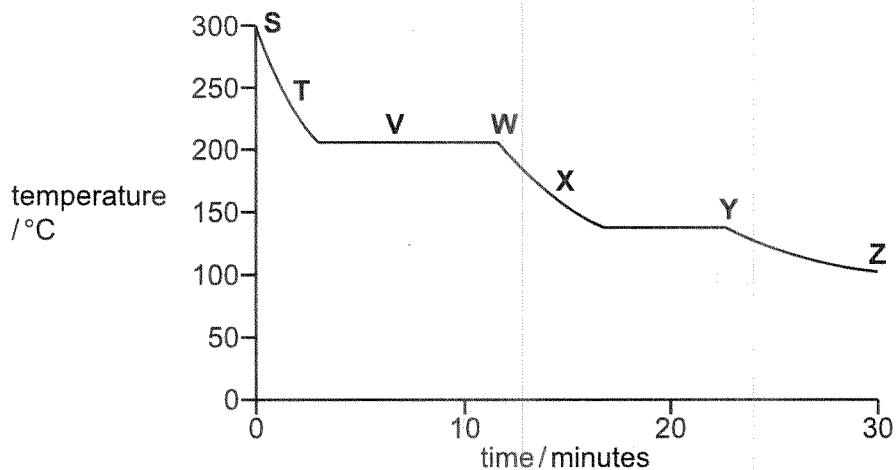
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Q9.

The graph shows how the temperature of a substance changes as it is cooled over a period of 30 minutes. The substance is a gas at the start.



Each letter on the graph may be used once, more than once or not at all.

(a) Which letter, S, T, V, W, X, Y or Z, shows when

(i) the particles in the substance have the most kinetic energy,

..... [1]

(ii) the particles in the substance are furthest apart,

..... [1]

(iii) the substance exists as both a gas and a liquid?

..... [1]

(b) Use the graph to estimate the freezing point of the substance.

..... °C [1]

(c) Name the change of state directly from a solid to a gas.

..... [1]

(d) When smoke is viewed through a microscope, the smoke particles in the air appear to jump around.

(i) What term describes this movement of the smoke particles?

..... [1]

(ii) Explain why the smoke particles move in this way.

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

[Total: 8]

# IGCSE Chemistry Topical Paper 4      Topic 1 : The Particulate Nature of Matter

[0620/42/O/N/17/Q1]

**Q10.**

(a) Dust particles in the air move around in a random way.

(i) What term describes the random movement of the dust particles?

..... [1]

(ii) Identify the particles in the air which cause the random movement of the dust particles.

..... [2]

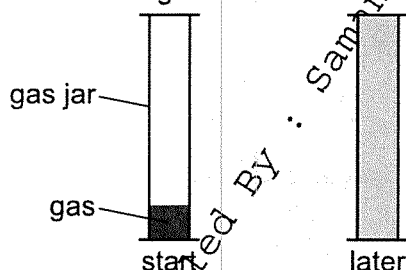
(iii) Explain why the dust particles move in this way.

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

(b) When chlorine gas,  $Cl_2$ , is put into a gas jar, it spreads out to fill the gas jar.

When bromine gas,  $Br_2$ , is put into a gas jar, it also spreads out to fill the gas jar.

The process takes longer for bromine gas than for chlorine gas.



(i) What term describes the way that the gas particles spread out?

..... [1]

(ii) Use **data** from the Periodic Table to explain why bromine gas takes longer to fill a gas jar than chlorine gas.

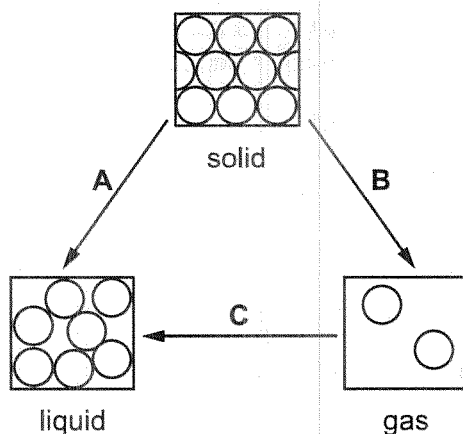
.....  
 .....  
 ..... [2]

(iii) Explain why increasing the temperature increases the rate at which the gas particles spread out.

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



**Q7.** Matter can exist as solid, liquid or gas. The arrows show some changes of state.



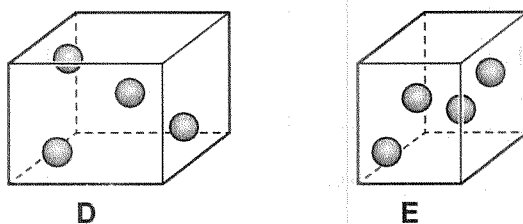
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(c) The diagrams represent the same number of particles of a gas in two containers, D and E, which have different volumes. The two containers are at the same temperature.



In which container will the pressure be higher? Explain your answer.

..... [1]

[Total: 5]

**IGCSE Chemistry Topical Paper 4      Topic 1 : The Particulate Nature of Matter**

[0620/42/O/N/16/Q1]

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- (b) Complete the table to show the separation, arrangement and movement of particles in each physical state.

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|--------|-------------------------|--------------------------|-----------------------|
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| liquid | touching one another    | randomly arranged        | move over one another |
| gas    |                         |                          |                       |

[6]

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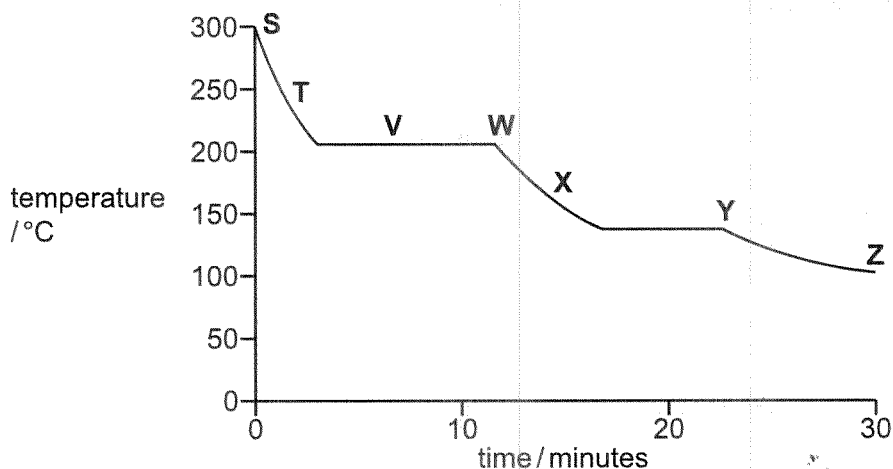
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[Total: 9]

Q9.

The graph shows how the temperature of a substance changes as it is cooled over a period of 30 minutes. The substance is a gas at the start.



Each letter on the graph may be used once, more than once or not at all.

(a) Which letter, S, T, V, W, X, Y or Z, shows when

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..... [1]

(ii) the particles in the substance are furthest apart,

..... [1]

(iii) the substance exists as both a gas and a liquid?

..... [1]

(b) Use the graph to estimate the freezing point of the substance.

..... °C [1]

(c) Name the change of state directly from a solid to a gas.

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

[Total: 8]

[0620/42/O/N/17/Q1]

Q10.

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..... [1]

(ii) Identify the particles in the air which cause the random movement of the dust particles.

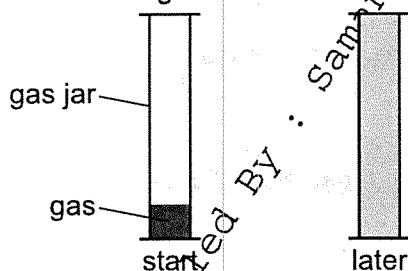
..... [2]

(iii) Explain why the dust particles move in this way.

..... [2]

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The process takes longer for bromine gas than for chlorine gas.



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..... [1]

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..... [2]

(iii) Explain why increasing the temperature increases the rate at which the gas particles spread out.

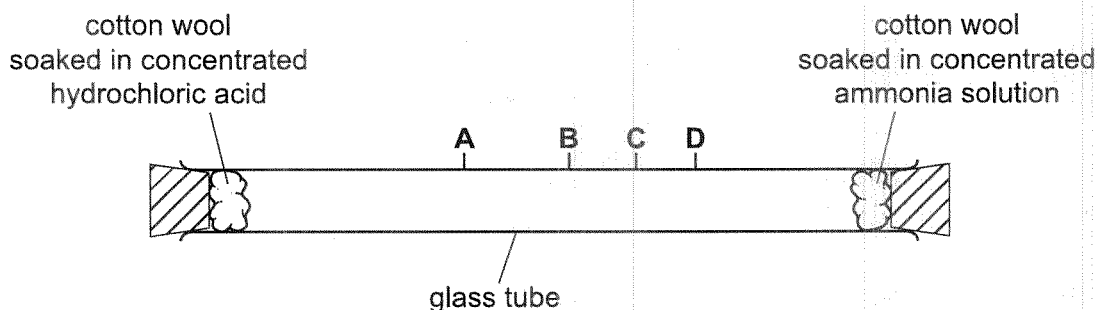
..... [1]



Q11.

Concentrated ammonia solution gives off ammonia gas. Concentrated hydrochloric acid gives off hydrogen chloride gas. Ammonia,  $\text{NH}_3$ , and hydrogen chloride,  $\text{HCl}$ , are both colourless gases. Ammonia reacts with hydrogen chloride to make the white solid ammonium chloride.

Apparatus is set up as shown.



After ten minutes a white solid forms in the tube where the gases meet.

(a) (i) Write the chemical equation for the reaction of ammonia with hydrogen chloride.

..... [1]

(ii) Name the process by which the ammonia and hydrogen chloride gases move in the tube.

..... [1]

(iii) At which point, A, B, C or D, does the white solid form? Explain why the white solid forms at that point.

the solid forms at .....

explanation .....

..... [3]

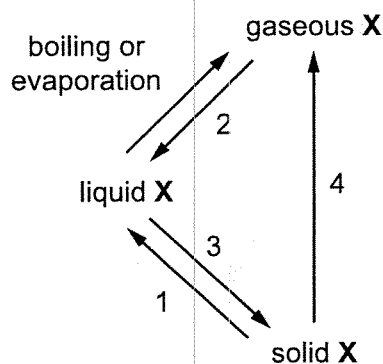
(iv) The experiment was repeated at a higher temperature.

Predict how the results of the experiment would be different. Explain your answer.

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

Q12:

Element X can undergo the following physical changes.



(a) (i) Give the scientific name for each of the numbered physical changes.

- 1 .....  
 2 .....  
 3 .....  
 4 .....

[4]

(ii) Explain why the changes shown are physical changes.

- .....  
 ..... [1]

(iii) One difference between boiling and evaporation is the rate at which the processes occur.  
 State **one** other difference between boiling and evaporation.

- .....  
 ..... [1]

(b) Describe the separation, arrangement and motion of particles of element X in the solid state.

- separation .....  
 arrangement .....  
 motion .....

[3]

Q13.

- (d) In terms of particles, explain what happens to the rate of this reaction when the temperature is increased.

.....

.....

.....

.....

.....

[3]

Compiled By : Saman Atif

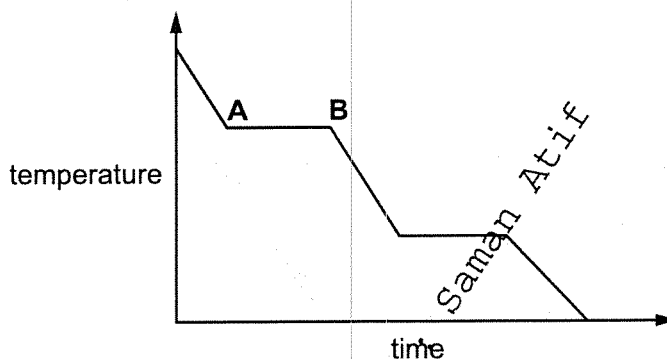
Q14.

(a) Complete the table about solids, liquids and gases.

|        | particle separation | particle arrangement | type of motion |
|--------|---------------------|----------------------|----------------|
| solid  |                     | regular              | vibrate only   |
| liquid | touching            |                      | random         |
| gas    | apart               | random               |                |

[3]

(b) The graph shows the change in temperature as a sample of a gas is cooled.



Name the change of state taking place between A and B.

[1]

(c) A bottle of liquid perfume is left open at the front of a room.

After some time, the perfume is smelt at the back of the room.

Name the **two** physical processes taking place.

1 .....

2 .....

[2]

[Total: 6]

[0620/33/O/N/12/Q3]

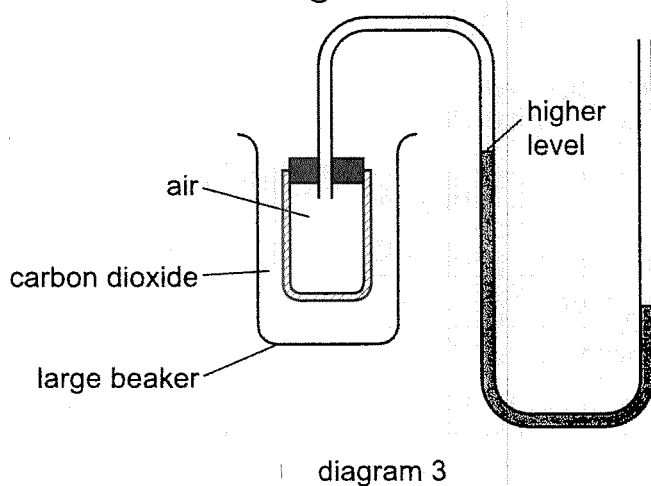
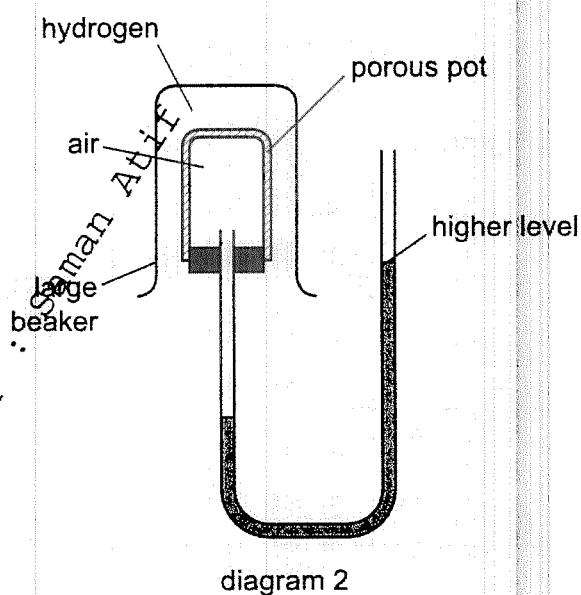
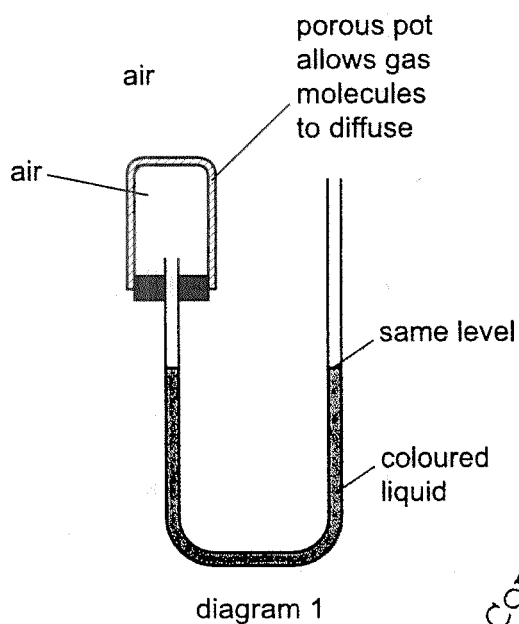
**Q1.(a)** A small amount of liquid bromine is added to a container which is then sealed.



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]

[0620/33/M/J/14/Q5-D]

**Q2.**

- (d) The equilibrium mixture leaving the reaction chamber contains 15% ammonia. Suggest how the ammonia could be separated from the mixture.

|          | boiling point/°C |
|----------|------------------|
| hydrogen | –253             |
| nitrogen | –196             |
| ammonia  | –33              |

.....

..... [2]



IGCSE Chemistry Topical Paper 4      Topic 1 : The Particulate Nature of Matter

|        |                                |          |       |
|--------|--------------------------------|----------|-------|
| Page 4 | Mark Scheme: Teachers' version | Syllabus | Paper |
|        | IGCSE – October/November 2010  | 0620     | 33    |

Q1.

- (b) (i) **particles/molecules** have more energy / move faster [1]  
collide harder / collide more frequently / more collisions / collide with more force (with the walls) [1]
- (ii) (1) nitrogen has smaller  $M_r$  / lighter molecules / lower density [1]  
nitrogen **molecules** / **particles** move faster (than chlorine molecules) [1]
- (2) at higher temperature nitrogen **molecules or particles** (not atoms) move faster / have more energy [1]

|        |                               |          |       |
|--------|-------------------------------|----------|-------|
| Page 2 | Mark Scheme                   | Syllabus | Paper |
|        | IGCSE – October/November 2012 | 0620     | 32    |

Q2.

- (a) liquid; [1]
- (b) (l) and (s); [1]  
reversible sign; [1]  
**accept:** X in equation  
**ignore:** any compounds just look for state symbols  
must be the same compound on both sides of equation
- (c) boiling / condensation; [1]  
**accept:** evaporation or vaporisation
- (d) (in region BC) solid melts / liquid boils (in region DE); [1]  
at one / fixed / sharp / single / specific temperature; [1]

[Total: 6]





**IGCSE Chemistry Topical Paper 4      Topic 1 : The Particulate Nature of Matter**

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**Q3.**

- (a) (i) (particles) spread to fill total available volume / move from high concentration to low concentration / moves down a concentration gradient (1) [1]
- (ii) mass or  $M_r$  (1) [1]
- (b) (i) helium atoms / molecules are lighter than molecules in air or  $N_2$  and  $O_2$   
or helium is less dense than air or  $N_2$  and  $O_2$ .  
or helium diffuses (through the porous barrier) faster than air or  $N_2$  and  $O_2$ . (1) [1]
- (ii) faster rate of diffusion / molecules move faster (at high temperatures). (1) [1]

| Page 2 | Mark Scheme           | Syllabus | Paper |
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**Q4.**

- (a) any **three** from:  
particles have more energy (1)  
move faster (1)  
collide more frequently (1)  
more particles have energy greater than  $E_a$  [3]  
**guidance:** more colliding molecules have enough energy to react is worth (2)
- (b) particles move in all directions / randomly in both liquids and gases (1)
- no bonds / very weak forces between particles in gases (1)  
molecules can move apart / separate (to fill entire volume) (1)  
**OR**  
bonds / forces / IMF between particles in liquids (1)  
molecules cannot move apart / separate (so fixed volume in liquids) (1) [3]

[Total: 6]

| Page 2 | Mark Scheme                             | Syllabus | Paper |
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**Q5.**

- (a) (i)  $(X(s) \leftrightarrow X(l))$  [1]
- (ii) melting point / freezing point (of X) [1]
- (iii) gas / gaseous or vapour [1]
- (iv) not horizontal or line slopes or line is lower [1]



# IGCSE Chemistry Topical Paper 4      Topic 1 : The Particulate Nature of Matter

Q6.

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|          |                                                                                                                                                                          |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |                                                                                                                                                                          |  | oxide                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 6(c)(i)  | Any <b>two</b> from:<br>(particles move in) random motion;<br><br>(particles) collide;<br><br>(particles) move from a region of high concentration to low concentration; |  | A alternative phrases for collide<br><br>2 A down a concentration gradient                                                                                                                                                                                                                                                                                                                                                                             |
| 6(c)(ii) | C;<br>M2 it has a lower (relative) molecular mass (than HBr);<br><br>M3 ethylamine diffuses faster (than HBr);                                                           |  | A ethylamine is less dense<br>A ethylamine is a lighter molecule but<br>I 'ethylamine is lighter'<br>3 I ethylamine is a smaller molecule<br>A ethylamine <b>molecules</b> or <b>particles</b><br>move faster<br><br>A ECF for M2 and M3 if A is given e.g.<br>HBr diffuses faster for M3 because it is a<br>lighter molecule for M2<br>A ECF for M2 if B is given e.g. they diffuse<br>at same rate for M3 because molecules<br>weigh the same for M2 |

Q7.

| Page 2 | Mark Scheme                             | Syllabus | Paper |
|--------|-----------------------------------------|----------|-------|
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|           |                                                                    |  |   |
|-----------|--------------------------------------------------------------------|--|---|
| 2(a)(i)   | melt(ing)                                                          |  | 1 |
| 2(a)(ii)  | sublimation / sublime                                              |  | 1 |
| 2(a)(iii) | condensing / condensation                                          |  | 1 |
| 2(b)      | overcome / break the attractive forces                             |  | 1 |
| 2(c)      | <b>E AND</b> particles hit the walls (of the container) more often |  | 1 |

| Page 2 | Mark Scheme                             | Syllabus | Paper |
|--------|-----------------------------------------|----------|-------|
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Q8.

|          |                                                                                                                                                                                                                                      |         |          |         |         |        |  |  |  |     |              |        |        |  |   |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----------|---------|---------|--------|--|--|--|-----|--------------|--------|--------|--|---|
| 1(a)     | fixed volume <b>AND</b> take the shape of the container                                                                                                                                                                              |         | 1        |         |         |        |  |  |  |     |              |        |        |  |   |
| 1(b)     | <table border="1"> <tr> <td>solid</td><td>touching</td><td>regular</td><td>vibrate</td></tr> <tr> <td>liquid</td><td></td><td></td><td></td></tr> <tr> <td>gas</td><td>not touching</td><td>random</td><td>random</td></tr> </table> | solid   | touching | regular | vibrate | liquid |  |  |  | gas | not touching | random | random |  | 6 |
| solid    | touching                                                                                                                                                                                                                             | regular | vibrate  |         |         |        |  |  |  |     |              |        |        |  |   |
| liquid   |                                                                                                                                                                                                                                      |         |          |         |         |        |  |  |  |     |              |        |        |  |   |
| gas      | not touching                                                                                                                                                                                                                         | random  | random   |         |         |        |  |  |  |     |              |        |        |  |   |
| 1(c)(i)  | melting                                                                                                                                                                                                                              |         | 1        |         |         |        |  |  |  |     |              |        |        |  |   |
| 1(c)(ii) | sublimation                                                                                                                                                                                                                          |         | 1        |         |         |        |  |  |  |     |              |        |        |  |   |



# IGCSE Chemistry Topical Paper 4      Topic 1 : The Particulate Nature of Matter

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**Q9.**

|           |                                                                                      |   |
|-----------|--------------------------------------------------------------------------------------|---|
| 2(a)(i)   | S                                                                                    | 1 |
| 2(a)(ii)  | S                                                                                    | 1 |
| 2(a)(iii) | V                                                                                    | 1 |
| 2(b)      | any value in the range 130–145 °C                                                    | 1 |
| 2(c)      | sublimation                                                                          | 1 |
| 2(d)(i)   | Brownian motion                                                                      | 1 |
| 2(d)(ii)  | nitrogen / oxygen / carbon dioxide / air molecules hit / bombard the smoke particles | 1 |
|           | (the bombarding particles) move randomly                                             | 1 |

0620/42

Cambridge IGCSE – Mark Scheme  
PUBLISHED

October/November  
2017

**Q10.**

|           |                                                                                                                                                                               |   |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 1(a)(i)   | Brownian (motion)                                                                                                                                                             | 1 |
| 1(a)(ii)  | molecules                                                                                                                                                                     | 1 |
|           | nitrogen / N <sub>2</sub> / N OR oxygen / O <sub>2</sub> / O                                                                                                                  | 1 |
| 1(a)(iii) | nitrogen OR oxygen (particles) collide with / bombard / hit the dust (particles)                                                                                              | 1 |
|           | (the bombarding particles) move randomly                                                                                                                                      | 1 |
| 1(b)(i)   | diffusion                                                                                                                                                                     | 1 |
| 1(b)(ii)  | Br <sub>2</sub> has an M <sub>r</sub> of 160 AND Cl <sub>2</sub> has an M <sub>r</sub> of 71 / bromine has an A <sub>r</sub> of 80 AND chlorine has an A <sub>r</sub> of 35.5 | 1 |
|           | (heavier) bromine (molecules / particles) diffuses more slowly                                                                                                                | 1 |
| 1(b)(iii) | particles have more energy / move faster                                                                                                                                      | 1 |

|        |                                 |          |       |
|--------|---------------------------------|----------|-------|
| Page 9 | Mark Scheme                     | Syllabus | Paper |
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**Q11.**

|           |                                                                                                 |   |
|-----------|-------------------------------------------------------------------------------------------------|---|
| 6(a)(i)   | NH <sub>3</sub> + HCl → NH <sub>4</sub> Cl;                                                     | 1 |
| 6(a)(ii)  | diffusion;                                                                                      | 1 |
| 6(a)(iii) | solid forms at A;                                                                               | 1 |
|           | explanation: ammonia molecules / particles have a smaller mass; (and so) move / diffuse faster; | 2 |
| 6(a)(iv)  | M1 solid forms in less time / faster / quicker;                                                 | 1 |
|           | M2 particles / molecules have more energy;                                                      | 1 |
|           | M3 (and so) move faster / diffuse faster;                                                       | 1 |



IGCSE Chemistry Topical Paper 4      Topic 1 : The Particulate Nature of Matter

0620/42

Cambridge IGCSE – Mark Scheme  
PUBLISHED

October/November 2018

Q12.

| Question  | Answer                                                                                              | Marks |
|-----------|-----------------------------------------------------------------------------------------------------|-------|
| 1(a)(i)   | M1 Melting<br>M2 Condensing<br>M3 Freezing<br>M4 Sublimation                                        | 4     |
| 1(a)(ii)  | No new substances are made<br>or<br>The change can be reversed (by a physical process)              | 1     |
| 1(a)(iii) | Boiling happens at a specific temperature<br>or<br>Evaporation happens over a range of temperatures | 1     |
| 1(b)      | M1 Separation: Touching<br>M2 Arrangement: Regular<br>M3 Movement: Vibrate                          | 3     |

0620/42

Cambridge IGCSE – Mark Scheme  
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May/June 2020

Q13.

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                | Marks |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 4(d)     | particles gain kinetic energy / particles move faster (1)<br>greater number of collisions with activation energy (or more) / greater number of particles with activation energy (or more) / greater number of particles with energy required for reaction (1)<br>more collisions are successful / more collisions are fruitful / more collisions lead to reaction (1) | 3     |

0620/43

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Q14.

| Question | Answer                   |                     |                      |                | Marks |
|----------|--------------------------|---------------------|----------------------|----------------|-------|
| 5(a)     |                          | particle separation | particle arrangement | type of motion | 3     |
|          | solid                    | touching            |                      |                |       |
|          | liquid                   |                     | random               |                |       |
|          | gas                      |                     |                      | random         |       |
| 5(b)     | condensing               |                     |                      |                | 1     |
| 5(c)     | evaporation<br>diffusion |                     |                      |                | 2     |



| Page 3 | Mark Scheme                   | Syllabus | Paper |
|--------|-------------------------------|----------|-------|
|        | IGCSE – October/November 2012 | 0620     | 33    |

## Q1.

- (a) explanation of evaporation e.g. particles (or molecules) with a lot of energy leave the liquid / bromine particles break free from each other / forces or bonds between bromine molecules broken / molecules (in liquid) have weak forces holding them together / weak intermolecular forces / Van der Waals forces between molecules (don't have to be stated as weak) / (weak intermolecular forces alone scores this mark);

**allow:** particles (or molecules) of bromine escape from liquid

[1]

diffusion / diffuse / movement of particles;

[1]

explanation of diffusion involving qualified movement of molecules / particles i.e. random movement of molecules / particles move in all directions;

[1]

- (b) air more dense / heavier / higher  $M_r$  than hydrogen;

[1]

hydrogen diffuses faster (than air diffuses out);

[1]

**accept:** diffusion in is faster than out (without naming gases)

pressure inside pot is greater (than outside);

[1]

air less dense / lighter / lower  $M_r$  than carbon dioxide;

[1]

air diffuses / moves faster (than carbon dioxide);

[1]

**accept:** diffusion out is faster than in (without naming gases)

pressure inside pot less (than outside);

[1]

ORA in both parts

[Total: 9]

| Page 4 | Mark Scheme           | Syllabus | Paper |
|--------|-----------------------|----------|-------|
|        | IGCSE – May/June 2014 | 0620     | 33    |

## Q2.

- (d) lower the temperature (1)  
only ammonia will liquefy (1)  
**OR**  
add water (1)  
only ammonia will dissolve (1)  
**OR**  
increase pressure (1)  
only ammonia will liquefy (1)

[2]



# Kinetic Particle Theory - MCQs





## IGCSE Chemistry Topical Paper 2      Topic 1 : The Particulate Nature of Matter

**Q1.**

[0620/01/M/J/07/Q1]

When there is no wind, the scent of flowers can be detected more easily on a warm evening than on a cold evening.

This is because the molecules of the scent .....1..... .....2..... than in colder conditions.

Which words correctly complete gaps 1 and 2?

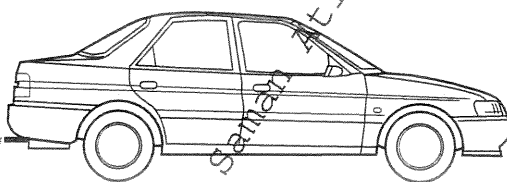
|          | gap 1    | gap 2                    |
|----------|----------|--------------------------|
| <b>A</b> | condense | nearer to the flowers    |
| <b>B</b> | condense | further from the flowers |
| <b>C</b> | diffuse  | nearer to the flowers    |
| <b>D</b> | diffuse  | further from the flowers |

**Q2.**

[0620/01/O/N/07/Q1]

Oxides of nitrogen from car exhausts can spread through the atmosphere.

car exhaust  
fumes



This occurs because gas molecules move from a region of .....1..... concentration to a region of .....2..... concentration by a process called .....3.....

Which words correctly complete the gaps?

|          | 1    | 2    | 3           |
|----------|------|------|-------------|
| <b>A</b> | high | low  | diffusion   |
| <b>B</b> | high | low  | evaporation |
| <b>C</b> | low  | high | diffusion   |
| <b>D</b> | low  | high | evaporation |

**Q3.**

[0620/01/O/N/08/Q1]

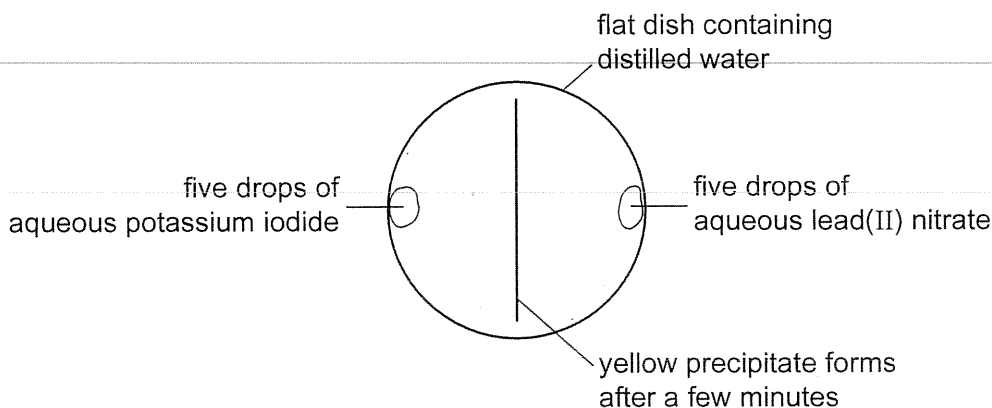
In which substance are the particles furthest apart at room temperature?

- A** ethanol
- B** methane
- C** salt
- D** sugar





**Q4.** A yellow precipitate is formed in the experiment shown.



How is the precipitate formed?

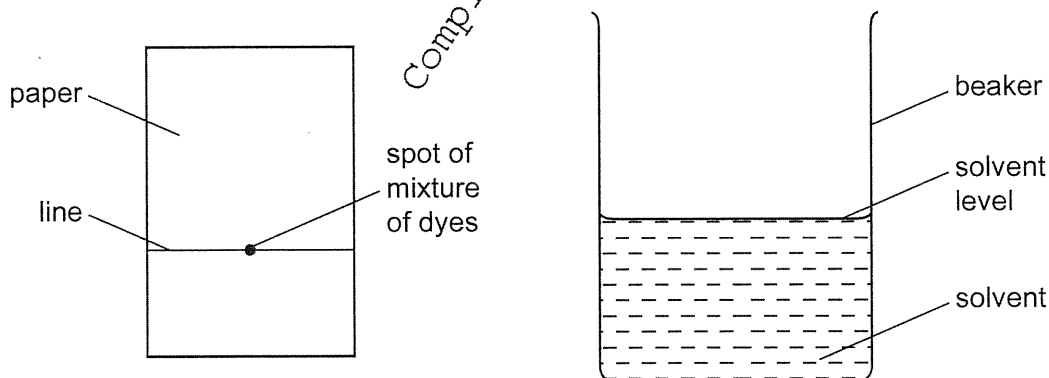
- A Particles collide, diffuse and then react.
- B Particles collide, react and then diffuse.
- C Particles diffuse, collide and then react.
- D Particles diffuse, react and then collide

Samran Atif

**Q5.**

[0620/01/O/N/08Q2]

An experiment is carried out to separate a mixture of two dyes. A line is drawn on a piece of chromatography paper and a spot of the dye mixture placed on it. The paper is dipped into a solvent and left for several minutes.



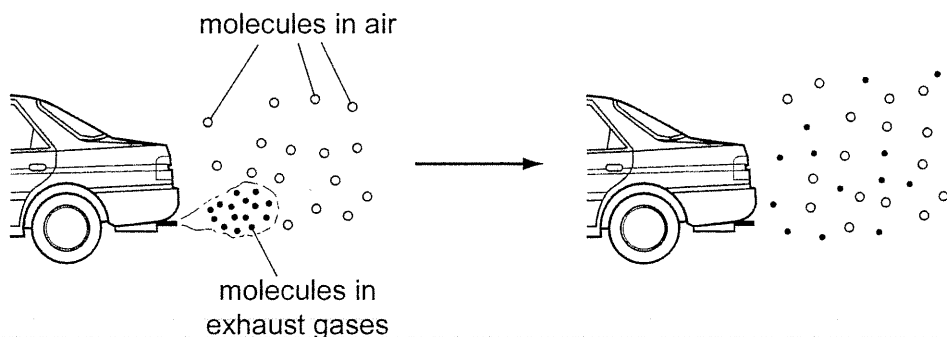
Which statement about this experiment is correct?

- A The dyes must differ in their boiling points.
- B The dyes must differ in their solubilities in the solvent.
- C The line must be drawn in ink.
- D The line must be placed below the level of the solvent.

## IGCSE Chemistry Topical Paper 2      Topic 1 : The Particulate Nature of Matter

[0620/12/M/J/09Q1]

**Q6.** The diagram shows how the molecules in the exhaust gases diffuse into the air.



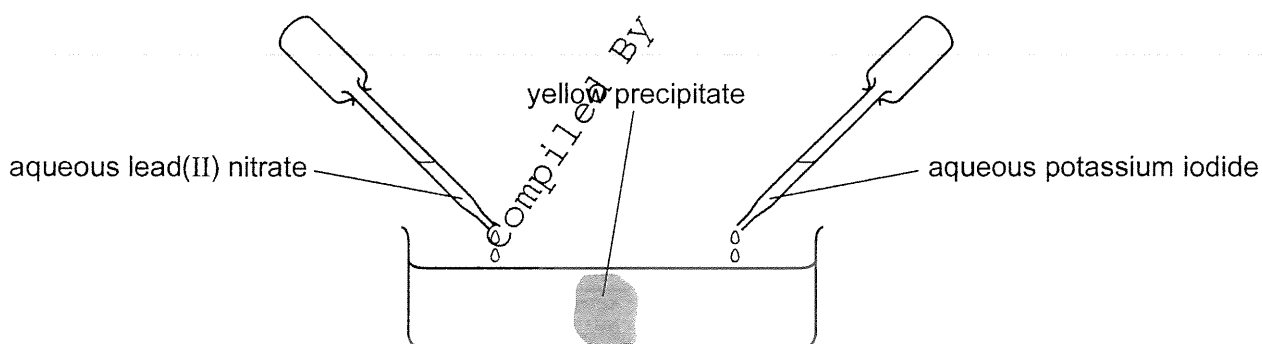
Which statement describes what happens to these molecules next?

- A The molecules fall to the ground because they are heavier than air molecules.
- B The molecules go back together as they cool.
- C The molecules spread further into the air.
- D The molecules stay where they are.

**Q7.**

[0620/12/O/N/09Q2]

Aqueous lead(II) nitrate and aqueous potassium iodide are added to a dish containing water, as shown.



A yellow precipitate forms after a few minutes.

Which process occurs before the precipitate forms?

- A diffusion
- B distillation
- C fermentation
- D filtration

Q8.

[0620/12/M/J/10/Q1]

The diagram shows a cup of tea.



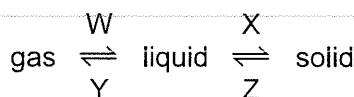
Which row describes the water particles in the air above the cup compared with the water particles in the cup?

|   | moving faster | closer together |
|---|---------------|-----------------|
| A | ✓             | ✓               |
| B | ✓             | x               |
| C | x             | ✓               |
| D | x             | x               |

[0620/12/O/N/10/Q1]

Q9.

In which changes do the particles move further apart?



A W and X

B W and Z

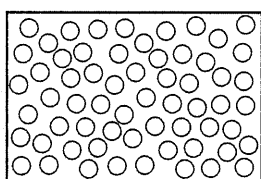
C X and Y

D Y and Z

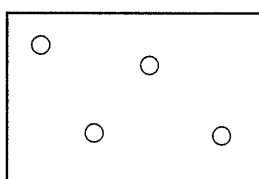
Q10.

[0620/12/M/J/11/Q1]

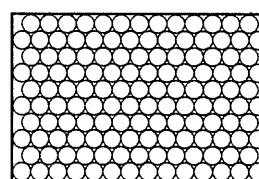
The diagrams show the arrangement of particles in three different physical states of substance X.



state 1



state 2



state 3

Which statement about the physical states of substance X is correct?

A Particles in state 1 vibrate about fixed positions.

B State 1 changes to state 2 by diffusion.

C State 2 changes directly to state 3 by condensation.

D The substance in stage 3 has a fixed volume.

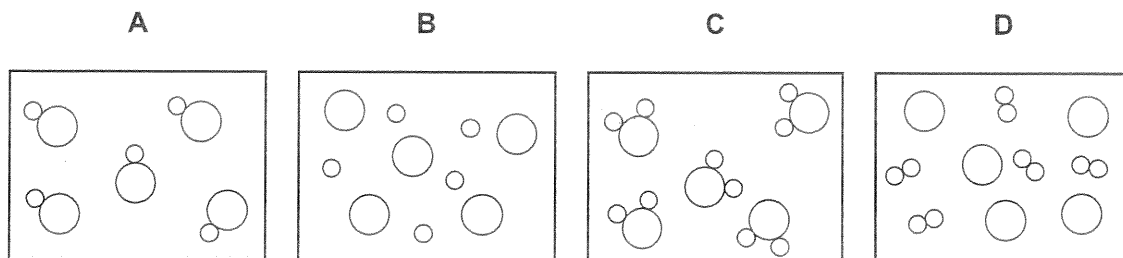
# IGCSE Chemistry Topical Paper 2      Topic 1 : The Particulate Nature of Matter

[0620/12/M/J/11/Q2]

Q11.

In the diagrams, circles of different sizes represent atoms of different elements.

Which diagram represents hydrogen chloride gas?



Q12.

[0620/12/O/N/11/Q1]

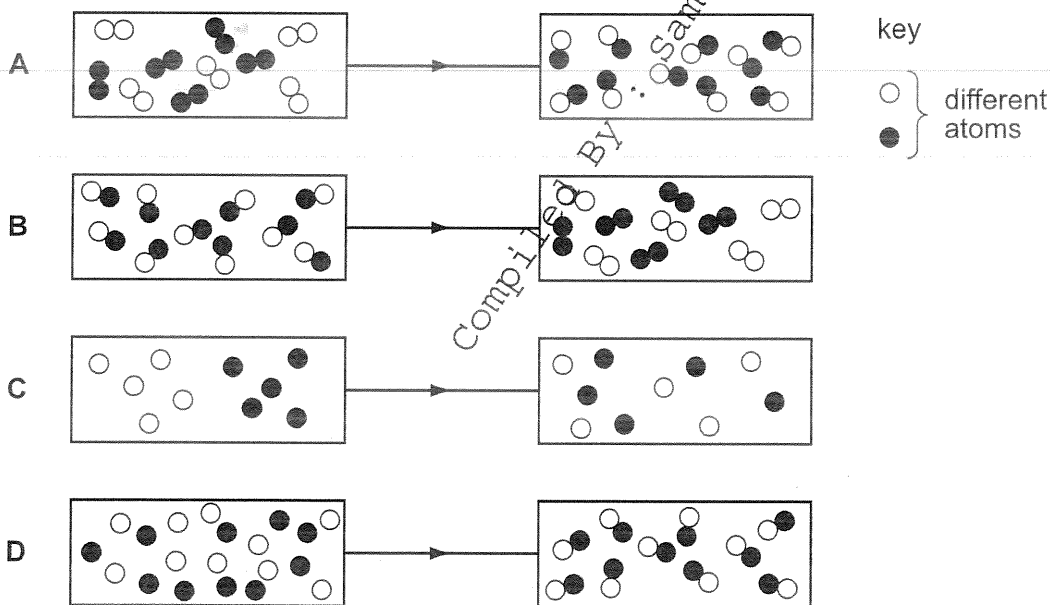
In which substance are the particles close together and slowly moving past each other?

- A air
- B ice
- C steam
- D water

Q13.

[0620/11/M/J/12/Q1]

Which diagram shows the process of diffusion?



Q14.

[0620/13/O/N/12/Q1]

'Particles moving **very slowly** from an area of high concentration to an area of low concentration.'

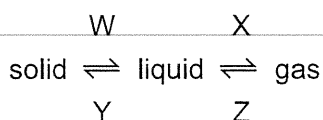
Which process is being described above?

- A a liquid being frozen
- B a solid melting
- C a substance diffusing through a liquid
- D a substance diffusing through the air

[0620/12/O/N/12/Q1]

Q15.

What are the processes W, X, Y and Z in the following diagram?



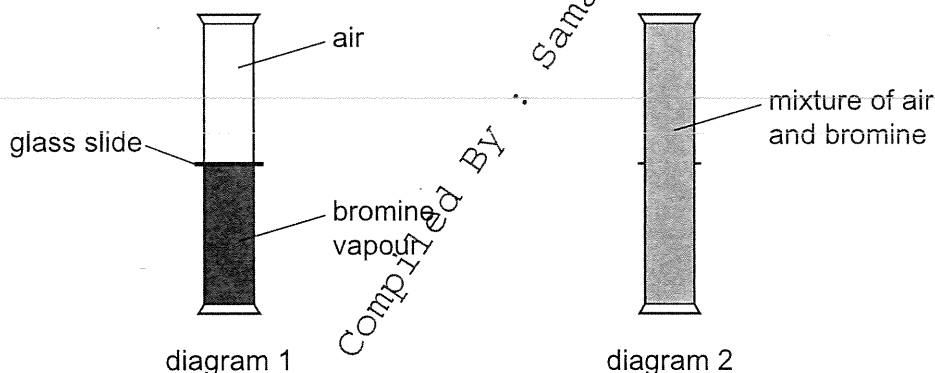
|   | W          | X        | Y          | Z          |
|---|------------|----------|------------|------------|
| A | condensing | boiling  | freezing   | melting    |
| B | condensing | freezing | melting    | boiling    |
| C | melting    | boiling  | freezing   | condensing |
| D | melting    | freezing | condensing | boiling    |

[0620/13/O/N/13/Q1]

Q16.

A gas jar of bromine vapour and a gas jar of air are set up as shown in diagram 1.

The glass slide is removed. Diagram 2 shows the appearance of the gas jars after one hour.



Which statement explains why the bromine and air mix together?

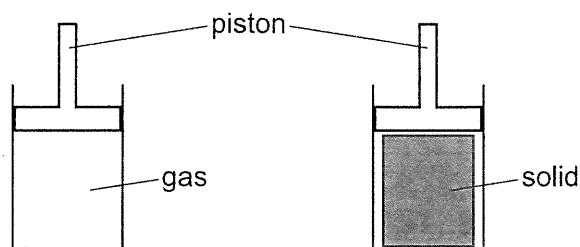
- A Bromine is denser than air.
- B Bromine is lighter than air.
- C Bromine molecules moved upwards and molecules in air moved downwards.
- D Molecules in bromine and air moved randomly.

## IGCSE Chemistry Topical Paper 2      Topic 1 : The Particulate Nature of Matter

[0620/12/O/N/13/Q1]

**Q17.**

An attempt was made to compress a gas and a solid using the apparatus shown.



Which substance would be compressed and what is the reason for this?

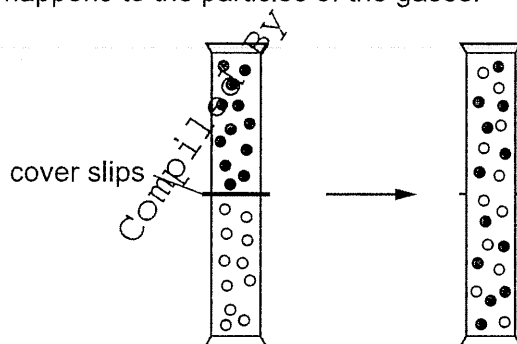
|          | substance | reason                                 |
|----------|-----------|----------------------------------------|
| <b>A</b> | gas       | the gas particles are close together   |
| <b>B</b> | gas       | the gas particles are far apart        |
| <b>C</b> | solid     | the solid particles are close together |
| <b>D</b> | solid     | the solid particles are far apart      |

0620/12/M/J/14/Q1]

**Q18.**

Two gas jars each contain a different gas. The gas jars are connected and the cover slips are removed.

The diagram shows what happens to the particles of the gases.



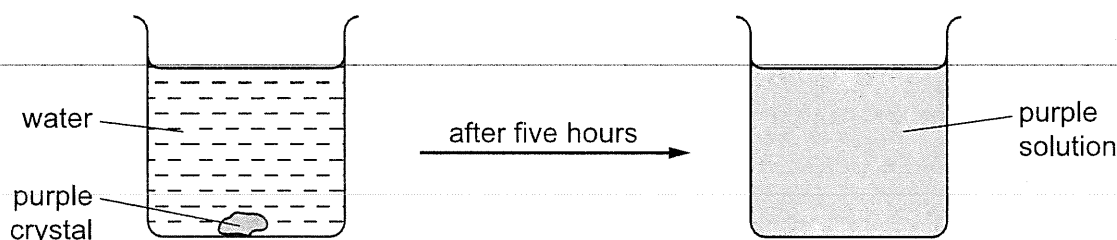
Which process has occurred?

- A** chemical reaction
- B** condensation
- C** diffusion
- D** evaporation

**Q19.**

[0620/11/M/J/[14/Q1]

The diagram shows the result of dropping a purple crystal into water.



Which processes take place in this experiment?

|          | chemical reaction | diffusing | dissolving |
|----------|-------------------|-----------|------------|
| <b>A</b> | ✓                 | ✓         | ✓          |
| <b>B</b> | ✓                 | x         | ✓          |
| <b>C</b> | x                 | x         | ✓          |
| <b>D</b> | x                 | ✓         | ✓          |

**Q20.**

[0620/13/O/N/14/Q1]

A few drops of perfume were spilt on the floor. A few minutes later the perfume could be smelt a few metres away.

Which two processes had taken place?

- A** distillation and condensation
- B** distillation and diffusion
- C** evaporation and condensation
- D** evaporation and diffusion

**Q21.**

[0620/12/O/N/14/Q2]

Which statement is an example of diffusion?

- A** A kitchen towel soaks up some spilt milk.
- B** Ice cream melts in a warm room.
- C** Pollen from flowers is blown by the wind.
- D** The smell of cooking spreads through a house.



# IGCSE Chemistry Topical Paper 2      Topic 1 : The Particulate Nature of Matter

[0620/11/O/N/14/Q1]

**Q22.** Which statement is an example of diffusion?

- A A kitchen towel soaks up some spilt milk.
- B Ice cream melts in a warm room.
- C Pollen from flowers is blown by the wind.
- D The smell of cooking spreads through a house.

[0620/13/M/J/15/Q1]

**Q23.** A sugar cube is dropped into a hot cup of tea.

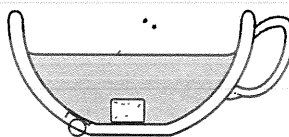
The tea is not stirred.

Which statement explains why the tea becomes sweet?

- A The heated water molecules penetrate the sugar cube.
- B The hot tea causes the sugar to melt.
- C The sugar cube dissolves and its molecules diffuse.
- D The sugar molecules get hot and evaporate.

[0620/12/M/J/15/Q1]

**Q24.** The diagram shows a sugar lump in a cup of tea.



Which two processes must happen to spread the sugar evenly in the tea?

|   | first process | second process |
|---|---------------|----------------|
| A | diffusion     | dissolving     |
| B | dissolving    | diffusion      |
| C | dissolving    | melting        |
| D | melting       | diffusion      |

[0620/13/O/N/15/Q1]

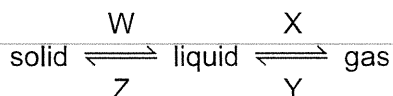
**Q25.** In which process do particles move closer together but remain in motion?

- A condensation
- B diffusion
- C evaporation
- D freezing



[0620/11/M/J/15/Q1]

**Q26.** The changes that occur when a substance changes state are shown below.



Which process, W, X, Y or Z, is occurring in the following four situations?

- 1 Butter melts on a warm day.
- 2 Water condenses on a cold surface.
- 3 The volume of liquid ethanol in an open beaker reduces.
- 4 Ice forms inside a freezer.

|   | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| A | W | X | Y | Z |
| B | W | Y | X | Z |
| C | X | Y | Z | W |
| D | X | Z | Y | W |

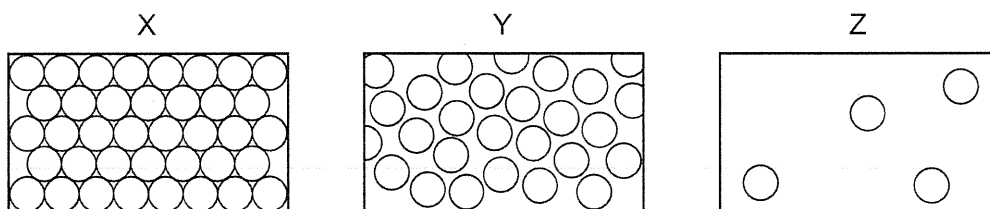
[0620/12/O/N/15/Q1]

**Q27.** Which change of state takes place during evaporation?

- A gas to liquid
- B liquid to gas
- C liquid to solid
- D solid to gas

[0620/11/O/N/15/Q1]

**Q28.** Diagrams X, Y and Z represent the three states of matter.



Which change occurs during boiling?

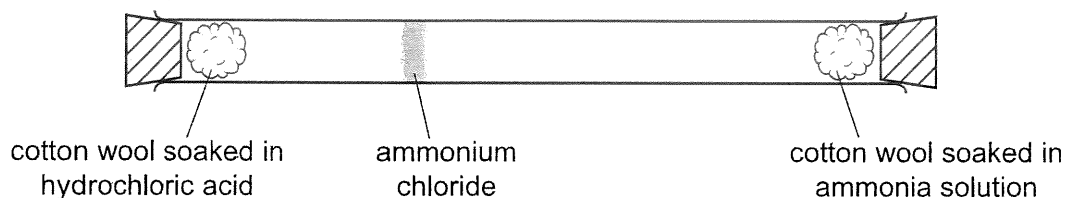
- A X to Y
- B Y to Z
- C Z to X
- D Z to Y

**IGCSE Chemistry Topical Paper 2      Topic 1 : The Particulate Nature of Matter**

**Q29.**

[0620/23/M/J/16/Q1]

The diagram shows an experiment to demonstrate diffusion.



Which statement explains why the ring of ammonium chloride appears as shown?

- A** Ammonia solution only produces a gas which moves until it meets the hydrochloric acid.
- B** Both solutions produce a gas, but ammonia moves quicker than hydrogen chloride because it is lighter.
- C** Hydrochloric acid produces hydrogen chloride which stays at one end of the tube until the ammonia reaches it.
- D** The two solutions run along the tube until they meet.

**Q30.**

[[062/22/M/J/16/Q1]

The particles of a substance gain energy and change from a regular ordered structure to a disordered structure with large distances between the particles.

Which change of state is described?

- A** boiling
- B** evaporation
- C** melting
- D** sublimation

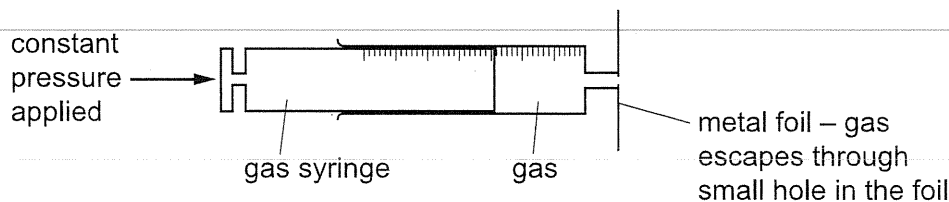


## IGCSE Chemistry Topical Paper 2 Topic 1 : The Particulate Nature of Matter

**Q31.**

[0620/21/M/J/16/Q1]

The rate of diffusion of two gases, methane,  $\text{CH}_4$ , and ethene,  $\text{C}_2\text{H}_4$ , is measured using the apparatus shown.



Which gas diffuses faster and why?

|          | gas that diffuses faster | reason                                                                           |
|----------|--------------------------|----------------------------------------------------------------------------------|
| <b>A</b> | ethene                   | Ethene molecules are heavier and so move faster.                                 |
| <b>B</b> | ethene                   | Ethene molecules have a double bond which makes them more reactive.              |
| <b>C</b> | methane                  | Methane molecules are lighter and so move faster.                                |
| <b>D</b> | methane                  | Methane molecules are smaller so they can get out of the small hole more easily. |

[0620/21/O/N/16/Q1]

**Q32.**

'Particles moving **very slowly** from an area of higher concentration to an area of lower concentration.'

Which process is being described?

- A** a liquid being frozen
- B** a solid melting
- C** a substance diffusing through a liquid
- D** a substance diffusing through the air

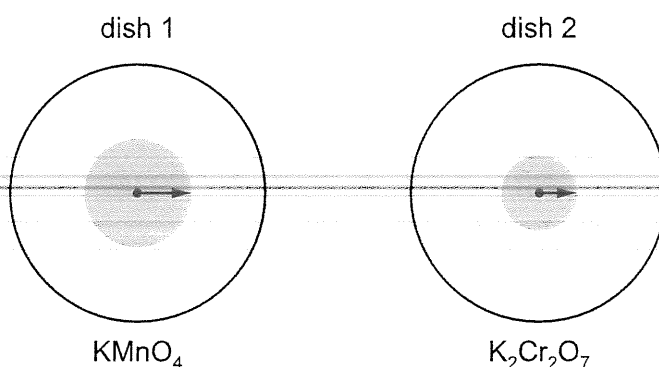
## IGCSE Chemistry Topical Paper 2      Topic 1 : The Particulate Nature of Matter

[0620/21/M/J/17/Q1]

**Q33.**

Small crystals of purple  $\text{KMnO}_4$  ( $M_r = 158$ ) and orange  $\text{K}_2\text{Cr}_2\text{O}_7$  ( $M_r = 294$ ) were placed at the centres of separate petri dishes filled with agar jelly. They were left to stand under the same physical conditions.

After some time, the colour of each substance had spread out as shown.



The lengths of the arrows indicate the relative distances travelled by particles of each substance.

Which statement is correct?

- A Diffusion is faster in dish 1 because the mass of the particles is greater.
- B Diffusion is faster in dish 2 because the mass of the particles is greater.
- C Diffusion is slower in dish 1 because the mass of the particles is smaller.
- D Diffusion is slower in dish 2 because the mass of the particles is greater.

**Q34.**

[0620/21/O/N/17/Q1]

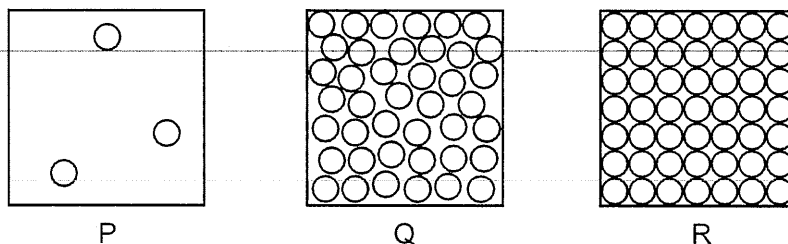
Which process causes the greatest increase in the distance between particles?

- A condensation
- B freezing
- C melting
- D sublimation

Q35.

[0620/22/O/N/17/Q1]

The diagram shows the arrangement of particles in the three states of matter.



Solid carbon dioxide (dry ice) sublimes to gaseous carbon dioxide.

Which row describes the initial and final states?

|   | initial state | final state |
|---|---------------|-------------|
| A | P             | R           |
| B | Q             | P           |
| C | R             | P           |
| D | R             | Q           |

Q36.

[0620/23/O/N/17/Q1]

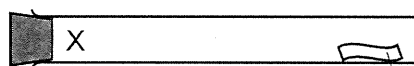
Which statement describes sublimation?

- A Particles moving slowly past each other speed up and move further apart.
- B Particles vibrating next to each other become mobile and move slowly past each other.
- C Particles vibrating next to each other start to move rapidly and move further apart.
- D Rapidly moving particles slow down and move closer together.

Q37.

[0620/22/M/J/18/Q1]

A gas is released at point X in the apparatus shown.



damp Universal Indicator paper

Which gas turns the damp Universal Indicator paper red most quickly?

- A ammonia,  $\text{NH}_3$
- B chlorine,  $\text{Cl}_2$
- C hydrogen chloride,  $\text{HCl}$
- D sulfur dioxide,  $\text{SO}_2$

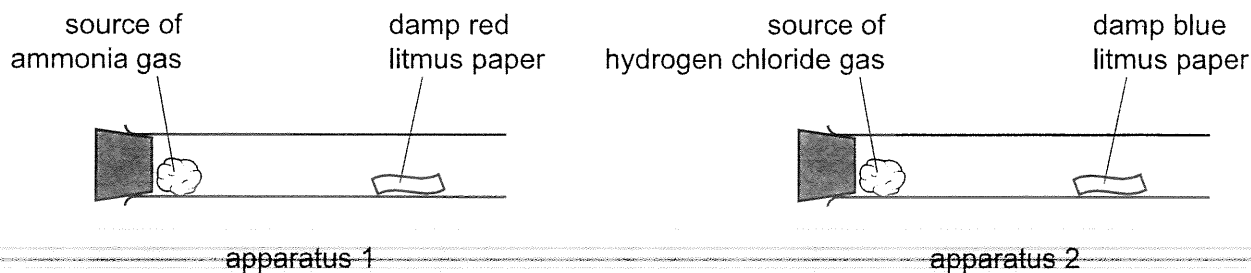
## IGCSE Chemistry Topical Paper 2      Topic 1 : The Particulate Nature of Matter

[0620/21/M/J/18/Q1]

**Q38.**

A student investigated the diffusion of ammonia gas,  $\text{NH}_3$ , and hydrogen chloride gas,  $\text{HCl}$ .

Two sets of apparatus were set up as shown at room temperature and pressure.



The damp red litmus paper in apparatus 1 changed colour after 30 seconds.

How long does it take for the damp blue litmus paper to change colour in apparatus 2?

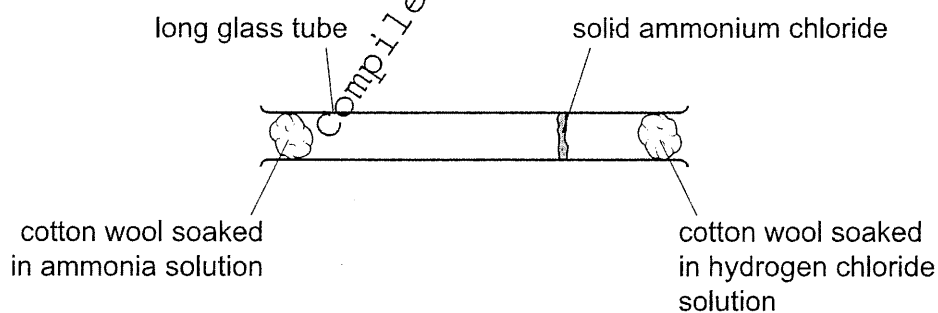
- A 64 seconds
- B 30 seconds
- C 21 seconds
- D The blue litmus paper would not change colour.

**Q39.**

[0620/23/M/J/18/Q1]

Ammonia gas is reacted with hydrogen chloride gas using the apparatus shown.

Solid ammonium chloride is produced.



Which statement explains why the solid ammonium chloride is formed nearer to the hydrogen chloride?

- A Ammonia solution is a base and hydrogen chloride solution is an acid.
- B Ammonia molecules diffuse more slowly than hydrogen chloride molecules.
- C Hydrogen chloride has a greater molecular mass than ammonia.
- D Hydrogen chloride moves by Brownian motion.



[0620/21/O/N/18/Q1]

**Q40.**

When smoke particles are observed with a microscope they are seen to move around randomly. This is called Brownian motion.

What causes Brownian motion?

- A diffusion of the smoke particles
- B molecules in the air hitting the smoke particles
- C sublimation of the smoke particles
- D the smoke particles hitting the walls of the container

[0620/22/O/N/2018/Q1]

**Q41.**

Oxygen and fluorine are gaseous elements next to each other in the Periodic Table.

Under the same conditions of temperature and pressure, oxygen diffuses .....1..... than fluorine because its .....2..... is less than that of fluorine.

Which words correctly complete gaps 1 and 2?

|   | 1      | 2              |
|---|--------|----------------|
| A | faster | molecular mass |
| B | faster | reactivity     |
| C | slower | molecular mass |
| D | slower | reactivity     |

[0620/23/O/N/2018/Q1]

**Q42.**

Gases are separated from liquid air by fractional distillation. The boiling points of four gases are shown.

Which gas is both monatomic and a liquid at  $-200^{\circ}\text{C}$ ?

|   | gas      | boiling point/ $^{\circ}\text{C}$ |
|---|----------|-----------------------------------|
| A | argon    | $-186$                            |
| B | helium   | $-269$                            |
| C | neon     | $-246$                            |
| D | nitrogen | $-196$                            |

## IGCSE Chemistry Topical Paper 2      Topic 1 : The Particulate Nature of Matter

**Q43.**

[0620/21/M/J/2019/Q1]

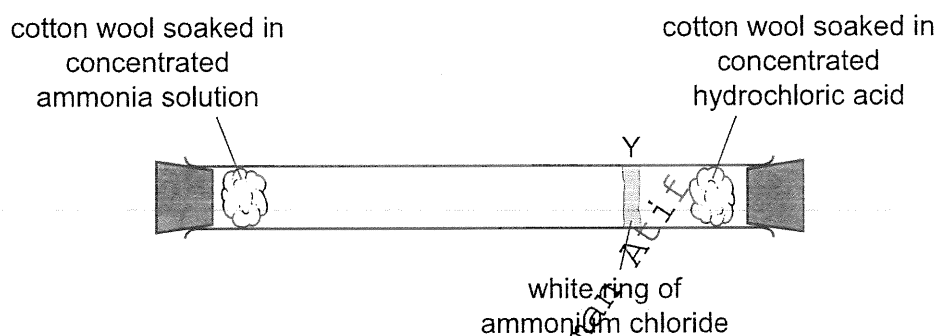
Which statement explains why ammonia gas,  $\text{NH}_3$ , diffuses at a faster rate than hydrogen chloride gas,  $\text{HCl}$ ?

- A Ammonia expands to occupy all of the space available.
- B Ammonia has a smaller relative molecular mass than hydrogen chloride.
- C Ammonia is an alkali and hydrogen chloride is an acid.
- D Ammonia molecules diffuse in all directions at the same time.

**Q44.**

[0620/22/M/J/2019/Q1]

The apparatus shown is set up. After 20 minutes a white ring of ammonium chloride is seen at position Y.



Which statement about the molecules of ammonia and hydrogen chloride is correct?

- A Molecules in ammonia have a larger  $M_r$  than molecules of hydrogen chloride and so they move more slowly.
- B Molecules in ammonia have a larger  $M_r$  than molecules of hydrogen chloride and so they move more quickly.
- C Molecules in ammonia have a smaller  $M_r$  than molecules of hydrogen chloride and so they move more slowly.
- D Molecules in ammonia have a smaller  $M_r$  than molecules of hydrogen chloride and so they move more quickly.

**Q45.**

[0620/21/O/N/2019/Q1]

Samples of four gases are released in a room at the same time.

The gases are carbon dioxide,  $\text{CO}_2$ , hydrogen chloride,  $\text{HCl}$ , hydrogen sulfide,  $\text{H}_2\text{S}$ , and nitrogen dioxide,  $\text{NO}_2$ .

Which gas diffuses fastest?

- A carbon dioxide
- B hydrogen chloride
- C hydrogen sulfide
- D nitrogen dioxide

**Q46.**

[0620/22/O/N/2019/Q1]

The rate of diffusion of a gas depends on its molecular mass and the temperature.  
Which combination of molecular mass and temperature gives the slowest rate of diffusion?

|   | molecular mass | temperature |
|---|----------------|-------------|
| A | high           | high        |
| B | high           | low         |
| C | low            | high        |
| D | low            | low         |

**Q47.**

[0620/23/O/N/2019/Q1]

Which two gases will diffuse at the same rate, at the same temperature?

- A carbon monoxide and carbon dioxide
- B carbon monoxide and nitrogen
- C chlorine and fluorine
- D nitrogen and oxygen

**Q48.**

[0620/22/M/J/2020/Q1]

A mixture of ice and water is left to stand and the ice melts.  
Which row describes what happens as the ice is melting?

|   | temperature of mixture | energy changes                                |
|---|------------------------|-----------------------------------------------|
| A | increases              | average kinetic energy of particles increases |
| B | increases              | energy is used to overcome attractive forces  |
| C | stays the same         | average kinetic energy of particles increases |
| D | stays the same         | energy is used to overcome attractive forces  |

**Q49.**

[0620/22/O/N/2020/Q1]

Which gas has the slowest rate of diffusion?

- A  $H_2$
- B  $NH_3$
- C  $CH_4$
- D  $CO_2$

**Q50.**

[0620/23/O/N/2020/Q2]

When a dark grey solid element is heated, it changes directly into a purple gas.  
Which word describes this change?

- A boiling
- B evaporation
- C melting
- D sublimation

# IGCSE O LEVEL CHEMISTRY TOPICAL PAPER 2

## MARKING SCHEME

### TOPIC #. 1 The Particulate Nature of Matter

| Q. # | Ans.# | Q. # | Ans.# | Q. # | Ans.# | Q. # | Ans.# | Q. # | Ans.# |
|------|-------|------|-------|------|-------|------|-------|------|-------|
| 1    | D     | 26   | B     | 51   |       | 76   |       | 101  |       |
| 2    | A     | 27   | B     | 52   |       | 77   |       | 102  |       |
| 3    | B     | 28   | B     | 53   |       | 78   |       | 103  |       |
| 4    | C     | 29   | B     | 54   |       | 79   |       | 104  |       |
| 5    | B     | 30   | D     | 55   |       | 80   |       | 105  |       |
| 6    | C     | 31   | C     | 56   |       | 81   |       | 106  |       |
| 7    | A     | 32   | C     | 57   |       | 82   |       | 107  |       |
| 8    | B     | 33   | D     | 58   |       | 83   |       | 108  |       |
| 9    | D     | 34   | D     | 59   |       | 84   |       | 109  |       |
| 10   | D     | 35   | C     | 60   |       | 85   |       | 110  |       |
| 11   | A     | 36   | C     | 61   |       | 86   |       | 111  |       |
| 12   | D     | 37   | C     | 62   |       | 87   |       | 112  |       |
| 13   | C     | 38   | A     | 63   |       | 88   |       | 113  |       |
| 14   | C     | 39   | C     | 64   |       | 89   |       | 114  |       |
| 15   | C     | 40   | B     | 65   |       | 90   |       | 115  |       |
| 16   | D     | 41   | A     | 66   |       | 91   |       | 116  |       |
| 17   | B     | 42   | A     | 67   |       | 92   |       | 117  |       |
| 18   | C     | 43   | B     | 68   |       | 93   |       | 118  |       |
| 19   | D     | 44   | D     | 69   |       | 94   |       | 119  |       |
| 20   | D     | 45   | C     | 70   |       | 95   |       | 120  |       |
| 21   | D     | 46   | B     | 71   |       | 96   |       | 121  |       |
| 22   | D     | 47   | B     | 72   |       | 97   |       | 122  |       |
| 23   | C     | 48   | D     | 73   |       | 98   |       | 123  |       |
| 24   | B     | 49   | D     | 74   |       | 99   |       | 124  |       |
| 25   | A     | 50   | D     | 75   |       | 100  |       | 125  |       |

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