TOPIC 1·3 IDENTIFICATION OF IONS AND GASES

PAPER 1

Each question below is provided with four answers. Select the correct answer and write A, B, C or D in the brackets provided.

1. Aqueous sodium hydroxide reacts with a metal ion producing a coloured precipitate. This precipitate changes colour on standing. What is the ion present? (N2000 P1 19)

   A Al^{3+} **B** Cu^{2+} **C** Fe^{2+} **D** Zn^{2+} ( )

2. An excess of sodium hydroxide is added to an aqueous solution of salt **X** and boiled. Ammonia gas is only given off after aluminium foil is added to the hot solution. What could be **X**? (N2000 P1 29)

   A Ammonium chloride **C** Sodium chloride
   B Ammonium nitrate **D** Sodium nitrate ( )

3. Under suitable conditions, hydrochloric acid reacts with each of the following substances. Which reaction gives a colourless solution only? (N2001 P1 17)

   A Calcium carbonate **C** Potassium hydroxide
   B Iron(II) hydroxide **D** Silver nitrate ( )

4. After acidification with dilute nitric acid, a colourless solution of **X** reacts with aqueous silver nitrate to give a white precipitate.

   What could **X** be? (N2001 P1 20)

   A Calcium iodide **C** Lead(II) iodide
   B Copper(II) chloride **D** Sodium chloride ( )

5. An aqueous solution of a sulphate is made from a solid hydroxide, of a metal *M*, by the reaction:

   $$M(OH)_2(s) + H_2SO_4(aq) \rightarrow MSO_4(aq) + 2H_2O(l)$$

   For which hydroxide would the method **not** work? (N2002 P1 4)

   A Barium hydroxide **C** Iron(II) hydroxide
   B Copper(II) hydroxide **D** Magnesium hydroxide ( )

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6. In separate experiments, an excess of aqueous sodium hydroxide or aqueous ammonia was gradually added to a solution **X**.

In both experiments, a precipitate was obtained which dissolved in an excess of the added reagent.

What could **X** contain? (N2002 P1 20)

A Copper(II) nitrate
B Iron(II) nitrate
C Iron(III) nitrate
D Zinc nitrate ( )

7. A salt is dissolved in water. The results of two separate tests on it are shown in the table.

	test	result
1	add aqueous ammonia	a white precipitate which dissolves when an excess of aqueous ammonia is added
2	add dilute nitric acid then aqueous barium nitrate	a white precipitate

What is the salt? (N2003 P1 4)

A Aluminium chloride
B Aluminium sulphate
C Zinc chloride
D Zinc sulphate ( )

8. An acid, **X**, was added to a solution of the nitrate of metal **Y**. A dense white precipitate was formed.

What are **X** and **Y**? (N2003 P1 20)

	acid **X**	metal **Y**
A	hydrochloric	calcium
B	nitric	zinc
C	sulphuric	aluminium
D	sulphuric	barium

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9. Aluminium sulphate is used in water treatment. Aqueous aluminium sulphate is acidic. The table shows the results of tests on four different samples of treated water.

To which sample had as excess of aluminium sulphate been added? (N2003 P1 21)

sample	pH of sample	reaction with an excess of aqueous ammonia
A	3	white precipitate
B	3	no reaction
C	7	no reaction
D	11	white precipitate

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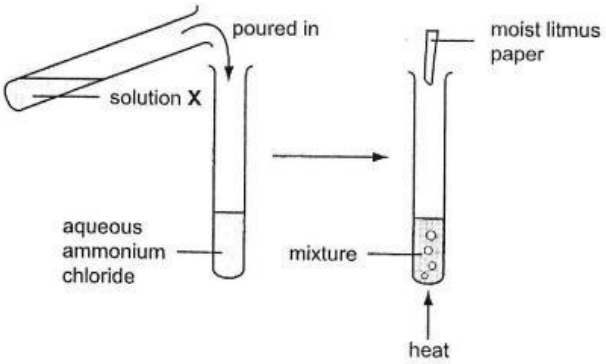
10. A pale green solution **X** gives a green precipitate with excess aqueous sodium hydroxide. An alkaline gas is only given off when the mixture is warmed with powdered aluminium.

Which ions does **X** contain? (N2004 P1 1)

A Ammonium and copper(II)
B Ammonium and iron(III)
C Copper(II) and nitrate
D Iron(II) and nitrate ( )

11. The diagrams show an experiment with aqueous ammonium chloride.



A gas, **Y**, is produced and the litmus paper changes colour. What are solution **X** and gas **Y**? (N2005 P1 4)

	solution **X**	gas **Y**
A	aqueous sodium hydroxide	ammonia
B	aqueous sodium hydroxide	chlorine
C	dilute sulphuric acid	ammonia
D	dilute sulphuric acid	chlorine

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12. Which two gases each change the colour of damp red litmus paper? (N2005 P1 5 / N2008 P1 3)

A ammonia and chlorine
B ammonia and hydrogen chloride
C carbon dioxide and chlorine
D carbon dioxide and sulphur dioxide ( )

13. An aqueous solution of compound **X** reacts with aqueous sodium hydroxide to form a green precipitate and then aluminium powder is added. The mixture is heated and a gas that turns damp red litmus paper blue is given off.

What is **X**? (N2006 P1 3)

A ammonium nitrate
B copper(II) chloride
C iron(II) nitrate
D iron(III) chloride ( )

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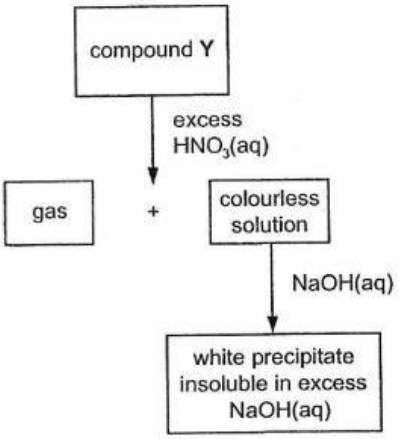
14. Which of the following reagents could be used to distinguish between dilute nitric acid and dilute hydrochloric acid? (N2006 P1 4)

A aqueous barium chloride
B copper(II) carbonate
C aqueous silver nitrate
D aqueous sodium hydroxide ( )

15. The scheme shows some reactions of a compound **Y**. (N2006 P1 5)



What could the compound **Y** be?

A aluminium sulphate
B calcium carbonate
C copper(II) carbonate
D zinc carbonate ( )

16. On bubbling carbon dioxide into an aqueous solution of X, a white precipitate, Y, is formed. This precipitate dissolves when more carbon dioxide is bubbled through, forming a colourless solution of Z.

What are the formulae of X, Y and Z? (N2007 P1 3)

	X	Y	Z
A	$CaCO_3$	$Ca(OH)_2$	$Ca(HCO_3)_2$
B	$Ca(OH)_2$	$CaCO_3$	$Ca(HCO_3)_2$
C	$Ca(OH)_2$	$Ca(HCO_3)_2$	$CaCO_3$
D	$CaCO_3$	$Ca(HCO_3)_2$	$CaCO_3$

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17. When testing for a chloride ion using silver nitrate, the solution must be acidified with dilute nitric acid.

What is the purpose of the nitric acid? (N2007 P1 5)

A to act as a catalyst
B to oxidise the chloride ion
C to prevent precipitation of silver carbonate
D to prevent the decomposition of any silver chloride formed ( )

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18. A student carries out three tests on a gas **X**. (N2007 P1 24)

test	observations
damp red litmus paper	stays red
aqueous bromine	stays brown
lighted splint	gas burns

Which gas could **X** be?

A ammonia
B ethene
C methane
D carbon dioxide ( )

19. Which gas is evolved when an alkaline solution of sodium nitrate is warmed with aluminium? (N2007 P1 25)

A ammonia
B nitrogen
C nitrogen dioxide
D oxygen ( )

20. In which reaction is the sulphate ion removed from solution? (N2008 P1 2)

A $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$
B $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
C $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$
D $Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + CO_2$ ( )

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SECTION II ATOMIC STRUCTURE AND STOICHIOMETRY: THE PARTICULATE NATURE OF MATTER

TOPIC 2·1 KINETIC PARTICLE THEORY

PAPER 1

Each question below is provided with four answers. Select the correct answer and write A, B, C or D in the brackets provided.

1. An inflated balloon will shrink if placed in a refrigerator. This is because the lower temperature causes the gas particles in the balloon to move (N2000 P1 1)

   A faster and become closer together.
   B faster and become further apart.
   C slower and become closer together.
   D slower and become further apart. ( )

2. Which one of the following correctly describes the particles in a dilute sugar solution at room temperature? (N2000 P1 2)

	Sugar molecules	Water molecules
A	Widely separated, moving at random	Close together, moving at random
B	Widely separated, moving at random	Close together, not moving
C	Widely separated, not moving	Widely separated, moving at random
D	Close together, moving at random	Widely separated, vibrating slightly

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3. The table shows the melting and boiling points of four pure substances. Which substance is a liquid at room temperature and would rapidly evaporate if left exposed to the air? (N2000 P1 3)

Substance	Melting point/°C	Boiling point/°C
A	–100	–35
B	–7	58
C	–6	225
D	44	280

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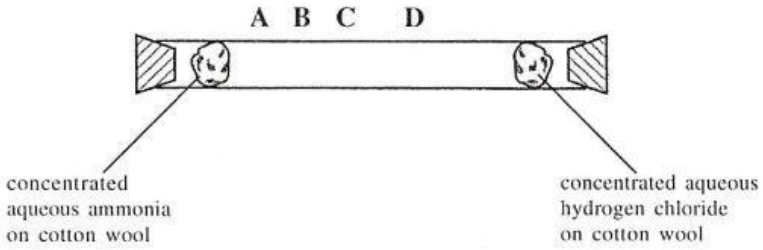
4. Ammonia, $M_r = 17$, and hydrogen chloride, $M_r = 36.5$, diffuse in the tube shown. When these gases meet, they produce a white cloud of ammonium chloride. Where in the tube does the white cloud first appear? (N2001 P1 2)



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5. Which property of a gas affects the rate at which it spreads throughout a laboratory? (N2002 P1 1)

A Boiling point
B Molecular mass
C Reactivity
D Solubility in water

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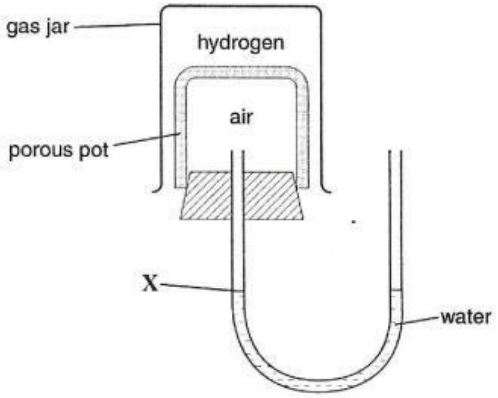
6. The apparatus shown in the diagram was set up.



Over a period of time how will the water level at **X** change? (N2003 P1 3)

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.

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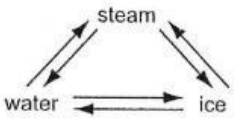
7. In which conversion do H_2O molecules lose speed? (N2004 P1 5)

A ice → water
B ice → steam
C steam → ice
D water → steam



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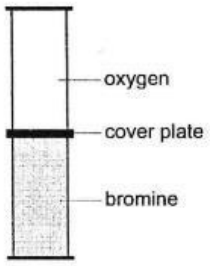
8. The cover-plates were removed from the gas jars shown in the diagram. After several days, the colour of the gas was the same in both jars. Which statement explains this change? (N2005 P1 3)

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.



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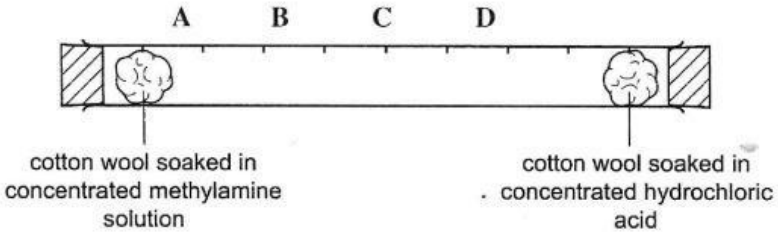
9. Methylamine, CH_3NH_2 ($M_r = 31$), and hydrogen chloride, HCl ($M_r = 36.5$) are both gases which are soluble in water.

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? (N2007 P1 4)



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