SECTION A [30 marks]

1 Under the same conditions, which gas diffuses at the same rate as nitrogen gas?

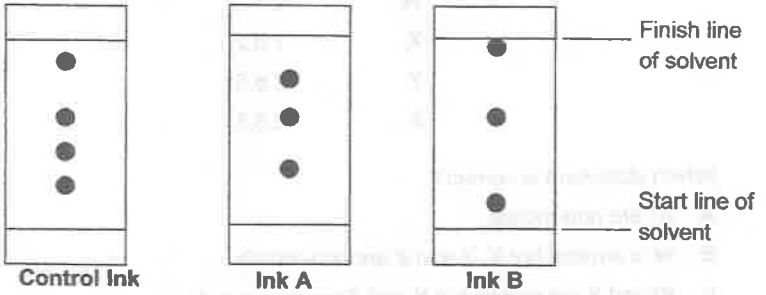
A Carbon dioxide

B Carbon monoxide

C Neon

D Sulfur dioxide

2 The chromatogram below shows the separation of the different dyes in two inks.



Which of the following statements about both inks are **true**?

A Both **Ink A** and **B** are made up of similar dyes as the **Control Ink**.

B **Ink A** has 1 similar dye to **Ink B** and **Control Ink**.

C **Ink A** is made up of **Control Ink** and **Ink B** only.

D **Ink B** is made up of **Control Ink** and **Ink A** only.

3 The particles in substance **Z** are widely spaced and able to move freely.

Z changes to a state in which the particles are in contact but still able to move freely. What is this change called?

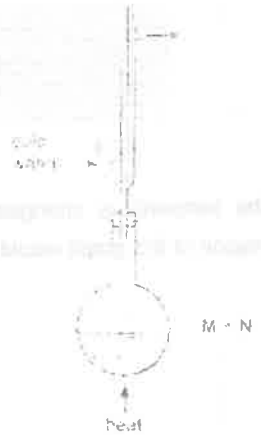
A Condensation

B Evaporation

C Freezing

D Melting

4 The diagram shows the apparatus used to prepare a liquid compound L.



Compound **L** (boiling point of 57°C) is made by heating together two liquids, **M** (boiling point 78°C) and **N** (boiling point 95°C). What is the purpose of the condenser?

A To allow liquid **L** to escape as fast as it is formed.

B To enable **M** & **N** to mix efficiently.

C To keep air away from the reacting liquid.

D To prevent **M** & **N** escaping before the reaction is completed.

5 Two isotopes of chlorine are $^{35}_{17}Cl$ and $^{37}_{17}Cl$.

Which statement about these isotopes is correct?

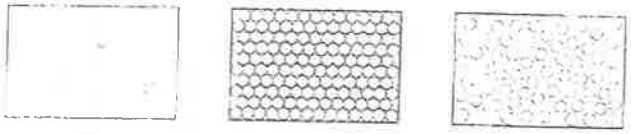
A They have the same number of electrons and protons.

B They have the same number of neutrons and electrons.

C They have the same number of neutrons and protons.

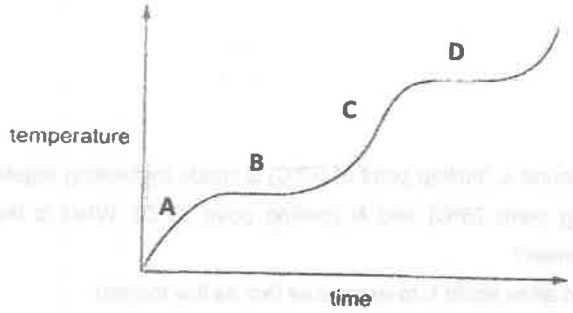
D They have the same number of nucleons and electrons.

6 Diagram **W**, **X** and **Y** show how the particles of a substance are packed at different temperature.



W X Y

The graph shows the temperature changes which occur on warming the substance. In which region of the graph would all the particles be packed as in **Y**?



7 Three separations are listed.

i. obtaining water from sodium chloride solution

ii. obtaining iodine from mixture of iodine and nickel

iii. obtaining solid chloride from aqueous sodium chloride

Which method would be involved in these separations?

	i	ii	iii
A	distillation	sublimation	crystallisation
B	distillation	sublimation	evaporation
C	filtration	sublimation	evaporation
D	evaporation	crystallisation	filtration

8 Element **Y** reacts with chlorine to form a liquid of formula YCl_2.

Which is the electronic configuration of **Y**?

A 2,2

B 2,8,1

C 2,8,2

D 2,8,6

9 Four elements have the following electronic configurations.

W	2
X	2,8,2
Y	2,8,5
Z	2,8,8

Which statement is correct?

A All are non-metals.

B **W** is a metal but **X**, **Y** and **Z** are non-metals.

C **W** and **X** are metals but **Y** and **Z** are non-metals.

D **X** is a metal but **W**, **Y** and **Z** are non-metals.

10 Which one of the following statements is true?

A Ar has more electrons than Cl^-.

B Cl^- has more electrons than K^+.

C Fe^{3+} has more electrons than Fe^{2+}.

D K has more electrons than K^+.

11 Which of the ionic equations represents the reaction between magnesium and hydrochloric acid?

A $Mg + H^+ \rightarrow Mg^+ + H$

B $Mg + H^+ \rightarrow Mg^{2+} + H^-$

C $Mg + 2H^+ \rightarrow Mg^{2+} + 2H$

D $Mg + 2H^+ \rightarrow Mg^{2+} + H_2$

12 The table shows the details of the particles present in an atom of potassium and in ions of potassium and sulfur.

formula	proton number	nucleon number	number of neutrons	number of electrons
K	19	39	W	19
K^+	19	39	20	X
S^{2-}	16	Y	16	Z

What are the values of **W**, **X**, **Y** and **Z**?

	W	X	Y	Z
A	19	18	32	18
B	19	19	34	16
C	20	18	32	18
D	20	19	34	16

13 Which element is **most** likely to be carbon in the form of diamond?

	melting point/°C	electrical conductivity
A	30	good
B	119	poor
C	2600	good
D	3500	poor

14 Sodium is a metal. What can be deduced about this metal?

A It has a high melting point.
B It is a conductor of electricity in solid state.
C It is a conductor of electricity in solid and molten state.
D It is a conductor of electricity in molten and aqueous state.

15 In which molecule are all the outer electrons of the atoms involved in bonding?

A HF
B H_2O
C NH_3
D CH_4

16 When a liquid covalent compound boils, its molecules become more widely spaced. Which property of the molecules has the most influence on the energy required to boil this compound?

A The reactivity of the molecules
B The strength of the covalent bonds in the molecules
C The strength of the forces of attraction between the atoms
D The strength of the forces of attraction between the molecules

17 The melting point of aluminium oxide is much higher than that of calcium oxide. Which statement explains this?

A A calcium ion has more protons than an aluminium ion.
B A calcium ion has more shells of electrons than an aluminium ion.
C A calcium ion has a smaller charge than an aluminium ion.
D Calcium is more reactive than aluminium.

18 Zinc oxide is an amphoteric oxide. Which statement about zinc oxide is correct?

A It will not react with hydrochloric acid but will react with sodium hydroxide.
B It will not react with hydrochloric acid or sodium hydroxide.
C It will react with both hydrochloric acid and sodium hydroxide.
D It will react with hydrochloric acid but will not with sodium hydroxide.

19 Element **Q** has an electronic configuration of 2,8,6. Element **R** is from Group III. What would be the formula of the compound formed between **Q** and **R**?

A Q_2R_3
B Q_3R_2
C R_2Q_3
D R_3Q_2

20 Which salts contain covalent bonds?

1. Ammonium chloride
2. Magnesium bromide
3. Potassium sulfate
4. Aluminium oxide

A 1 and 2
B 1 and 3
C 2 and 3
D 3 and 4

21 What are the particles present in aqueous ammonia?

1. NH_3
2. H_2O
3. NH_4^+
4. OH^-

A 1 and 2
B 1, 3 and 4
C 3 and 4
D All the above.

22 Which mixture of gases would **not** change the colour of damp blue litmus paper?

A carbon dioxide and oxygen
B chlorine and nitrogen
C hydrogen and ammonia
D neon and hydrogen chloride

23 Flowers of hydrangea bush are blue when grown in acidic soil and pink in alkaline soil. Which substance is added to the soil of hydrangea bush with blue flowers so that it produces pink flowers?

A calcium hydroxide
B citric acid
C copper (II) sulfate
D hydrochloric acid

24 What does the term strong acid mean in relation to hydrochloric acid, HCl?

A Every molecule produces one hydrogen ion in aqueous state.
B Its aqueous solution has a pH less than 7.
C Its salt, silver chloride, is insoluble in water.
D The solution has high concentration of HCl molecules.

25 Methylamine dissolves in water to give an alkaline solution. A few drops of Universal Indicator are added to an aqueous solution of methylamine. Which data shows the pH of the solution and the colour of the solution after the indicator was added?

	pH	colour of solution
A	greater than 7	blue
B	greater than 7	orange
C	less than 7	blue
D	less than 7	orange

26 In which reaction does the oxidation state of iron remain unchanged?

A $2Fe+3Cl_2 \rightarrow 2FeCl_3$
B $2FeCl_2+Cl_2 \rightarrow 2FeCl_3$
C $Fe+2FeCl_3 \rightarrow 3FeCl_2$
D $Fe_2O_3+6HCl \rightarrow 2FeCl_3+3H_2O$

27 The solubility of some salts is shown.

Soluble	Insoluble
barium chloride barium nirate sodium chloride sodium nitrate sodium sulfate	barium carbonate barium sulfate

Which aqueous solutions are mixed to prepare an insoluble salt?

A barium carbonate and sodium chloride
B barium nitrate and sodium chloride
C sodium nitrate and barium chloride
D sodium sulfate and barium nitrate

28 Separate samples of hydrogen peroxide are added to aqueous potassium iodide and to acidified potassium permaganate. What colour changes are seen?

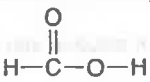
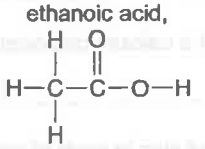
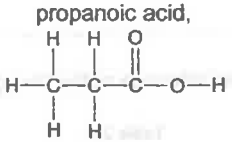
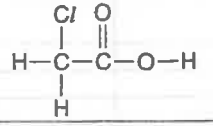
	potassium iodide	acidified potassium permaganate
A	brown to colourless	orange to green
B	brown to colourless	purple to colourless
C	colourless to brown	orange to green
D	colourless to brown	purple to colourless

29 Which substance in the equation is reduced?

$$2KMnO_4 + H_2O_2 + 3H_2SO_4 \rightarrow 3O_2 + 2MnSO_4 + K_2SO_4 + 4H_2O$$

A H_2O_2
B H_2SO_4
C $KMnO_4$
D $MnSO_4$

30 The dissociation constant for an acid indicates the extent to which it dissociates into ions. The higher the dissociation constant, the stronger the acid. The dissociation constant for some acids are given below along with two possibly correct statements.

acid	dissociation constant
methanoic acid, 	1.80×10^{-4}
ethanoic acid, 	1.75×10^{-5}
propanoic acid, 	1.34×10^{-5}
chloroethanoic acid, 	1.40×10^{-3}

Statement 1: Increasing the length of the carbon chain makes the acid stronger.
Statement 2: Replacing a hydrogen by a chlorine in ethanoic acid makes the acid stronger

Based on the data above, which statement(s) is/are correct?

A both statements
B statement 1 only
C statement 2 only
D none of the statement

SECTION B [40 marks]

Write your answers on the paper in the spaces provided.

1 Name the piece of apparatus most suitable to complete the following laboratory action:

(a) separate iron filing from sand.

.....[1]

(b) measure exactly 25.00 cm^3 of solution into a beaker.

.....[1]

(c) measure exactly 12.5 g of a calcium carbonate.

.....[1]

(d) add exactly 25.0 cm^3 of solution to each of several beakers.

.....[1]

2 Most substances can be placed into **one** of the five groups listed in Table 2.1.

Table 2.1

group	letter
element	A
compound	B
mixture of elements	C
mixture of compounds	D
mixture of elements and compounds	E

Which of the groups, **A**, **B**, **C**, **D** or **E** in the Table, best describes each of the following substances?

Air .....

Brass .....

Hassium .....

Petroleum .....

[4]

3 Atoms of non-metallic elements can combine with other atoms to form many different compounds.

(a) One of these compounds, ammonia, is a non-conductor of electricity and has low melting point.

(i) Name the type of chemical bonding present in a molecule of ammonia.

.....[1]

(ii) Draw a 'dot and cross' diagram to show the arrangement of electrons in a molecule of ammonia in the space below.

[2]

(iii) Explain why liquid ammonia cannot conduct electricity.

.....

.....[2]

(iv) Explain why ammonia has low melting point.

.....

.....[2]

(b) Another of these compounds, magnesium fluoride, has a high melting point and is a conductor of electricity when molten.

(i) Name the type of chemical bonding present in magnesium fluoride.

.....[1]

(ii) Draw a 'dot and cross' diagram to show the arrangement of electrons in magnesium fluoride in the space below.

[2]

(iii) Explain why magnesium fluoride is solid at room temperature.

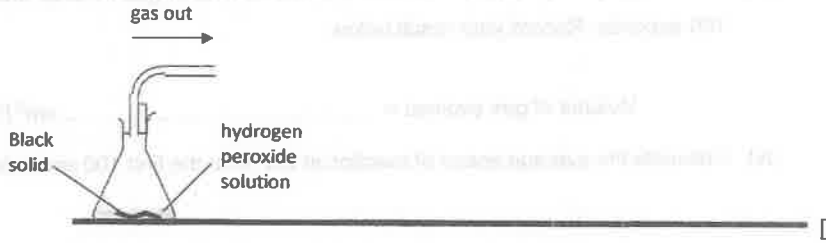
.....

.....

.....[2]

4 The decomposition of hydrogen peroxide solution to produce oxygen is sped up by mixing this solution with a black solid. The total volume of gas produced can be measured at fixed intervals of time.

(a) Complete the diagram below to show how the volume of gas can be collected and measured every few seconds.



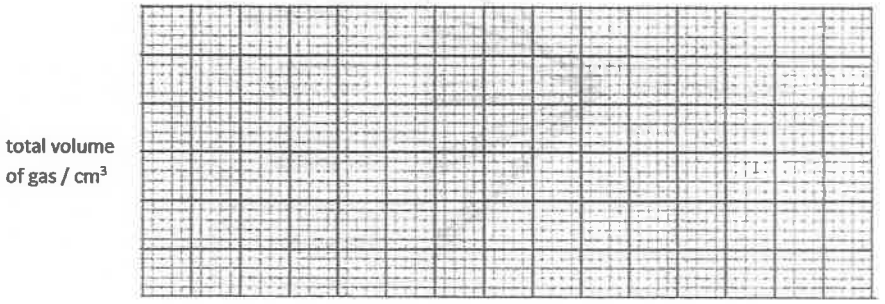
[2]

(b) The results of this experiment are shown in the Table 4.1.

Table 4.1

time/s	0	20	40	60	140	180	200	220
total volume of gas / cm^3	0	14	25	32	48	50	50	50

(i) Plot these results on the graph paper below and draw a line of best fit.



[2]

(ii) Why were no further measurements taken after 220 seconds?

.....

.....[1]

(iii) Indicate on your graph, how to estimate the volume of gas evolved after 100 seconds. Record your result below.

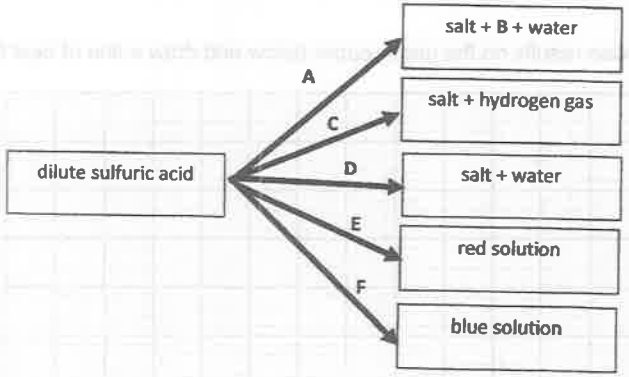
Volume of gas evolved = ...cm^3 [1]

(iv) Calculate the average speed of reaction in cm^3/s for the first 100 seconds.

Average speed of reaction = ...cm^3/s [1]

5 The flow chart shows some reactions of dilute sulfuric acid.

Six unknown substances, **A**, **B**, **C**, **D**, **E** and **F** are shown in the chart.



(a) Use the substances **A**, **B**, **C**, **D**, **E** and **F** to answer the following questions.

(i) Which substance is Universal Indicator?

.....[1]

(ii) Which substance is carbon dioxide?

.....[1]

(iii) Which substance is a metal?

.....[1]

(iv) Which substance could be sodium hydrogencarbonate?

.....[1]

(b) Substance **F** is a metal oxide. Suggest the name of this oxide.

.....[1]

(c) Substance **D** can be titrated with dilute sulphuric acid to give the products shown in the flow chart. Suggest the name and formula of substance **D**.

.....[2]

6 The reaction of iron (III) sulfate with potassium iodide is a redox reaction.

$$Fe_2(SO_4)_3 + 2KI \rightarrow 2FeSO_4 + I_2 + \textbf{product X}$$

(a) Give the name and formula of **product X**.

.....[2]

(b) Complete the table to show the oxidation states of iron and iodine. [2]

element	oxidation state in reactant	oxidation state in products
Iron		
iodine		

(c) Which element is reduced in the reaction? Use the ideas of **electron transfer** to explain your answer.

.....[2]

SECTION C [20 marks]

Write your answers on the paper in the spaces provided.

1 **(a)** The table shows information about the preparation of pure samples of solid salts. Complete the table by filling in the missing information. [4]

formula of salt	formulae of reagents used
(i) $CuCl_2$	..... HCl
(ii)	KOH HNO_3
(iii) $PbSO_4$	....

(b) Write an ionic equation (with state symbols) for the reaction of **(a) (iii)**.

.....[2]

[Turn over

(c) Describe a way to prepare a pure sample of silver chloride, AgCl, from silver metal. Use the following information to help you: .

- silver does not react with hydrochloric acid,
- silver reacts with hot concentrated nitric acid to form silver nitrate
- all nitates are soluble in water
- silver chloride is insoluble in water

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.....[4]