CHEMISTRY

MANEB QUESTION PAPERS

COVERING A PERIOD BETWEEN

1998 *to* 2019

COMPILED BY

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ELEMENTS AND CHEMICAL BONDING

2012-6.

a. The table below shows electron configurations of elements **R, S, T, U** and **V**

Element	Electron Configuration
R	2,7
S	2,8,6
T	2,8,2
U	2,4
V	2

(i) Which elements in the Table belong to period 2 of the periodic table? (2marks)

(ii) Give a reason for the answer in 6.a.(i). (1mark)

2011-4

a. (i) State three ways in which atoms attain stability. (3marks)

b. Table 1 shows atomic numbers and boiling points of some elements represented by letters **D, Q, T, X** and **Z**

Table 1

Element	**Atomic Number**	**Boiling Point(^{0}C)**
D	3	1342
Q	13	2467
T	16	445
X	18	-186
Z	19	760

(i) Identify any two letters that represent elements which belong to period 3 in the periodic table. (2marks)

(ii) Which element is in gaseous state at room temperature (25^0C)? (1mark)

(iii) What type of bonding would exist when element **Q** reacts with element **T**? (1mark)

(iv) Write down the chemical equation for the reaction that would occur between **D** and **T**. (3marks)

2010-1.

e. Explain why helium, which has 2 valence electrons, is taken as a group 8 element.

2009-1.

a. Define "electron configuration?" (1mark)

b. Figure 1 is a graph of atomic radius across the periods against atomic number for some elements in the periodic table

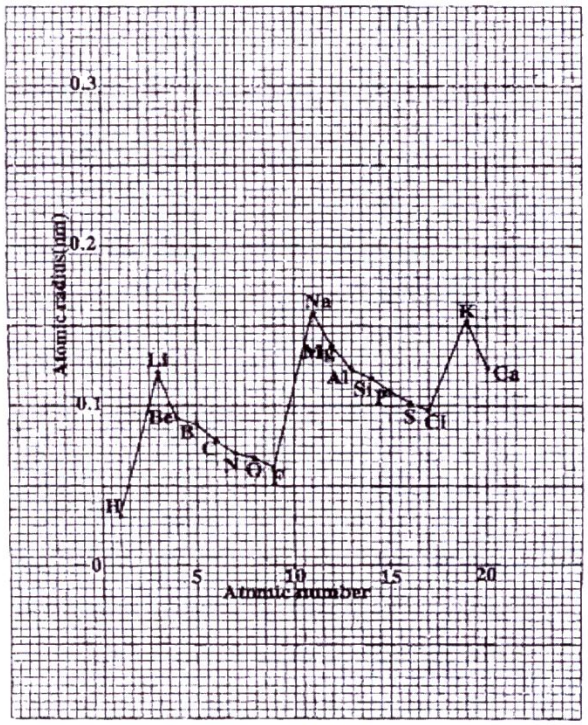


Figure 1

(i) To which group does element O belong? (1mark)

(ii) Give a reason for the answer to 1.b.(i). (1mark)

(iii) Why is there a sudden increase in atomic radius from F to Na? (2marks)

(iv) In terms of atomic radius, explain the difference in reactivity between F and Cl. (4marks)

(v) Give two differences between the type of bonding in Lithium metal (Li) and chlorine gas (Cl_2) (2marks)

2017

(c) A sample of chlorine contains two isotopes $^{35}_{17}Cl$ and $^{37}_{17}Cl$.

Calculate the relative atomic mass of the chlorine if 75% of the isotopes are of $^{35}_{17}Cl$ and 25% of the isotopes are of $^{37}_{17}Cl$. (3marks)

1. (a) State any three physical properties of alkali metal. (3marks)

(b) **Figure 6** is a graph of atomic radius across the periods against atomic number for some elements in the periodic table.

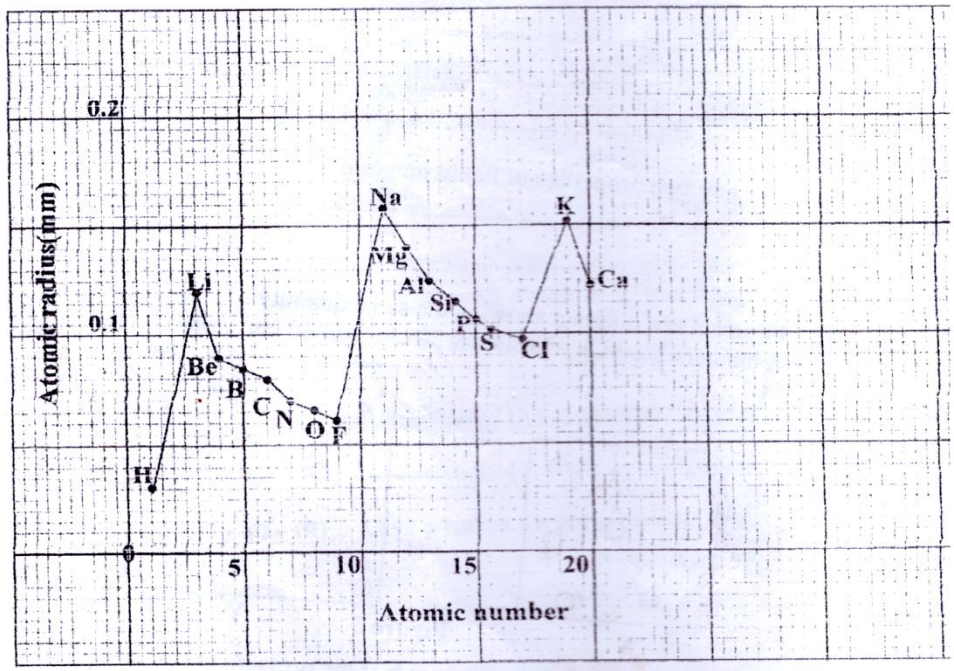


Figure 6

(i) Which group 2 element has the largest atomic radius? (1mark)

(ii) Explain the trend in atomic radii across a period. (3marks)

(iii) Why is there a sudden increase in atomic radius from Cl to K? (2marks)

(iv) Draw electron dot and cross diagrams for the reaction between Lithium (Li) and Chlorine (Cl) to form Lithium Chloride (LiCl). (4marks)

2009-1.

d. Table 1 Shows the number of valence electrons and valences of some elements.

Element	Number of valence electrons	Valency
Li	1	1
Be	2	2
N	5	3
O	6	2

(i) How can element N attain a stable configuration? (1mark)

(ii) Give reason for the answer to 1.d.(i). (1mark)

(iii) What is the formula of a compound that is formed between Li and O? (1mark)

(iv) Give the charge on a Be ion. (1mark)

1999

1. (a) Table 1 below shows the boiling points of some chloride which are represented by the letters A, B, C, D and F.

Table 1

CHLORIDE	BOILING POINT °C
A	1460
B	1410
C	180
D	1380
E	-85
F	60

(i) Which chloride has the lowest boiling point? (1mark)

(ii) Hydrogen chloride is a gas as room temperature. Select a letter from the table which could represent hydrogen chloride. (1mark)

(iii) Divide the chlorides into those which are likely to be ionic and those which are likely to be covalent. (2marks)

(iv) Explain your reasoning in 1.a(iii) (3marks)

(v) Helium does not form a chloride. Why? (2marks)

2001-1.

a. Element **X** has a mass of 89 amu and atomic number 19

(i) How many protons are in the atom? (1mark)

(ii) What would happen if element **X** was mixed with water? (1mark)

(iii) Give a reason for the answer to 1.a.(ii). (1mark)

2002

1. (a) Define the following:

(i) Atomic number; (1mark)

(ii) Electron configuration. (1mark)

(b) Figure 3 is a graph of density against atomic number for the first 20 elements of the periodic table.

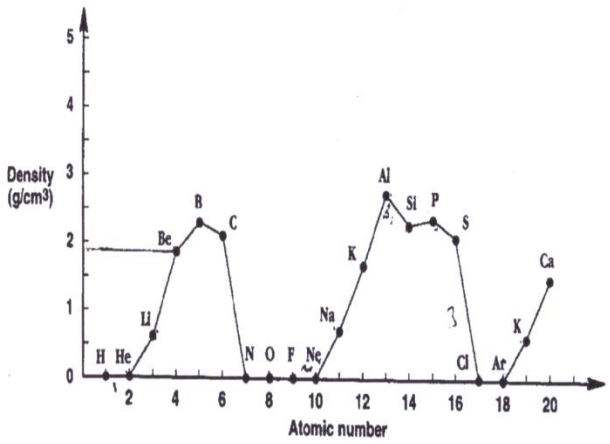


Figure 3

(i) What is the density of Be? (1mark)

(ii) How does the graph show that density is a periodic property of elements? (2marks)

(iii) Which element has the greatest density? (1mark0

(iv) How many complete periods are represented by the graph? (1mark)

2007-5.

a. Table 1 shows atomic numbers and electron configurations of some elements

Table 1

Element	Atomic number	Electron configuration
A	18	2, 8, 8
B	10	2, 8
C	20	2, 8, 8, 2
D	12	2, 8, 2
E	2	2
F	9	2, 7

(i) Identify an element that comes first in period 2. (1mark)

(ii) Which two elements can form positive ions? (2marks)

(iii) Give a reason for the answer to 5.a.(ii). (2marks)

(iv) Give any three properties of element **A**. (3marks)

2002

c

(i) In which of the following substances are atoms covalently bonded?
CH_3OH, $CuCl_2$, SO_2 and BeF_2.
(2marks)

(ii) Draw an electron dot and cross diagram of CH_3OH in the space below. (2marks)

d.

(i) Balance the following chemical equation:

$CH_4 + O_2 \rightarrow CO_2 + H_2O$
(2marks)

(ii) What type of reaction is represented by the equation in 1d(i)? (1mark)

2018.

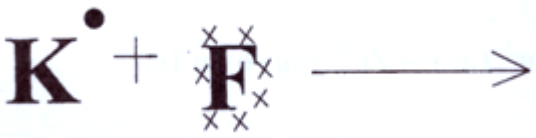
1.

a. State any two physical properties of halogens. (2marks)

b. Explain why bromine (Br_2) has a higher boiling point than chlorine (Cl_2). (3marks)

c. Write a balanced chemical equation to show the reaction between sodium (Na) and water (H_2O) (3marks)

d. Complete the following equation to show the bonding between potassium (K) and Flourine (F). (3marks)



e. Explain why ionic compounds conduct electricity in molten state and **not** when in solid state. (2marks)

2014

1. (a) State the three sub-atomic particles of an atom. (3marks)

(b) An atom with a mass number of 23 has 13 neutrons. Work out the electron configuration for the atom.
(3marks)

(c) **Table 1** shows the electrical conductivity of solids **A, B, C, D** and **E** when dissolved in water.

Table 1

Compound	**Conductivity**
A	Does not conduct
B	Conducts
C	Does not conduct
D	Conducts
E	Does not conduct

(i) Classify the compounds as ionic and molecular

Ionic:

(2marks)

Molecular:

(3marks)

(ii) Give a reason for the answer in 2c(i). (2marks)

2005-2

Table 1 shows the arrangement of some elements in the Periodic table

Table 1

H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar
K	Ca						

a. Draw the atomic structure of Cl. (3marks)

b. A certain element could be represented as $^{28}_{14}X$

(i) To which group does **X** belong? Give a reason.(2marks)

(ii) Identify element **X** in Periodic Table

1998

1. (a) **Figure 1** is a graph of boiling points against atomic number of the first 19 elements in the **Periodic Table**. Use the graph to answer the questions that follow.

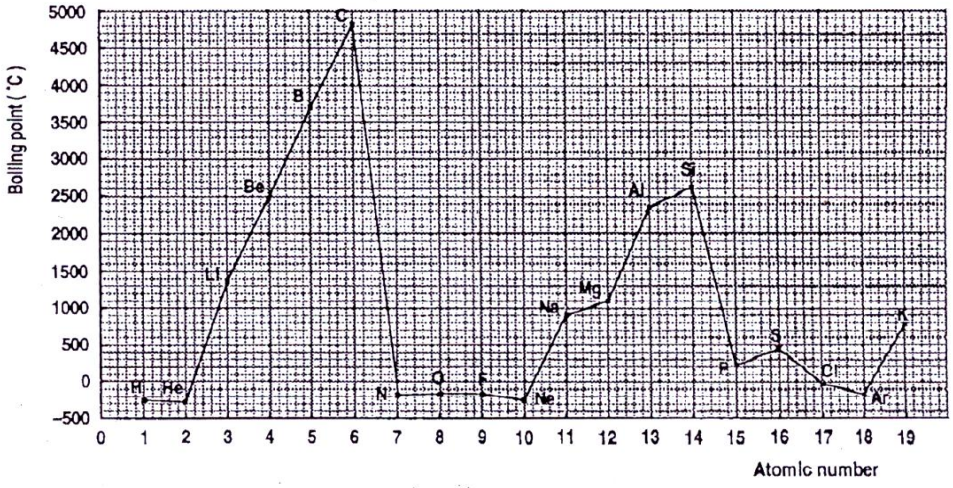


Figure 1

(i) Estimate the boiling point of **Na**. (1mark)
(ii) Write down the atomic number of the element with the highest boiling point. (1mark)
(iii) In which group of the **Periodic Table** does element **P** belong? (1mark)
(iv) Identify the element which is in the same group as Be. (1mark)
(v) Which **three** elements have the lowest boiling points? (1mark)
(vi) Give a common property of the elements you have identified in 1.a.(v) (1mark)
(vii) **Ca** is an element whose atomic number is 20. Would you expect to have a higher or lower boiling point than **K**? (1mark)
(viii) study the graph and describe in general terms how the boiling point of elements in a given period changes as the atomic number increases.

2000-4

d. Figure 4 is a diagram showing nuclei of two atoms

Figure 4

(i) Explain why these atoms react in the same way. (3marks)
(ii) What are atoms of this type called? (1mark)
(iii) To which period of periodic table could each belong? (1mark)
(iv) Explain the answer to d(iii). (1mark)

2004-1.

a. Table 1 shows particles found in the atoms of four elements.

Table 1

ELEMENT	PROTONS	NEUTRONS	ELECTRONS	MASS NUMBER
Hydrogen (H)	1			1
Carbon (C)			6	12
Nitrogen (N)	7	7		
Sodium (Na)		12	11	

(i) Complete the table by filling the missing numbers. (4marks)
(ii) Which element in the table will easily form anionic compound? (1mark)
(iii) Give a reason for the answer to 1.a.(ii). (2marks)

c.

Table 2 shows elements represented by letters Q, R, L, M, W, Y and Z in the same period of the periodic table.

GROUP	I	II	III	IV	V	VI	VII	VIII
Elements	Q	R	L	M	X	W	Y	Z.

(i) Write the formula of a charged atom of R. (1mark)
(ii) Give the letter of the element in the table which belongs to the halogen family. (1mark)
(iii) Give the letter of an element in the table that would not react with another element. (1mark)
(iv) Give a reason for the answer to 1c(iii) (1mark)

1. (a) State any three sources of sulphur. (3marks)
(b) **Table 1** shows the arrangement of some elements in the Periodic Table

Table 1

H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar
K	Ca					Br	Kr

(i) To which period does Li belong? (1mark)
(ii) Write the electron configuration for P.

(iii) Explain the trend in reactivity when moving up the group of **Br, C*l*** and **F**.(1mark)

(iv) Draw an electron dot and cross diagram to show bonding in a carbon dioxide molecule.

2013

1. (a) Mention any one difference between "polar" and "non polar" molecules. (2marks)

(b) Table 1 shows atomic number, melting points and boiling points of group 7 elements.

Table 1

Element	Atomic Number	Melting point (°C)	Boiling point (°C)
Flourine	9	-220	-188
Chlorine	17	-101	-34
Bromine	35	-7	59
Iodine	53	114	184

(i) Which elements are gases at room temperature? (2marks)

(ii) Draw the atomic structure of chlorine (Cl). (3marks)

(iii) Why does iodine have a higher melting point than fluorine? (3marks)

(iv) Calculate the number of neutrons in an iodine atom if its atomic mass is 127. (3marks)

2003-3

c. Table 1 shows the first 20 element of the periodic table

H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar
K	Ca						

(i) Write down the atomic number of Si (1mark)

(ii) Work out the electron configuration of K given that its atomic number is 19. (1mark)

(iii) Draw an electron dot and cross diagram of CO_2 (2marks)

(iv) How can aluminium (Al) attain an inert gas configuration? (1mark)

(v) Explain why the melting points of group CII elements increase with increasing atomic number.

1. <u>Types of bonds and their properties</u>

2012-6.

a. The table below shows electron configurations of elements **R, S, T, U** and **V**

Element	**Electron Configuration**
R	2,7
S	2,8,6
T	2,8,2
U	2,4
V	2

(iii) Give a pair of elements that would form an ionic compound when they react. (2marks)

(iv) Draw an electron dot and cross diagram for the compound formed when S combines with U. (3marks)

2011-4

a. (ii) Explain how ionic bonding occurs. (3marks)

2010-1

c. (i) State any three properties of metals. (3marks)

d. **Figure 1** is a diagram of atomic number of elements **R** and **Q**

Figure 1

(i) Write down the electronic configuration of elements **R** and **Q**. (1mark0

(ii) To which period and group of the periodic table does element **R** belong? (1mark each)

(iii) Draw a dot and cross diagram of the component that would be produced when **R** reacts with **Q**.

2008-1

b. Magnesium and chlorine can be represented as $^{24}_{12}Mg$ and $^{35.5}_{17}Cl$, respectively.

(i) What are the valencies of magnesium and chlorine? (1mark each)

(ii) What is the molecular formula of the compound formed as a result of magnesium reacting with chlorine? (2marks)

c.

(i) Draw an electron dot and cross diagram of carbon dioxide (CO_2) given that carbon is in group 4 and oxygen in group 6 of the periodic table. (4marks)

(ii) What type of bonding exists in carbon dioxide? (1mark)

(iii) Give a reason for the answer to 1.c.(ii) (1mark) (1mark)

2004-1

a.

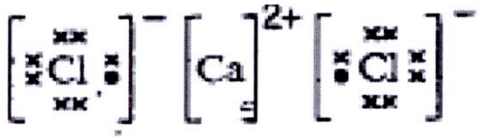
(iv) Work out the molecular mass of methane (CH4). (2marks)

(v) What kind of chemical bonds are involved in methane? (1mark)

(vi) Explain the answer to 1.a(v) (3marks)

b.

The dot and cross diagram of calcium chloride is shown below.



(i) Write the chemical formula of calcium chloride. (1mark)

(ii) Explain the meaning of the sign 2+ on the Ca atom. (1mark)

2003-6.

a. Why are metals good conductors of heat? (2marks)

e. State two differences between ionic compounds and covalent compounds. (2marks)

2012-6

b. State any three physical properties of halogens. (3marks)
c. Explain what happened if chlorine is mixed with potassium bromide solution. (2marks)

2010-1

c.(ii) Explain why potassium is more reactive than sodium (2marks)

f. State any two uses of sulphates

2009-1

c.

(i) Mention any two uses of sulphur. (1mark)

(ii) Give any two physical properties of sulphur. (2marks)

CHEMICAL REACTION AND STOICHIOMETRY

2004-7.

a. Describe how the concentration of $20cm^3$ of sodium chloride solution can be determined by evaporation method. (10marks)
b. State two sources of error in 8a. (2marks)

2003-3

a.
(i) What is a "mole"? (1mark0
(ii) A solution was made by dissolving 8g of sodium hydroxide in $100cm^3$ of water. Calculate the molarity of the solution. RAM: Na = 23, O=16, H = 1)(5marks)

2003-6

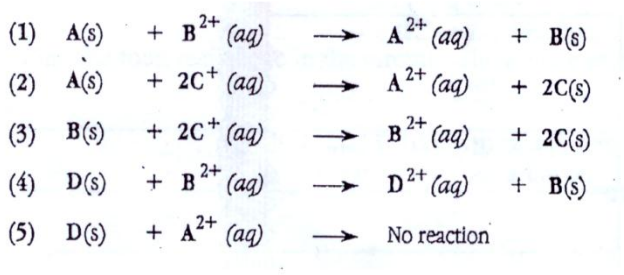
d.

(i) What is meant by "empirical formula of a compound"? (1mark)

(ii) Work out the empirical formula of a compound that has the following percentage composition by mass of elements: C = 40%, H=6.67%, and O = 53.33%. (RAM C = 12, H = 1, O = 16) (6marks)

1998

2. (a) The equations below represent displacement reactions involving four elements. The elements are represented by letters A, B, C and D. Study the equations and then answer the questions that follow.



(i) Are these elements A, B, C and D likely to be all metals, all non-metals or some of each? State the reason for your answer. (2marks)
(ii) Write half reactions to represent the changes which occur in the reaction in equation (1). (2marks)
(iii) Arrange the elements A, B, C and D in order of reactivity starting with the least reactive. (2marks)
(iv) Write an equation to represent what you would expect to happen when solid C is placed in an aqueous solution of D^{2+}? (2marks)

(v) Which reaction would you expect to be most vigorous if concentrations and temperature were the same? Give a reason for your choice. (2marks)

(b) The formula of hydrated sodium carbonate is **Na_2CO_3 XH_2O** where **X** represents the number of molecules of water of crystalisation.

To determine the value of **X**, a sample of hydrated sodium carbonate crystals was heated to constant mass. The results obtained were as follows:

Mass of hydrated sodium carbonate before heating= 7.15g

Mass of sodium carbonate after heating = 2.65g

(i) Calculate the decrease in mass. (1mark)

(ii) How many moles of water were lost in the experiment? (3marks)

(iii) How many moles of anhydrous sodium carbonate were formed at the end of the experiment? (3marks)

(iv) Using your answer to (ii) and (iii) work out the value of X in the formula $Na_2CO_3XH_2O$.
Atomic Masses: (H=1, O=16, Na=23, C=12) (3marks)

1999

2. (a) The arrangement shown in Figure 4 below was used to carry out a titration of acetic acid against 0.1M sodium hydroxide solution. Diagram A shows the volume of acetic acid before the reaction and diagram B shows the volume of the acid at the end point.

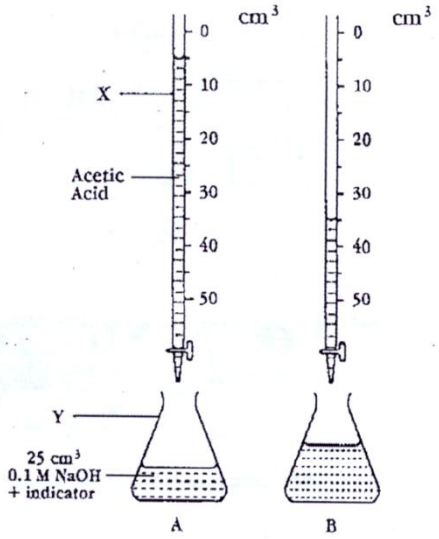


Figure 4

(i) Give the names of the pieces of apparatus labeled X and Y. (1 mark for each)

(ii) State the name of the indicator and its colour in A. (2marks)

(iii) What is meant by 'end point'? (1mark)

(iv) What volume of acetic acid was added to the 25cm3 of 0.1M NaOH? (2marks)

(v) Calculate the concentration in moles per litre of the acetic acid. (3marks)

2003-8

c. Describe how 250cm^3 of a 1M copper sulphate solution could be prepared using hydrated copper sulphate crystals ($CuSO_4 – 5H_2O$)

(The molar mass of $CuSO_4 – 5H_2O$ is 250g) (7marks)

2012-5.

e. Figure 3 is an energy level for the reaction between magnesium (Mg) and oxygen gas (O_2)

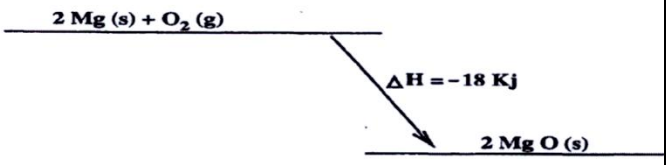


Figure 3

(i) Is the reaction exothermic or endothermic? (1mark)

(ii) Give a reason for the answer in 5.e.(i). (2marks)

(iii) State the meaning of the arrow in the diagram. (1mark)

3. When sodium thiosulphate is mixed with dilute hydrochloric acid, sulphur precipitate is produced. To study the speed of this reaction different volumes of sodium thiosulphate and water were added to a constant volume of hydrochloric acid. In each case time taken for the precipitate to appear was noted and the value of $\frac{1}{time}$ calculated. The table below shows the results of the experiment. Use the table to answer the questions that follow:-

Volume of Sodium thiosulphate (cm^3)	Volume of distilled water (cm^3)	Volume of dilute hydrochloric acid (cm^3)	Time for the sulphur precipitate to appear (s)	$\frac{1}{time}$ (s^{-1})
40	0	40	8	0.125
30	10	40	11	0.091
20	20	40	14	0.071
15	25	40	21	0.048
10	30	40	32	0.031

a. Suggest two reasons for adding water to the reaction mixture. (2marks)

b. Plot a graph of $\frac{1}{time}$ on the vertical axis and the volume of sodium thiosulphate on the horizontal axis.

Scales (1cm = $0.01s^{-1}$ and 1cm = $5cm^3$).
(6marks)

Draw the best straight line through the points. (1mark)

Use the plotted graph to answer questions c, d, and e

c. One of the readings is probably wrong. Put a circle round it on your graph and explain how you know it is wrong. (2marks)

d. What volume of sodium thiosulphate and water would have to be used for the sulphur precipitate to appear in a time of 20 seconds? (2marks)

e. State the factor that is being investigated in this experiment and the conclusion that could be drawn from the results shown. (3marks)

f. The balanced full ionic equation for the reaction between sodium thiosulphate and dilute hydrochloric acid is as follow:-

$2Na^+(aq) + S_2O_3^{2-}(aq) + 2H^+(aq) + 2Cl^-(aq) \rightarrow$

$2Na^+ + SO_2 + H_2O + S + 2Cl^-$

(i) Indicate the states of products in the above equation. (2marks)

(ii) Write a balanced simplified ionic equation for the reaction. (2marks)

2011-3

c. Explain why bond breaking is endothermic while bond making is exothermic (4marks)

2007-3.

b.

(i) Draw an energy level diagram for the following chemical reaction: (3marks)

$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H2O(l)$. $\Delta H = -57kj/mol$

(ii) Is the reaction in 3.b.(i) endothermic or exothermic? (1mark)

(iii) Give a reason for the answer to 3.b.(i) endothermic or exothermic? (1mark)

(iv) What is the meaning of (aq) and (l) in the equations? (2marks)

2012-5.

a. Define "electroplating". (2marks)

b. Iron (Fe) displaces copper (Cu) from copper sulphate solution ($CuSO_4$).

(i) Write down a balanced chemical equation for the reaction. (3marks)

(ii) What is the reducing agent in the reaction? (1mark)

(iii) Give a reason for the answer in 5.b(ii). (1mark)

c. What is the difference between "oxidation" and "reduction"? (2marks)

2003-8.

a. What is the difference between an exothermic reaction and an endothermic reaction? (2marks)

b. Given that the reaction between methane (CH_4) and oxygen (O_2) to produce Carbon dioxide (CO_2) and water (H2O) is exothermic and the dissolving of ammonium nitrate (NH_4NO_3) is endothermic, draw energy level diagrams to illustrate the difference mentioned in 8a. (6marks)

2011-3.

d.

(i) Mention any two ways of preventing corrosion metals. (2marks)

(ii) Calculate the oxidation number of nitrogen (N) in nitrate (NO_3^-) given that the oxidation number of oxygen (O) is -2. (3marks)

1. (a) Give two ways of determining the strength of an acid. (2marks)

(b) State any two ways of expressing the concentration of a solution. (2marks)

(c) In a titration, $25cm^3$ of hydrochloric acid (HCl) of an unknown concentration was titrated against $20cm^3$ of 2M sodium hydroxide (2M NaOH) to which phenolphthalein was added.

(i) Name the standard solution in the titration (1mark)

(ii) Give a reason for the answer in 5.c.(i). (1mark)

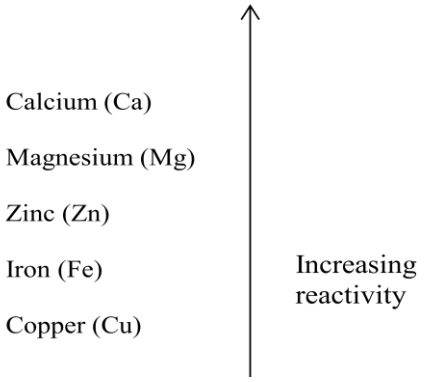
(d) (i) Which metal is used to galvanize iron? (1mark)

(ii) Explain how a scratched galvanized iron sheet is protected from rusting. (3marks)

2010-2.

a. State any two advantages of electroplating a metal

b. Below is part of a displacement series of metals



(i) Which metal would displace all other metals from their solution? (1mark)

(ii) Give a reason for the answer in 2.b.(i). (1mark)

(iii) What would happen if a piece of magnesium metal was placed in copper sulphate solution? (2marks)

d. Define "oxidation" in terms of oxygen content in a substance. (1mark)

e. The chemical equation below shows displacement between zinc (Zn) and lead nitrate ($Pb(NO_3)_2$)

$Zn + Pb(NO_3)_2 \rightarrow Zn(NO_3)_2 + Pb$

Name the reducing and oxidising agents in the reaction.

Reducing agent: (1mark)

Oxidising agent: (1mark)

f**. Figure 2** is a diagram showing the set-up of an experiment to investigate conditions for rusting of iron.

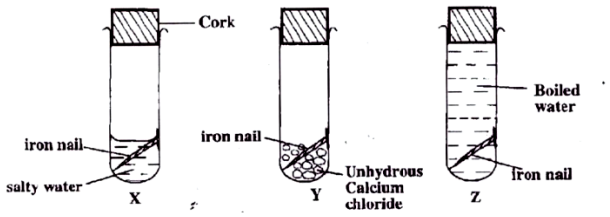


Figure 2

(i) Why was unhydrous calcium chloride used in tube Y? (1mark0

(ii) Why was water in tube Z boiled? (1mark)

(iii) State any two condition necessary for rusting of iron. (2marks)

2010-7.

b. With the aid of a labelled diagram, explain how a silver spoon could be electroplated using copper. In the explanation, include the half equation for the reaction at the cathode. (11marks)

1998

4. Using suitable examples and with the help of diagrams in each case, explain the difference between the terms given below:

(a) Hydronium and hydroxyl ions;(5marks)

(b) Covalent bonding and ionic bonding;(5marks)

(c) Isomerism and conformation. (5marks)

2009-5.

e. silver irons (Ag+(aq)) react with iron (Fe) according to the following equation:

$$\mathbf{2Ag^{+}(aq) + Fe^{0}(s) \rightarrow Fe^{2+}(aq) + 2Ag^{0}(s)}$$

(i) What is the meaning of (2+) of $Fe^{2+}(aq)$? (1mark)

(ii) What is the oxidation number of silver before reaction? (1mark)

(iii) Which substance has been reduced? (1mark)

(iv) Give a reason for the answer in 5.e.(iii) (1mark)

2009-8.

a. What is an "electrolyte"? (2marks)

b. With the aid of a well labelled diagram, describe an experiment that can be carried out to compare the electrical conductivity of potassium nitrate solution and potassium chloride solution (13 marks)

2008-7.

b. What is the difference between "oxidation" and "reduction" in terms of electron transfer? (1mark)

c. Explain how each of the following prevents rusting of iron

(i) painting (4marks)

(ii) galvanizing (5marks)

2005-2.

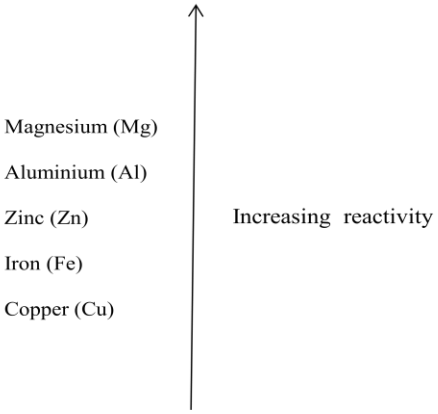
c.

(i) Write the chemical formula of the compound formed between Al and O. (1mark)

(ii) What type of bound exists between Al and O atoms in the compound formed in c (i)? Give a reason. (2marks)

2017-6.

e. The following is part of a reactivity series



(i) Which two elements will displace zinc (Zn) from its oxide? (2marks)

(ii) Give a reason for the answer to 6.e.(i) (1mark0

f. The following are half equations for the reaction between magnesium (Mg) and silver nitrate ($AgNO_3$):

$2Ag^+(aq) + 2e \rightarrow 2Ag^0(s)$

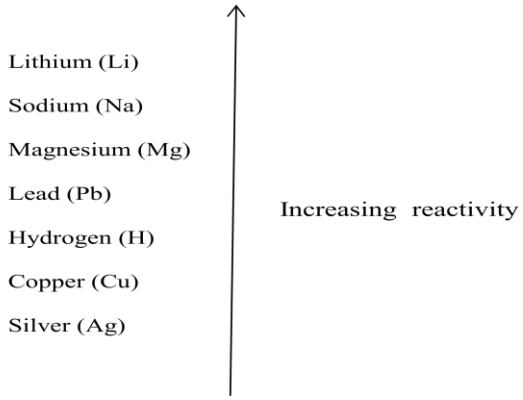
$Mg^0(s) - 2e \rightarrow Mg^{2+}(aq)$

(i) Write a full chemical equation for the reaction. (2marks)

(ii) Name the reducing and oxidizing agents in 6.f.(i). (2marks)

2006 – 5.

d. The following is part of an activity series



(i) State whether copper (Cu) will react with a solution of magnesium sulphate ($MgSO_4$) (1mark)

(ii) Explain the answer to 5.d.(i) (2marks)

(iii) Which element is the most electropositive in the activity series? (1mark)

(iv) Give a reason for the answer to 5.d.(iii) (2marks)

e.

(i) Write half equation for the reaction between silver nitrate (AgNO3) and Sodium (Na). (2marks)

(ii)Name the reducing and oxidizing agents in 5.e.(i). (2marks)

2005-7.

a. Draw a labelled diagram of the apparatus that would be used to electroplate an iron nail with copper using copper chloride as an electrolyte. (4marks)

b. Explain what happens during the process of electroplating of the iron nail in (a). Support the explanation with relevant chemical equations. (11marks)

2003-3.

b. Copper (Cu) reacts with silver ions (Ag+) according to the following chemical equation:

$Cu^0(s) + 2Ag^+(aq) \rightarrow 2Ag^0(s) + Cu^{2+}(aq)$

(i) What is the meaning of the zero sign (0) in $Cu^0(s)$? (1mark)

(ii) Pick out the oxidation agent and the reducing agent from the equation.
Oxidizing agent: (1marks)
Reducing agent: (1mark)

(iii) Write the two half equations for the reaction. (4marks)

2011-3.

b.

(i) Define an "acid" according to Lowry/Bronsted theory. (1mark)

(ii) Describe how a hydronium ion (H_3O^+) is formed. (2marks)

1998

(b) Below is a list of some elements which may be prepared by electrolysis of suitable molten substances or aqueous solutions.

Oxygen	**Zinc**	**potassium**
Silver	**copper**	**chlorine**
Hydrogen	**bromine**	**lead**

(i) In the statement above, what is meant by an element? (1mark)

(ii) Why must substances be in molten state or aqueous solution in order for electrolysis to take place? (1mark)

(iii) From the above list, pick out all elements whose ions would be discharged at the cathode during electrolysis if the substances were in molten state. (2marks)

(iv) One of the elements in the list can only be made by the electrolysis of a molten substance. Name the element, and explain why an aqueous solution would not be suitable in this case. (3marks)

(v) From the above list, select **one** element whose ions would be discharged at the anode and give the equation to represent the discharge reaction of this ion. (3marks)

2010-2.

c. Water reacts with the carbonate ion according to the following chemical equation.

$$H2O(l) + CO^{2-}{}_3(aq) \rightleftharpoons OH^-(aq) + HC)^-{}_3(aq)$$

Give one conjugate acid-base pair in the reaction. (3marks)

2007-3.

a. Ammonia is an example of a strong base

(i) What is a "strong base"? (1mark)

(ii) Write a chemical equation to show the ionization of ammonia in water. (3marks)

(iii) Identify one conjugate acid-base pair from the equation in 3.a.(ii) (1mark)

1999

(b) The equation for the reaction between magnesium metal and sulphuric acid is

$$Mg(s) + H_2SO_4(aq) \rightarrow MgSO_4(aq) + H_2(g)$$

(i) What do the symbols (s), (aq) and (g) stand for? (3marks)

(ii) Name the two products of the reaction. (2marks)

(iii) State the type of reaction that is represented by the equation. (1mark)

(iv) Figure 1 represents a mixture of magnesium and sulphuric acid solution before the reaction starts. Use the symbols given to show the contents of the beaker after reaction has gone to completion.

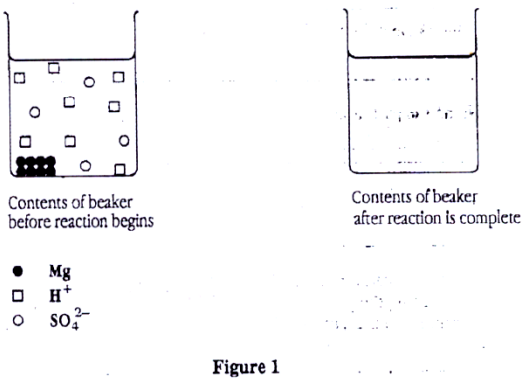


Figure 1

(v) Suppose the beaker and its contents were weighed before and after the reaction, would you expect the mass to increase, decrease or remain the same? (1mark)

(vi) Explain your answer in 1.b.(v). (1mark)

2006-5.

a.

(i) Name the ion responsible for the acidic properties of a substance. (1mark)

(ii) Why is carbonic acid a weak acid while hydrochloric acid a strong acid? (2marks)

2006-5.

c.

(i) What does the symbol $\rightleftharpoons$ mean in a chemical equation? (1mark)

(ii) Complete the following chemical equations:

1. $HSO_4^-(aq) + \_\_\_\_\_ \rightleftharpoons H_3O^+(aq) + \_\_\_\_\_ (aq)$

2. $H_3PO_4(aq) + NH_3(l) \rightleftharpoons \_\_\_\_\_ + H_2PO_4^-(aq)$

2002

2.

(i) What is the difference between strong and weak acids? (2marks)

(ii) Give an example of:

(1) strong acid (1mark)

(2) Weak acid (1mark)

(b) (i) State the products formed when acids react with metals. (2marks)

(ii) Write a chemical equation to represent the reaction between hydrochloric acid (HCl) and zinc metal (Zn) (2marks)

(c) Figure 5 is a diagram of the apparatus used in the purification of copper metal where one electrode is pure copper and the other impure copper.

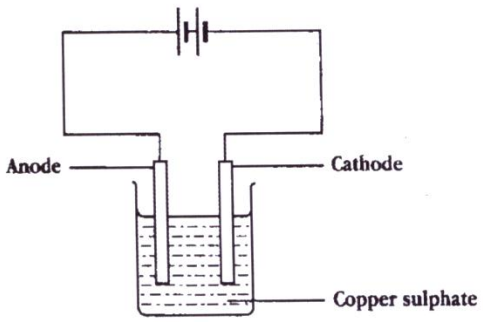


Figure 5

(i) Which of the electrodes is impure copper? (1mark)

(ii) Give a reason for your answer to 5c(i). (2marks)

(iii) What happens to the electrodes if the experiment is left for a few hours? (2marks)

(iv) What evidence will be there to show that the purification process was taking place? (1mark)

(v) Why does the colour of copper sulphate solution remain the same as the purification process takes place? (1mark)

(d) Figure 6 is a graph of the reaction between dilute hydrochloric acid (HCl) and calcium carbonate ($CaCO_3$)

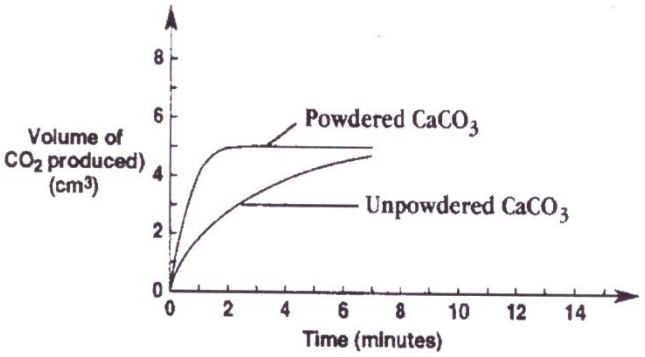


Figure 6

(i) What factor affecting the rate of reaction was being investigated? (1mark)

(ii) State any two factors that should be kept constant when investigating the factor you have mentioned in 5d(i) (2marks)

(iii) Calculate the rate of reaction for powdered $CaCO_3$ in the first minute of the reaction. (3marks)

2005-3.

a. Define "acid" according to Bronsted Lowry theory. (1mark)

2002

3. a

(i) Draw a labeled diagram of the set up of the apparatus that could be used to separate a mixture of water and ethanol. (5marks)

(ii) Explain why the distillate is not pure. (2marks)

b

(i) Define "molarity". (1mark)

(ii) Calculate the molarity of a solution prepared by dissolving 5g of sodium chloride (NACl) (3marks)

(iii) If $10cm^3$ of the solution in 1b(ii) was vaporized, how much NaCl would be left on the evaporating basin? (2marks)

1999

A teacher performed an experiment to find out the effect of pH on corrosion of iron. The results

obtained are shown in Table 3. A graph of the results was plotted as shown in **Figure 8**.

Table 3

pH of Solution	1	2	3	4	5	6	7
Percentage corrosion of iron nail (%)	60	55	50	45	15	10	5

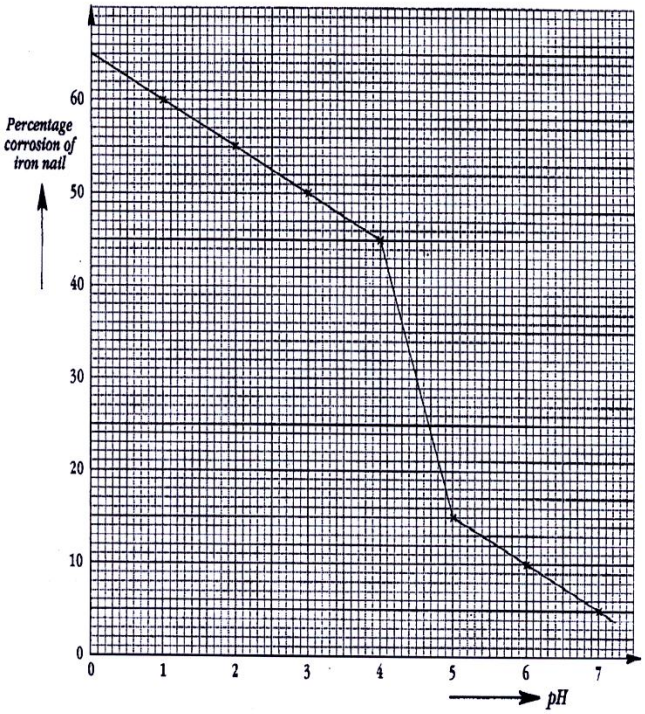


Figure 8

a. (i) How does percentage corrosion vary as pH increases from 1 to 7? (3marks)
   (ii) What conclusion can be drawn from these results? (2marks)
b. You are asked to verify the results in **Table 3**, write a detailed plan of the experiment. In your plan show the materials you would use and the procedure you would follow to do the experiment. (10marks)

1999

(b) Table 2 shows results obtained by a student who was investigating factors affecting the rate of reaction between magnesium and hydrochloric acid. Six experiments A, B, C, D, E and F were carried out. In each experiment a weighed amount of magnesium was added to 25cm^3 of acid and stirred with a thermometer. The initial and final temperatures of the solutions as well as the time taken for the magnesium to disappear were noted and recorded.

Table 2

Experiment	Volume of acid (cm^3)	Conc of HCl (mol/dm^3)	Mass and nature of magnesium	Temperature (°C)		Time (s)
				Initial	Final	
A	25	0.5	0.1 g ribbon	24	26	450
B	25	0.6	0.1 g powder	24	36	50
C	25	0.6	0.1 g ribbon	24	39	250
D	25	1.0	0.1 g ribbon	24	36	100
E	25	1.5	0.1 g ribbon	24	35	30
F	25	1.0	0.1 g ribbon	35	48	75

(i) Choose from the table four experiments which could be used to show the effect of concentration on the rate of reaction. (3marks)
(ii) Which two experiments could be used to determine the effect of temperature on the rate of reaction? (2marks)
(iii) State the third factor which is being investigated and select two experiments which show the effect of this factor on the rate of reaction. (3marks)
(iv) Explain the reasoning you used to select the two experiments in 3b(iii). (2marks)

2015

2. (a) **Figure 5** is a diagram showing the reaction between magnesium (Mg) and silver chloride solution (Ag Cl)

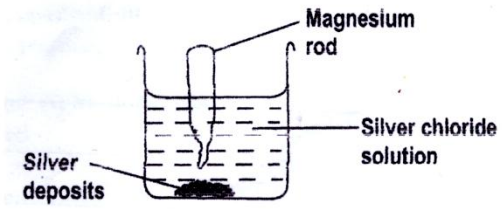


Figure 5

(i) Explain the reaction in **Figure 5** (4marks)

(ii) Write a chemical equation for the reaction. (3marks)

(b) In terms of electrical conductivity, explain the difference between "polar" and "non-polar" covalent molecules. (4marks)

2013

2. (a) What is an "empirical formula"? (1mark)

(b) Calculate the empirical formula of copper oxide (CuO) with chemical composition of 32g of copper and 8g of oxygen. (RAM:) = 16, Cu = 64) (6marks)

(c) **Figure 1** is a diagram showing the set up of an experiment on titration.

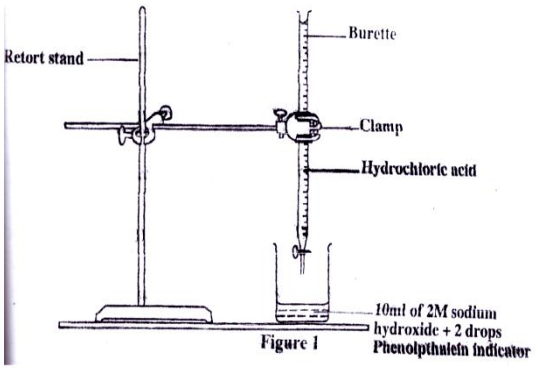


Figure 1

(i) What is the function of phenolphthalein indicator in the experiment? (1mark)

(ii) Name the standard solution in the experiment (1mark)

(iii) Give a reason for the answer in 3c (ii). (1mark)

(d) State any two ways of expressing the concentration of a solution. (2marks)

(e) (i) State any two ways of preventing rusting. (2marks)

(ii) Explain how rusting occurs. (3marks)

(iii) 2014

2. (a) Define "mole" (1mark)

(b) Magnesium (Mg) react with oxygen (O_2) according to the following equation:

$Mg_{(s)} + O_{2(g)} \rightarrow MgO^{(s)}$

(i) What does "s" stand for in the equation? (1mark)

(ii) Balance the equation (2marks)

(iii) If 120f of magnesium reacts completely in excess oxygen. How many moles of oxygen are used? (RAM: Mg = 24, O = 12)

(c) Sodium (NaCl) dissociates in water as follows

$NaCl_{(s)} + H2O_{(l)} \rightarrow Na_{(aq)} + Cl^{-}_{(aq)}\ \Delta H + 4kJmol^{-1}$

(i) Name the type of reaction basing on enthalpy change. (1mark)

(ii) Draw an energy level diagram for the process. (3marks)

(d) (i) What is a "weak acid"? (1mark)

(ii) State any one way of determining the strength of an acid. (1mark)

(iii) The conjugate acid-base pair for the reaction between water molecules are $H_2OH_3O^-$ and H_2O/OH.
Write an equation for the reaction. (3marks)

2018

2.

a. Define "standard solution". (1mark)

b. State two ways of expressing the concentration of a solution. (2marks)

c. Calculate the molarity of a sodium chloride (NaCl) solution made by dissolving 11.7g of NaCl in water and making up the volume to $4dm^3$. (RAM: Na = 23, Cl = 33.5) (6marks)

d. Zinc (Zn^0) reacts with copper ions (Cu2+) according to the following equation:

$$Zn^0(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu^0(s)$$

(i) Which element is oxidized? (1mark)

(ii) Give a reason for the answer in **3.d.(i).** (1mark)

(iii) What does "s" and "aq" mean in the equation? (2marks)

(iv) Write two half equations for the reaction between zinc and copper ions. (4marks)

2002

(c) (i) Define "reduction". (1mark)

(ii) A pupil carried out a series of experiments to find out positions of metals in a displacement series.

The following results were obtained after dipping metals in **Column X** into solutions containing ions in **Column Z**

X	Z	
METAL	**IONS**	**RESULTS**
Fe	Pb^{2+}	Lead (Pb) deposited
Pb	Cu^{2+}	Copper (Cu) deposited
Na	Mg^{2+}	Magnesium (Mg) deposited
Mg	Na^+	No change

(1) Name the type of reaction that took place during deposition of the metals. (1mark)

(2) List down the metals in order of decreasing reactivity. (3marks)

(d) Figure 4 is a diagram of a Daniell cell being used to light a bulb

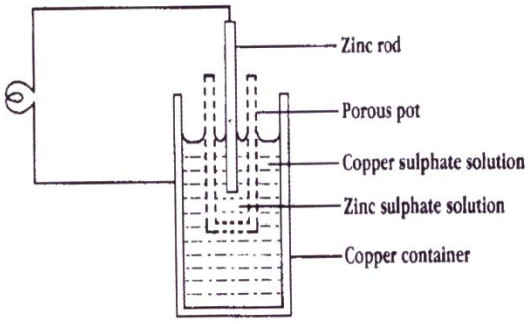


Figure 4

(i) State two functions of the porous pot. (2marks)

(ii) Write down a half equation for the reaction at the zinc electrode. (2marks)

Explain why the brightness of the bulb gets weaker after some time. (3marks)

2017

2. (a) State any two conditions that are necessary for rusting to take place (2marks)

(b) **Figure 1** is a diagram showing the process of electroplating a carbon rod.

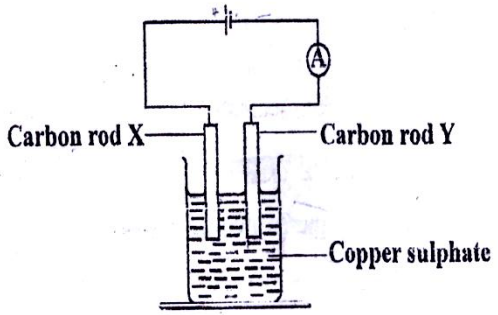


Figure 1

(i) Which carbon rod would be electroplated? (1mark)

(ii) Give any two observations that will be made in the experiment after some time. (2marks)

(iii) Write down a half equation for the reaction at the carbon rod. (2marks)

(c) Calculate the molecular formula of a compound if its empirical formula is CH_2O and has a molar of 180g

(RAM: C = 12, H = 1, O = 16) (4marks)

(d) What is a strong acid? (1mark)

(e) Ethanoic acid (CH_3COOH) reacts with water (H_2O) according to the following equation:

$$CH_3COOH_{(l)} + H_2O_{(l)} \rightleftharpoons CH_3COO^-_{(aq)} + H_3O^+_{(aq)}$$

(i) Identify the two conjugate acid-base pairs. (2marks)

(ii) Explain how the H_3O^+ ion was formed. (3marks)

2. (a) (i) State any two conditions necessary for rusting to take place. (2marks)

(ii) How does galvanizing prevent iron sheets from rusting? (2marks)

(b) Table 1 shows results of an experiment on displacement reactions involving copper (Cu), magnesium (Mg), zinc (Zn) and their aqueous solutions.

Table 1

Reaction	Observations
$Cu(s) + MgSO_4(aq)$	No reaction
$Mg(s) + CuSO_4(aq)$	Fast reaction
$Zn(s) + CuSO_4(aq)$	Slow reaction
$Mg(s) + ZnCl_2(aq)$	Moderate reaction
$Zn(s) + MgSO_4(aq)$	No reaction

(i) Write a balanced chemical equation for the reaction between magnesium (Mg) and copper sulphate ($CuSO_4$) solution. (2marks)

(ii) Arrange the metals in order of increasing reactivity. (3marks)

(c) Figure 4 is an energy level diagram for the dissolving of sodium hydroxide (NaOH) in water.

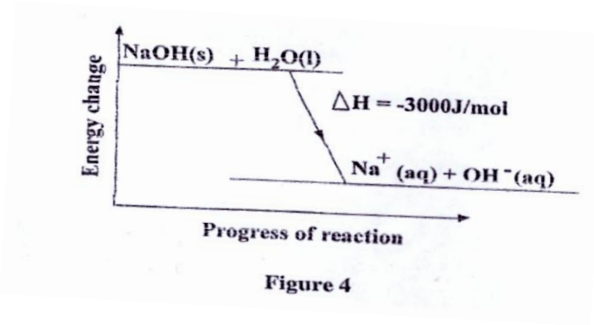


Figure 4

(i) What type of change is shown by the energy level diagram? (1mark)

(ii) Give a reason for the answer in 5c (i)
(2marks)

(d) Calculate the amount of water that must be added to $5cm^3$ of 2M hydrochloric acid to dilute it to 0.1M. (3marks)

ORGANIC CHEMISTRY

2012-3

The following are general formulae of organic compounds **A** and **B**.

A. $C_nH_{2n+1}COOH$
B. $C_nH_{2n+1}OH$

a. To which family does compound **B** belong? (1mark)
b. Mention any three properties of compound **A**. (3marks)
c. State any three uses of compound **B**. (3marks)
d. Mention the products formed when compounds **A** and **B** react. (2marks)
e. Work out molecular formula of compound **A** if n is 5. (3marks)
f. Describe how compounds **A** could be distinguished from compound **B**. (5marks)

2011-5

b. Mention any two properties of alkanols.
(2marks)

c. Ethanol (CH_3CH_2OH) changes to ethanoic acid (CH_3COOH) in the presence of atmospheric oxygen (O_2).

(i) What is the function of atmospheric oxygen in the reaction? (1mark)

(ii) Write a balanced chemical equation for the reaction. (3marks)

2010-4

b.

(i) Give three properties of carboxylic acids.
(3marks)

(ii) Mention any two natural sources of carboxylic acids. (2marks)

d.

Ethanol (C_2H_5OH) reacts with ethanoic acid (CH_3COOH) according to the following chemical equation.

$$CH_3COOH + C_2H_5OH \underset{H_2SO_4}{\overset{\text{Concentrated}}{\rightleftharpoons}} \text{\_\_\_\_\_} + H_2O$$

(i) Complete the equation.
(1mark)

(ii) Name the process in which ethanol reacts with ethanoic acid. (1mark)

2010-8

c. Explain why propanoic acid (C_2H_5COOH) conducts electricity when dissolved in water while propanol (C_3H_7OH) does not.

2009-5.

a. State any three uses of ethanoic acid. (3marks)
b. Why is the ethanoic acid regarded as a weak electrolyte? (1mark)
c. Write down the ionization equation of ethanoic acid (CH_3CHOOH) in water (H_2O). (4marks)
d. Why does sodium metal react with ethanol in the same way as it does with water? (1mark)

f.

(i) Write down the general formula for carboxylic acids. (1mark)

(ii) What is the formula and name of the smallest carboxylic acid? (2marks)

(iii) How would the boiling point of butane compare with that of a carboxylic acid similar size? (1mark)
(iv) Explain your answer to 5.f.(iii). (3marks)

2008.5

c. **Figure 5** is a diagram of an experimental set up.

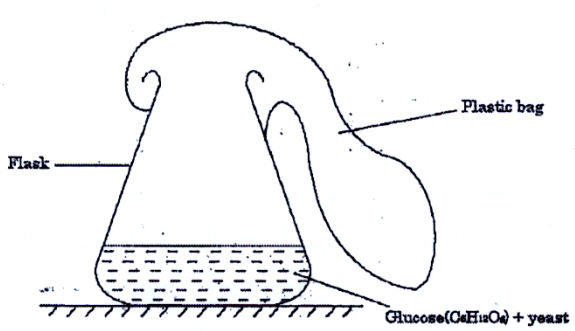


Figure 5

(i) Name the process that could occur in the flask. (1mark)
(ii) Write down a balanced equation of the process named in 5.c.(i). (3marks)

e. **Table 2** shows boiling points and solubility of some alkanols in water.

Name	Boiling point (°C)	Solubility
Methanol	65	Most soluble
Ethanol	78	Soluble
Propanol	97.	Partially soluble
Butanol	117	Insoluble

(i) Explain why the boiling points of alkanols increase from methanol to butanol. (3marks)
(ii) Explain why ethanol is more soluble in water than propanol. (8marks)

f.

(i) Complete the following equation to show the reaction between methane and chlorine.

$CH_4 + Cl_2 \rightarrow$ _____ + _____ (2marks)

(ii) Name this type of reaction. (1mark)

(iii) Give any one use of alkanes. (1mark)

2008-7

a. Describe an experiment that can be done to distinguish octane from octane. (5marks)

2007-1.

b. The following are formulae of some organic compounds:

A. $CH_3CH_2CH_2CH_2OH$

B. $CH_3CH_2CH_3$

C. $CH_3CH_2CH_2COOH$

D. $CH_3CH_2CH=CH_2$

E. $CH_3CH_2CH_2CH_3$

(i) Identify one compound which is an alkanol. (1mark)

(ii) Which compounds belong to the same homologous series? (1mark)

(iii) Explain why a solution of compounds C conducts electricity. (2marks)

(iv) Name compound D. (1mark)

2007-7

a. Draw full structures of ethanol (C_2H_5OH) and water (H_2O). (2marks)

b. Explain the difference in boiling points between ethanol and water. (5marks)

c. With the help of a labeled diagram, describe an experiment that can be done to separate a mixture of ethanol and water. (8marks)

2006-1

a. Given below is the general formulae of some homologous series represented by letters **P, Q, R** and **S**

P: C_nH_{2n}

Q: C_nH_{2n+2}

R: $C_nH_{2n+1}OH$

S: $C_nH_{2n+1}COOH$

(i) Name the homologous series represented by letter **Q** and **S**. (1mark each)

(ii) Which general formulae represent hydrocarbons? (2marks)

(iii) Draw the structure of a compound with three carbon atoms in homologous series **P**. (2marks)

(iv) Name the compound drawn in 1.a.(iii). (1mark)

(v) Explain how a compound of homologous series **Q** could be distinguished from a compound of homologous series **R**. (1mark)

c.

Ethene (C_2H_4) reacts with bromine (Br_2) in an addition reaction

(i) Draw the structure of the product formed. (1mark)

(ii) Name the product formed in 1.c.(i). (1mark)

(iii) Why are addition reactions important in industries? Give two reasons. (2marks)

2005-5

a. Figure 5 is a diagram showing how ethanol and tannic acid are produced

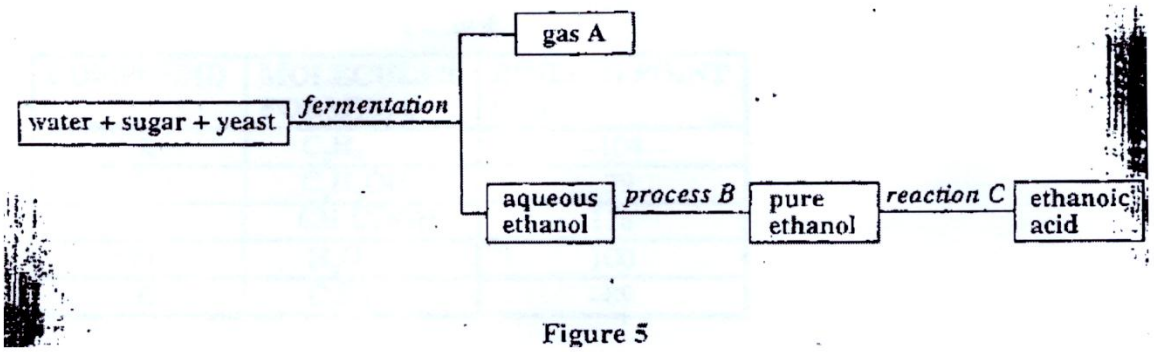


Figure 5

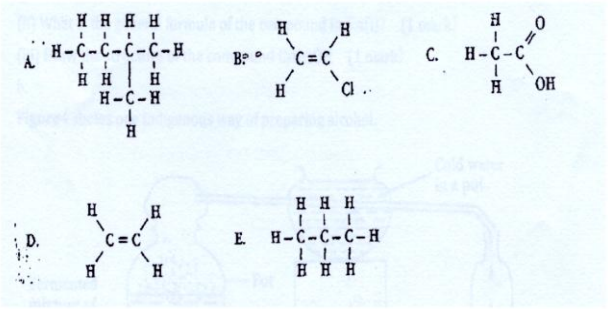
(i) Give the names of
(1) Gas A (1mark)
(2) Process B (1mark)
(3) Reaction C. (1mark)

(ii) Name the substance that is used in reaction C. (1mark)

(iii) What is the function of the substance in a (ii)? (1mark)

2005-5

b. The following are structures of some organic compounds



(i) Name compound A. (1mark)

(ii) Which compound is soluble in water? Give a reason. (2marks)

(iii) Write letters representing any three compounds that would not react with potassium, a group 1 metal element. (3marks)

(iv) Which one of the two compounds A and E would have a lower boiling point? Give a reason (2marks)

(v) What is the state of D at room temperature?

(vi) Describe a test that could be done to distinguish the compounds D and E.

2004-3

d. **Table 4** shows molecular formulae and boiling points of some compounds

Table 4

COMPOUND	MOLECULAR FORMULA	BOILING POINT (°C)
A	C_2H_4	–104
B	C_2H_5OH	79
C	CH_3COOH	118
D	H_2O	100
E	C_2H_6	–89

(i) Which compounds in the table are hydrocarbons? (2marks)

(ii) Which compounds in the table are soluble in water? (2marks)

(iii) Which compounds in the table are gases at room temperature? (2marks)

(iv) Explain why the boiling point of compound D is higher than the boiling point of compound E. (4marks)

(v) Describe a test which can be done to distinguish the compounds C and D. (4marks)

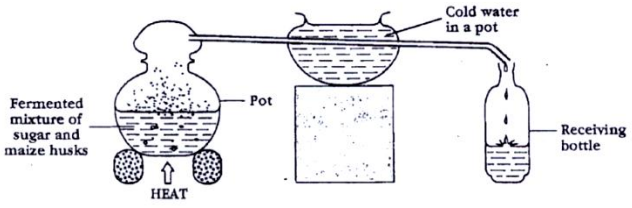
2003-5

(i) Name the compound $C_7H_{15}OH$ (1mark)

(ii) What is the general formula of the compound in 5.a(i)? (1mark)

(iii) Draw the structure of the compound $C_7H_{15}OH$ (1mark)

b. Figure 4 shows one indigenous way of preparing alcohol.



(i) Name the process illustrated in Figure 4. (1mark)

(ii) Name the alcohol collected in the receiving bottle (1mark)

(iii) The alcohol collected in figure 4 is produced by fermentation.

(1) Define "fermentation". (2marks)

(2) Write a word equation for the fermentation of sugar. (3marks)

c. Ethanoic acid (CH_3COOH) reacts with ethanol (C_2H_5OH) according to the following equation.

$$CH_3COOH(l) + C_2H_5OH(l) \xrightarrow[\text{Heat}]{\text{Conc. } H_2SO_4} CH_3COOC_2H_5(l) + H_2O(l)$$

(i) What is the name of this reaction? (1mark)

(ii) Name the two products of this reaction. (2marks)

(iii) Give one use of $CH_3COOC_2H_5$. (1mark)

2011-5.

d. **Figure 3** shows structures of some of organic compounds P, Q, R and S

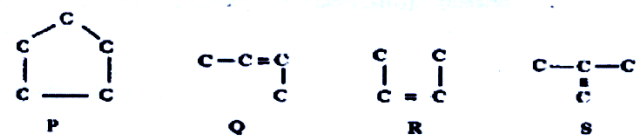


Figure 3

(i) Name the organic compounds labeled P and Q. (1mark each)

(ii) Identify the structure which is an isomer of compound Q. (1mark)

(iii) Give a reason for the answer in 5.d.(ii). (1mark)

(iv) Explain how compound P could be distinguished from compound R using bromine solution. (3marks)

2010-4.

c. (i) Define "isomers". (2marks)

(ii) Draw structural formulae for the four isomers of butanol (C_2H_9OH). (4marks)

(iii) Explain how compound P could be distinguished from compound R using bromine solution.

(2marks)

2008-5.

a. Define "isomers".

(i) Draw structural formulas for the two isomers of butane (C_4H_{10}).

(ii) Name the isomers draw in 5.b.(i). (1mark each)

2006-1

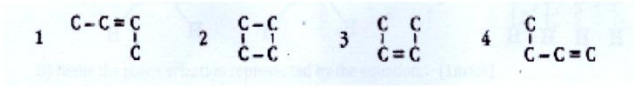
b.

(i) Write down all structural isomers of pentane. (3marks)

(ii) Name the isomers in 1.b.(i). (3marks)

2004-3

c. The following are structural formulae of four molecules with the molecular formula C_4H_8.



(i) Name the molecules 1 and 2 (1mark)

(ii) Which two structures are conformations of each other? (1mark)

2003-5.

d. Draw and name all the isomers of pentane (C_5H_{12}). (6marks)

2011-5.

a.

(i) Give any two properties of polymers. (2marks)

(ii) Explain how "condensation polymerization" occurs. (2marks)

2010-4

a.

(i) What are "polymers"?(1mark)

(ii) Mention any two uses of polythene. (2marks)

(iii) Give any three properties of plastic. (3marks)

3. (a) (i) State the products that are formed when ethanol burns in excess oxygen. (2marks)

(ii) Mention two organic families whose members react to produce esters. (2marks)

(b) **Figure 5** is a diagram showing how ethanol and ethanoic acid is produced

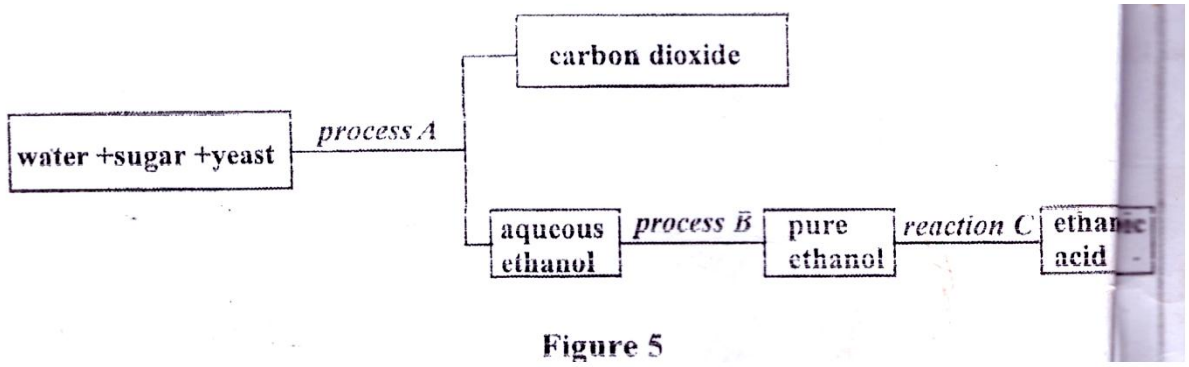


Figure 5

(i) Name process **A** and **B** . (1mark for each process)

(ii) What is the role of the yeast? (1mark)

(c) Given below are general formulae of some homologous series represented by the letters **M, N, O** and **P**.

M C_nH_{2n}

N C_nH_{2n-2}

O $C_nH_{2n+1}OH$

P $C_nH_{2n+1}COOH$

(i) Name the homologous series represented by the letters **M**, and **P** (2marks)

(ii) Which general formulae represent hydrocarbons? (2marks)

(d) Draw any three isomers of butanol (C_4H_9OH) (3marks)

(e) Explain why pentanol ($C_5H_{11}OH$) has a higher melting point than ethanol (C_2H_5OH) (3marks)

2016

3. (a) (i) What is a "hydrocarbon"? (1mark)

(ii) Write down the general formula for alkanols. (1mark)

(b) The molecular formulas of organic compounds R, S and T are C_2H_5OH, C_6H_{12} and CH_3COOH respectively.

(i) Draw the structure of compound T. (1mark)

(ii) Classify the compounds as soluble or insoluble in water. (3marks for both)

(iii) Which compounds would undergo addition reaction with chlorine gas? (1mark)

(iv) Give a reason for the answer in 2b (iii) (2marks)

(v) Write down a balanced equation for the reaction between **R** and **T**. (3marks)

(c) Mention the two main types of polymerization. (3marks)

(d) Draw three isomers of butane (C_4H_8) using carbon chains only (3marks)

2010-8

d. Explain how polythene is formed. (3marks)

2009-5

g. State any three ways of managing plastic wastes. (3marks)

2009-7.

a. Explain any three characteristics of thermoplastics. (6marks)

b. Explain any two advantages of recycling organic compounds. (4marks)

c. Explain why thermosetting plastics can be heated and moulded only once. (5marks)

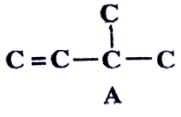
2015

3. (a) (i) Name the products formed during the fermentation of sugar by yeast. (2marks)

(ii) Describe how fermentation of sugar by yeast occurs. (2marks)

(b) Explain why thermosetting plastics do not melt when heated. (3marks)

(c) The following are isomers of organic compounds A and B



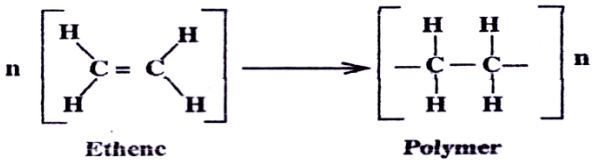
A

B

(i) Name the isomers **A** and **B**. (1 mark for each)

(ii) To which homologous series do the isomers belong? (1mark for each)

(d) Polymerisation of ethane takes place according to the following equation:



(i) Name the polymer. (1mark)
(ii) Give any two advantages of the polymer. (2marks)
(iii) Explain how the polymerization takes place. (3marks)

4. (a) **Figure 3** is an electron dot and cross diagram of ammonia.

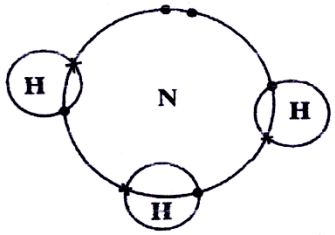


Figure 3

(i) Name the type of bonding that holds the atoms together. (1mark)
(ii) Give a reason for the answer in 6.a.(i). (1mark)
(iii) Write the chemical formula for ammonia. (1mark)

(b) (i) Mention any three properties of metals. (3marks)

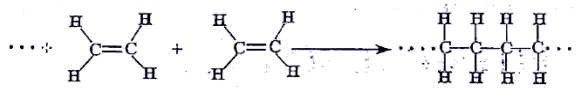
(ii) Explain how metallic bonding occurs (3marks)

2008-5

d. state any two disadvantages of synthetic polymers. (2marks)

2007-1

a. Polymerization of Ethene can be represented by the following equation:



(i) Name the polymerization represented by the equation. (1mark)
(ii) Describe how the polymer is formed from ethane molecules. (3marks)
(iii) Give two examples of artificial polymers. (2marks)

c.

(i) Give three differences between thermosetting and thermoplastic polymers. (3marks)

(ii) State two ways of disposing of plastic waste to avoid pollution. (2marks)

(iii) Give three advantages of plastic materials over metallic materials. (3marks)

1999

3. (a) Given below are general formulae of some homologous series represented by the letters **M, N, O** and **P**.

M $C_n H_{2n}$
N $C_n H_{2n+2}$
O $C_n H_{2n+1}OH$
P $C_n H_{2n+1}COOH$

(i) Name the homologous series represented by the letter **M** and **P**. (2marks)
(ii) Which general formulae represent hydrocarbons? (2marks)

(iii) Draw the structure of a member with three carbon atoms from series **N** and one member with one carbon atom from **O**. (2marks)

(iv) Name the compounds whose structures you have drawn in 5.a(iii). (2marks)

(v) Explain how you would distinguish a sample of a member of series M from a sample of a member of series N. (3marks)

(b) The formula of propanal is CH_3CH_2CHO.

(i) Name the homologous series to which propanal belongs. (1mark)

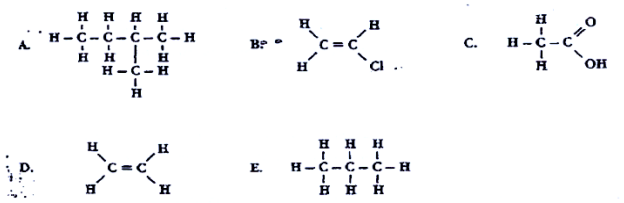
(ii) Propanal and propanone are isomers. Draw their expanded structure. (2marks)

(iii) Calculate the molecular mass of propanal CH_3CH_2CHO.
Atomic masses: (C = 12, H = 1, O = 16)

(iv) Two hydrocarbons X and Y have the same molecular mass as propanal. Determine the full structural formulae of X and Y. (2marks)

2005-5

b. The following is structures of some organic compounds



(v) Compound B is a monomer. Write an equation to show its polymerization. (2marks)

(vi) Give the name of the kid of polymerization in b(v). (1mark)

(vii) Give one use of the substance formed in the polymerization of compound. (1mark)

(x) Write the other isomers of substance A. (2marks)

c. Give two advantages of thermoplastics. (2marks)

2004-3

a. State one use of each of the following polymers
(i) Plastic
(ii) Carbohydrate (2marks)

b. State any two ways of disposing of plastics to avoid polluting the environment. (2marks)

2002

4. (a) A certain hydrocarbon has a carbon to hydrogen ratio of 4:9 and a relative molecular mass of 114. (RAM carbon = 12, hydrogen = 1)
Work out the molecular of the compound. (4marks)
(b) A student was given samples of C_5H_{12}, C_9H_{20}, C_5H_9COOH and CH_3COH in unlabelled bottles. Using a flow diagram, describe an investigation he would carry out in order to identify the samples. (11marks)

2014

3. (a) What are "hydrocarbons"? (1mark)

(b) **Figure 3** shows formulae of some organic compounds A, B, C and D.

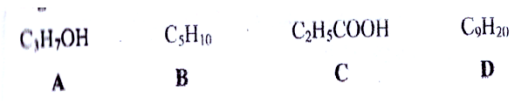


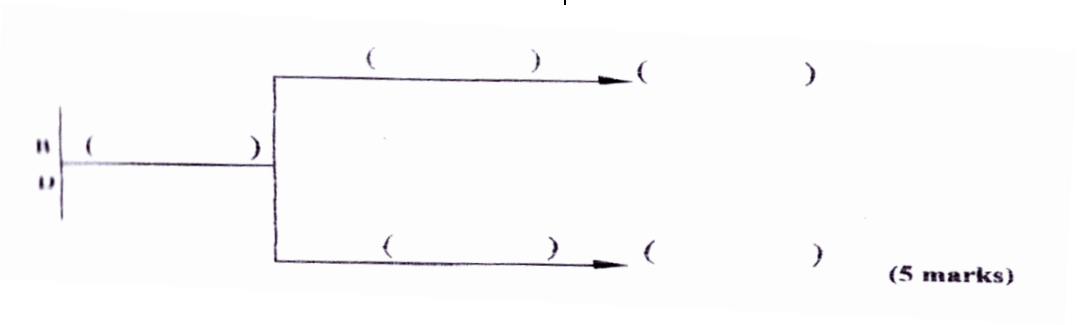
Figure 3

(i) Which compounds are hydrocarbons? (1mark)

(ii) Name compound A. (1mark)

(iii) Draw molecular structure of compound C. (2marks)

(iv) Complete the flow diagram for differentiating compounds B and D by filling in the missing information in the brackets.



(c) State any three properties of synthetic polymers. (3marks)

(d) Draw the structures of the two isomers of butane (C_4H_{10})

3. (a) Figure 3 shows structures of some organic compounds W, X, Y and Z

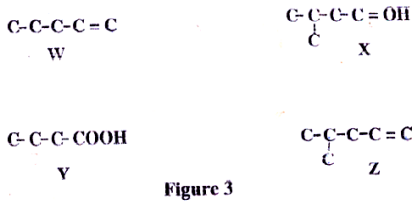


Figure 3

(i) To which homologous series do compound X and Z belong? (1mark for each)

(ii) Mention any three chemical properties of compound X. (3marks)

(iii) Write the general formula for compound Y (1mark)

(iv) Name two products that are formed when compounds X and Y react. (2marks)

(v) Which compounds belong to same homologous series? (2marks)

(vi) Give a reason for the answer in 5a(v). (1mark)

(b) Figure 4 is a diagram showing structures of plastic A and B.

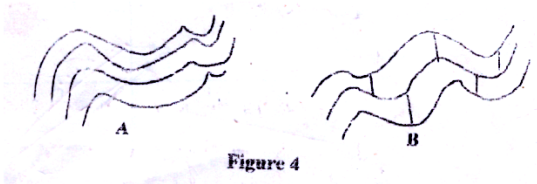


Figure 4

(i) Which structure represents thermosetting plastics? (1mark)

(ii) Give a reason for the answer in 5b(i). (2marks)

(c) Explain how ethanol (C_2H_5OH) could be distinguished from hexane (C_6H_{14}). (3marks)

2018

a. **Figure 2** is a diagram showing the arrangement of polymer chains after plastics **K** and **L**.

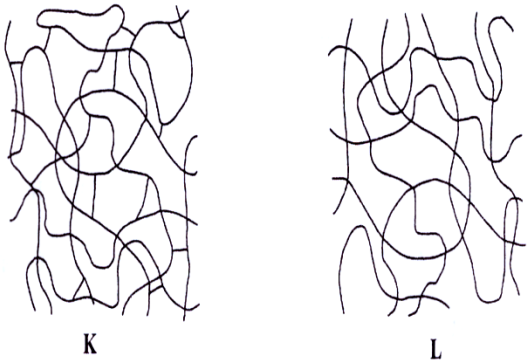


Figure 2

(i) Identify the type of plastics K and L. (1 mark for each)

(ii) State any two properties of plastics with polymer chains represented by **L**. (2marks)

(iii) Explain why structure K does not easily melt when heated. (3marks)

b. **Figure 3** is a diagram showing structure of organic compounds **X** and **Y**.

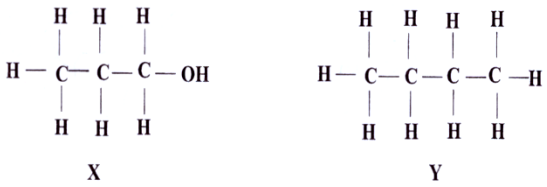


Figure 3

(i) To which families of organic compounds do **X** and **Y** belong? (1mark for each)

(ii) Write down the structure of an isomer of compound **Y**. (2marks)

(iii) Describe a test that could be done to distinguish compound **X** from **Y**. (6marks)

2019 PAPER

1.a.State the difference between "accuracy" and "precision". (2 marks)

b. Figure 1 is a diagram of container with molecular models in various positions. The models are supposed to be at the centre of the container.

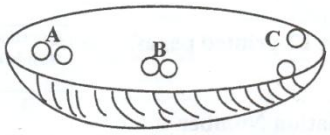


Figure 1

Using letters, A, B and C, identify the molecular models that have: -

(i) good precision but poor accuracy.(1 mark)
(ii) both poor precision and accuracy.(1 mark)
(iii)both good precision and accuracy.(1 mark)

1.c. In an experiment, 136g of gaseous ammonia (NH_3) reacted with excess oxygen (O_2) to produce nitric acid (HNO_3) and water (H_2O).

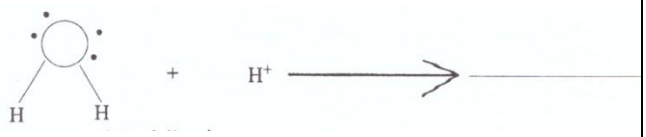
(i) Write a balanced equation for the reaction. (3)

(ii) How much nitric acid (HNO_3) could be produced from this reaction?

(RAM: N=14, H=1, O=16) (3 marks)

2.a. Work out the number of nitrogen atoms in 8 molecules of urea $CO(NH_2)_7$. (2 marks)

b. Complete the equation and label the dative bond. (2 marks)



c. Explain each of the following statements.

(i) Ionic compounds are soluble in water. (3)

(ii) Graphite conducts electricity. (3)

d. Explain how a polar bond is formed.(4)

3.a. Give any one use of electron configuration. (1 mark)

b. (i) Why is nitrogen gas inert at room temperature? (2 marks)

(ii) Explain any one way in which inertness of nitrogen is important. (3 marks)

c. The table below shows electron configuration and relative abundance of isotopes of an element.

Isotopes	Electron configuration	Relative abundance
X – 28	2 – 8 – 4	$^{8}/_{10}$
X – 29	2 – 8 – 4	$^{1}/_{10}$
X – 30	2 – 8 – 4	$^{1}/_{10}$

(i) To which group of the period table does element X belong? (1 mark)

(ii) Element X reacts with element Y whose valency is 2.
Write the chemical formula of the product. (2 marks)

4.a.A hydrocarbon contains 85.7% carbon and 14.3% hydrogen by mass. Write the molecular formula of the hydrocarbon if its relative formula mass is56.(RAM:C=12,H=1). (7marks)

c. Why is burning of plastic not recommended as a method of disposal? (2)

5. Figure 2 is a graph showing results of experiments A and B on one of the factors affecting rate of reactions.

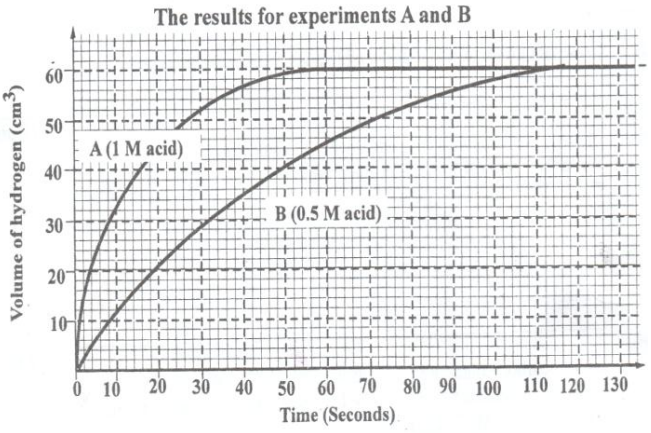


Figure 2

Adapted from Complete Chemistry by Rose pp. 122

a. State the factor affecting the rate of reaction which was being investigated. (1)

b. Which reaction is faster than the other?(1)

c. Give a reason for the answer in 5.b. (1)

6.Aluminium reacts with chlorine gas according to the following equation:

$2Al(s) + 3Cl2(g) \longrightarrow 2AlCl_3(s)$

a.Write oxidation and reduction half reactions.

Oxidation: (2 marks)

Reduction: (2 marks)

b.Calculate the volume of 8M KNO_3 stock solution to be diluted to 400ml so that the final concentration is 0.2M. (3 marks)

7.Figure 3 shows different structures of an organic compound.

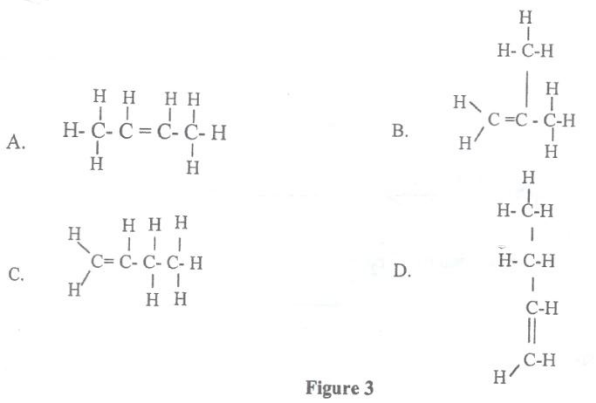
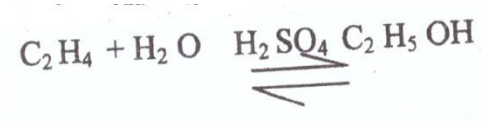


Figure 3

a. Identify conformers. (1 mark)
b. Which of these structures has the lowest boiling point? (1 mark)
c. Give a reason for the answer in 7(b).(2)

8.a. Ethene (C_2H_3) and water (H_2O) react to form ethanol (C_2H_5OH) according to the following chemical equation.



(i) Name the type of reaction in the reaction. (1 mark)
(ii) Give the function of H_2 SO_4 in the reaction. (1 mark)

b. (i) Complete the following equation: (2)

(ii) What is the function of $Cr_2O^{2-}_7$ in the reaction? (1 mark)

(iii) Name the products in the equation.(2)

9.a. Why is argon gas obtained before oxygen gas during separation of air into its component gases? (1 mark)

b. Describe how carbon dioxide is remove from air. (2 marks)

10.a. Mention any one type of wastes based on degradability. (1 mark)

b. Explain how burning of fuel causes global warming. (2 marks)

11.a. Why is the boiling point of hexanoic acid higher than that of hexanol? (3 marks)

b. With the aid of chemical equations, explain how ozone layer is depleted. (7 marks)

12. Describe the process of soap making. (10)

13. With the aid of a well labelled diagram, describe how copper can be refined using electrolysis. In your description, include half equations at the cathode and anode. (10 marks)