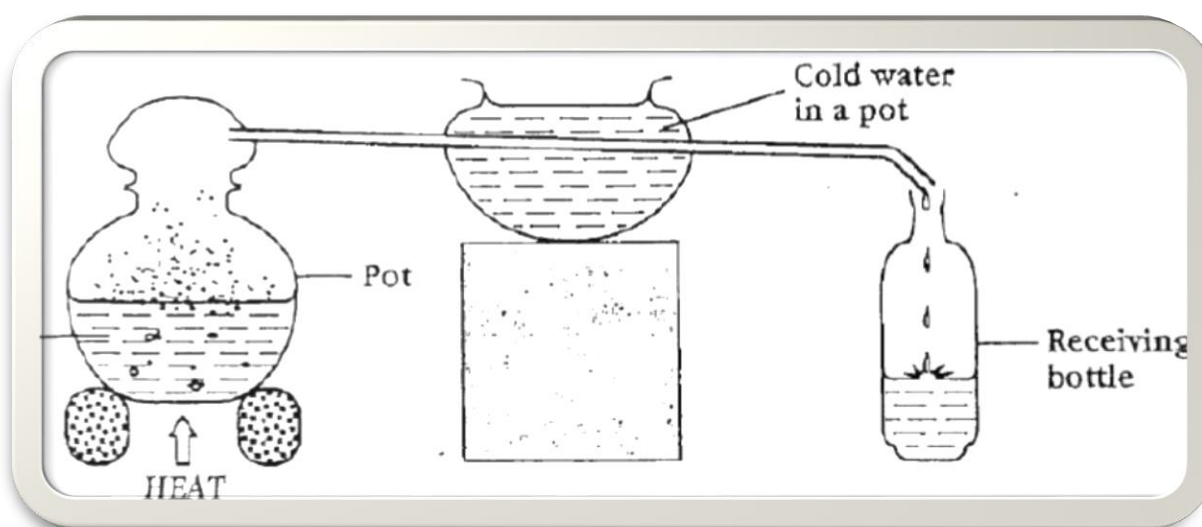


**MSCE**

**2003-2015**

**CHEMISTRY**



MSCE 2003-2015 COMPILED BY

MANUEL

**QUESTIONS AND MODEL ANSWERS**

**TOPIC 1. ELEMENTS AND CHEMICAL BONDING****2003**

The table below shows first 20 elements of periodic table.

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

- a. Write down the atomic number of Si. (1 mark)
- 
- b. Work out the electron configuration of K given that its atomic number is 19. (1 mark)
- 
- c. Draw an electron dot and cross diagram of CO<sub>2</sub>. (2 marks)
- 
- d. How can aluminum (Al) attain an inert gas configuration?
- 
- e. Explain why the melting points of group VII elements increase with increasing atomic number.
- 
- 

The table 2 below shows the atomic numbers, melting points, and radius of some halogens.

Name of element	Atomic number	Melting point (°C)	Boiling point (°C)	Atomic radius(nm)
Fluorine	9	-220	-188	0.071
Chlorine	17	-101	-34	0.099
Bromine	35	-7	59	0.114
Iodine	53	114	184	0.133

f. Which element is a liquid at 25°C. (1 mark)

---

g. Why does iodine have the biggest radius? (1 mark)

---

h. Work out the effective nuclear charge for fluorine. (2 marks)

---

i. Mention any two chemical properties of halogens. (marks)

---

**2004**

**The table 3 shows particles found in the atoms of four elements.**

ELEMENT	PROTONS	NEUTRONS	ELECTRONS	MASS NUMBER
Hydrogen (H)	1	0	1	1
Carbon (C)	6	6	6	12
Nitrogen (N)	7	7	7	14
Sodium (Na)	11	12	11	23

a. Complete the table by filling the missing numbers. (4 marks)

b. Which element in the table will easily form anionic compound?

Give reason for your answer. (3 marks)

c. Work out the molecular mass of methane (CH<sub>4</sub>). (2 marks)

---

d. What kind of chemical bonds are involved in methane? (1 marks)

Explain the answer above. (3 marks)

**2005**

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

b. What type of bond exists between Al and O atoms in the compound formed above. (*give reason*) 2 marks.

c. Define the term “allotropes” (1 marks)

d. State two allotropes of sulfur. (2 marks)

e. Give the halogen used for: (2 marks)

Sterilising drinking water\_\_\_\_\_

Photography\_\_\_\_\_

Table shows arrangement of some elements in the periodic table.

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

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

g. A certain element could be represented as  $\frac{24}{14}\text{X}$ .

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

---

Identify element X in periodic table. (1 mark)

---

## 2006

a. Halogens such as bromine, chlorine and iodine can be prepared by reacting an alkali metal salt with concentrated sulphuric acid in the presence of a catalyst. Name any salt from which each of the following can be prepared. (3 marks)

Br<sub>2</sub>, Cl<sub>2</sub> and I<sub>2</sub> \_\_\_\_\_

b. State any two properties of halogens.

---

c. Draw an electron shell diagram for a fluorine atom ( $\frac{19}{9}\text{F}$ ) (2 marks)

d. Arrange the elements  $\frac{127}{53}\text{I}$ ,  $\frac{35.5}{17}\text{Cl}$  and  $\frac{80}{35}\text{Br}$  in order of increasing reactivity. (3marks)

---

e. Explain the difference in reactivity of the elements above. (5 marks)

---

f. State any chemical property of Sulphur. (1 mark)

---

g. Explain with aid of diagram, rhombic Sulphur is more stable than monoclinic Sulphur. (4 marks)

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**2007**

**Table** shows atomic numbers and electron configuration of some elements.

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

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

---

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

---

c. Give any 3 properties of element A. (3 marks)

---

**2008**

- a. Element X has a mass of 59 and atomic number 19.

How many protons are in the atom?

---

What would happen if element X was mixed with water? Give reason. (3 mark)

---

---

- b. Magnesium and chlorine can be represented as  $\frac{24}{12}\text{Mg}$  and  $\frac{35.5}{17}\text{Cl}$ .

What are the valence of magnesium and chlorine? (2 marks)

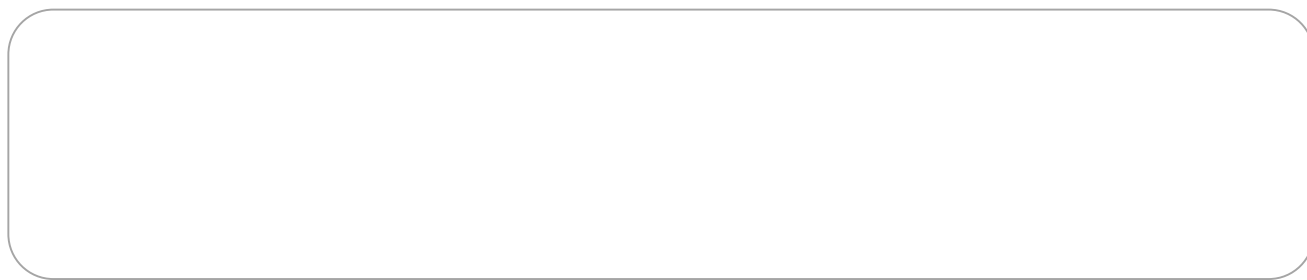
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What is the molecular formula of the compound formed as a result of magnesium reacting with chlorine? (2 marks)

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---

- c. Draw an electron dot and cross diagram of carbon dioxide ( $\text{CO}_2$ ) given that carbon is in group 4 and oxygen in group 6 of the periodic table.



What type of bonding exists in carbon dioxide? Give reason for the answer (2 marks)

---

- d. Sulphuric acid ( $\text{H}_2\text{SO}_4$ ) can be used as a dehydrating agent. Name the products in the dehydration of sucrose ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ ). (2 marks)

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Give any four uses of sulphuric acid. (4 marks)

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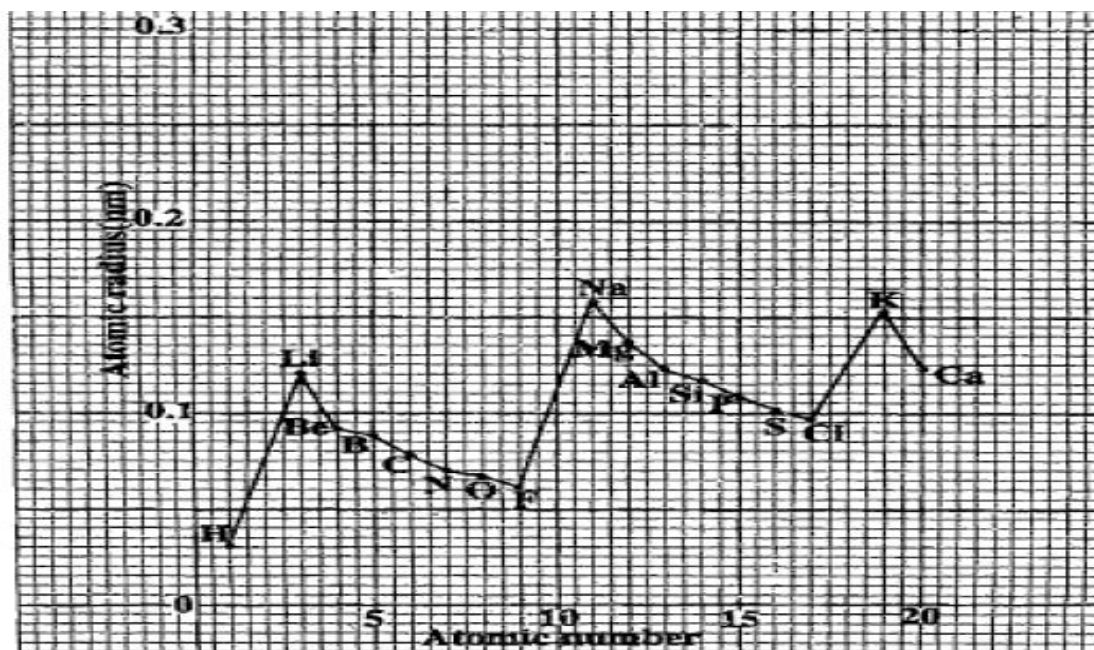
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2009

- a. **Define** *electron configuration*. (1 mark)

---

- b. Figure below is a graph of atomic radius across the periods against atomic number for some elements in the periodic table. (2 marks)



To which group of the periodic table does element O belong? Give a reason.

---

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



In terms of atomic radius, explain the difference in reactivity between F and Cl.

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Give two difference between the type of bonding in lithium metal (Li) and chlorine gas (Cl<sub>2</sub>). 2 marks

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c. Mention any two uses of Sulphur. 2 marks

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Give any two physical properties of Sulphur. 2 marks

---



---

d. Table shows the number of valence electrons and valences of some elements. (3 marks)

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

How can element N attain a stable configuration? Give reason for the answer.

---

What is the formula of a compound that is formed when Li reacts with O?

---

Give the charge on a **Be** ion.

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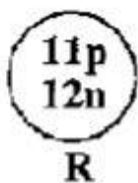
**2010**

a. Explain why potassium is more reactive than sodium.

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b. Figure below is a diagram of atomic nuclei of element R and Q.



Write down the electronic configurations of elements R and Q. 2 marks

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To which period and group of the periodic table does element R belong? 1 mark

---

Draw a dot and cross diagram of the component that would be when R reacts with Q. 3 marks

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

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d. State any two uses of sulphates.

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**2011**

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

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---

Explain how ionic bonding occurs. 3 marks

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---

b. **Table** shows atomic numbers and boiling points of some elements represented by letters.

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

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

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Which element is in the gaseous state at room temperature (25°C)?

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What type of bonding would exist when element Q reacts with element T?

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

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**2012**

a. The table below shows electron configuration of elements R, S, T and V.

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

Which elements in the belong to period 2 of the periodic table? 2 marks

---

Give a reason for the answer in above question. 1 mark

---

Give a pair of elements that would form an ionic compound when they react.

---

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

b. State any three physical properties of halogens. 3 marks

- c. Explain what happens if chlorine is mixed with potassium bromide solution. 2 marks

**2013**

- a. Mention any one difference between “polar” and “non-polar” molecules.

- b. **Table** below atomic numbers, melting points and boiling points of group 7 elements.

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

Which elements are gases at room temperature?

Draw the atomic structure of chlorine.

Why does iodine have a higher melting point than fluorine?

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Calculate the number of electrons in an iodine atom if its atomic mass is 127.

**2014**

a. State the three sub-atomic particles of an atom.

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

c. Table below shows the electrical conductivity of solids A, B, C, D and E.

compound	conductivity
A	<i>Does not conduct</i>
B	<i>conduct</i>
C	<i>Does not conduct</i>
D	<i>conduct</i>
E	<i>Does not conduct</i>

Classify the compounds as ionic and molecular.

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Give a reason for the answer in above question

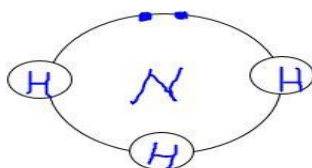
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**2015**

a. **Figure** below is an electron dot and cross diagram of ammonia.



Name the type of bonding that holds the atoms together.

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Give a reason for the answer in question above.

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Write the chemical formula for ammonia.

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Mention any three properties of metals

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Explain how metallic bonding occurs.

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## TOPIC 2: CHEMICAL REACTION 1 AND 2.

2003

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

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- b. Given that the reaction between methane ( $\text{CH}_4$ ) and oxygen ( $\text{O}_2$ ) to produce carbon dioxide ( $\text{CO}_2$ ) and water ( $\text{H}_2\text{O}$ ) is exothermic and dissolving of ammonium nitrate ( $\text{NH}_4\text{NO}_3$ ) is endothermic. Draw energy diagrams to illustrate difference.

(6 marks)

- c. What is a “mole”? 1 mark

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A solution was made by dissolving 8g of sodium hydroxide in 100cm<sup>3</sup> of water. Calculate the molarity of the solution. (RAM: Na=23, O=16, H=1) 5 marks

- d. What is meant by “empirical formula of a compound”?

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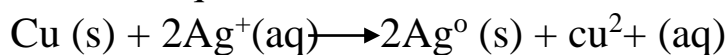
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Work out the empirical formula of a compound that has following percentage composition by mass of elements: C=40%, H=6.66% and O=53.33%.

(RAM: c=12, H=1, O=16). **6 marks**

- e. Describe how 250cm<sup>3</sup> of a 1M copper sulphate solution could be prepared using hydrated copper sulphate crystals. (CuSO<sub>4</sub>·5H<sub>2</sub>O) (the molar mass of CuSO<sub>4</sub>·5H<sub>2</sub>O is 250g) **7 marks**

- f. Copper (Cu) reacts with silver ions (Ag<sup>+</sup>) according to the following chemical equation.



What is the meaning of the zero sign on Cu<sup>0</sup> (s)? **1 mark**

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Pick out oxidizing agent and reducing agent from the equation. 2 marks

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Write the two half equations for the reaction. 4 marks

**2004**

- a. Describe how the concentration of 20cm<sup>3</sup> of sodium chloride solution can be determined by evaporation method. **8 marks**

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- b. State two sources of errors in above question. **2 marks**

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**2005**

- a. In a titration, 20cm<sup>3</sup> of hydrogen chloride solution reacted completely with 25cm<sup>3</sup> of 0.2M sodium hydroxide solution mixed with phenolphthalein solution.

Explain the function of phenolphthalein solution. 2 marks

---

Which was the standard solution in the titration? Give a reason. 2 marks

---

Write a balance equation for the reaction between sodium hydroxide and hydrochloric acid.

---

Calculate the concentration of the acid. 4 marks

- b. Draw a labeled diagram of the apparatus that would be used to electroplate an iron nail with copper using copper chloride as an electrolyte.

2 marks

Explain what happens during the process of electroplating of the iron nail in above. Support the explanation with relevant chemical equations. **8 marks**

- c. Define “acid” according to Bronsted Lowry theory. **1 mark**

**2006**

- a. Name the ion responsible for the acidic properties of a substance. **1 mark**

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

- b. The following is part of an activity series.

Lithium (Li)

Sodium (Na)

Magnesium (Mg)

Lead (pb)

Hydrogen (H)

Copper (cu)

Silver (Ag)



increasing reactivity

State whether copper (cu) will react with a solution of magnesium sulphate ( $\text{MgSO}_4$ ) Explain the answer **3 marks**

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Which element is the most electropositive in the activity series? **1 mark**

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Give a reason for the answer above. **2 marks**

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Write half equations for the reaction between silver nitrate ( $\text{AgNO}_3$ ) and sodium (Na) **2 marks**

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c. Calculate the volume of 0.1M sodium hydroxide that is needed to neutralize 20cm<sup>3</sup> of 0.1M hydrochloric acid. **3 marks**

**2007**

a. What is a strong base? **1 mark**

---

Write a chemical equation to show the ionization of ammonia in water. **3 marks**

---

Identify one conjugate acid base pair from the equation above. **1 mark**

b. Draw an energy level diagram for the following chemical equation.



State whether reaction is endothermic or exothermic. Reason for the answer.

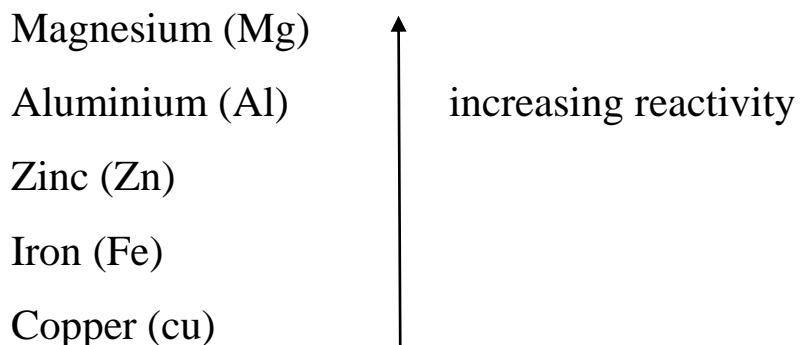
**3 marks**

c. A 300mg tablet of a drug was completely dissolved in 10ml of water. The molecular formula for the drug is  $\text{C}_9\text{H}_8\text{O}_4$ .

Calculate number of moles in the tablet. (RAM: C=12, H=1 and O=16) **4 marks**

Calculate the concentration of the solution in moles per litre.

d. The following is part of a reactivity series.



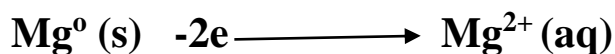
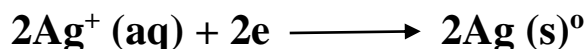
Which **two** elements will displace zinc (Zn) from its oxide? **2 marks**

---

Give reason for the answer above. **1mark**

---

e. The following are half equations for the reaction between magnesium (Mg) and silver nitrate ( $\text{AgNO}_3$ )



Write a full chemical equation for the reaction. **2 marks**

---

Name the reducing and oxidizing agent above. **2 marks**

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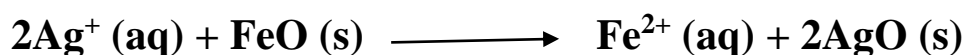
**2008**

a.  $60\text{cm}^3$  of a solution whose concentration is  $15\text{g/cm}^3$  were diluted with distilled water by raising its volume to  $80\text{cm}^3$ . Calculate the concentration of the new solution.

Calculate the empirical formula of an organic compound containing 48.0g of carbon, 12.0g of hydrogen and 32.0g of oxygen. (**RAM:C=12, H=1 and O=16**). **7 marks**

**2009**

- a. Silver ions  $\text{Ag}^+$  (aq) react with iron (Fe) according to the following equation.



What is the meaning of (2+) on  $\text{Fe}^{2+}$  (aq)? **1 mark**

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What is the oxidation number of silver before reaction? **1 mark**

---

Which substance has been reduced? **1 mark**

---

Give a reason for answer above. **2 marks**

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**2010**

- a. State any two advantage of electroplating a metal. **2 marks**
- 
-



**Below** is part of a displacement series of metal.

calcium (Ca)		<b>increasing reactivity</b>
Magnesium (Mg)		
Zinc (Zn)		
Iron (Fe)		
Copper (cu)		

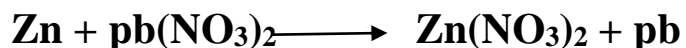
Which metal would displace all other metals from their solutions? **1 mark**

Give a reason for the answer above. **1 mark**

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

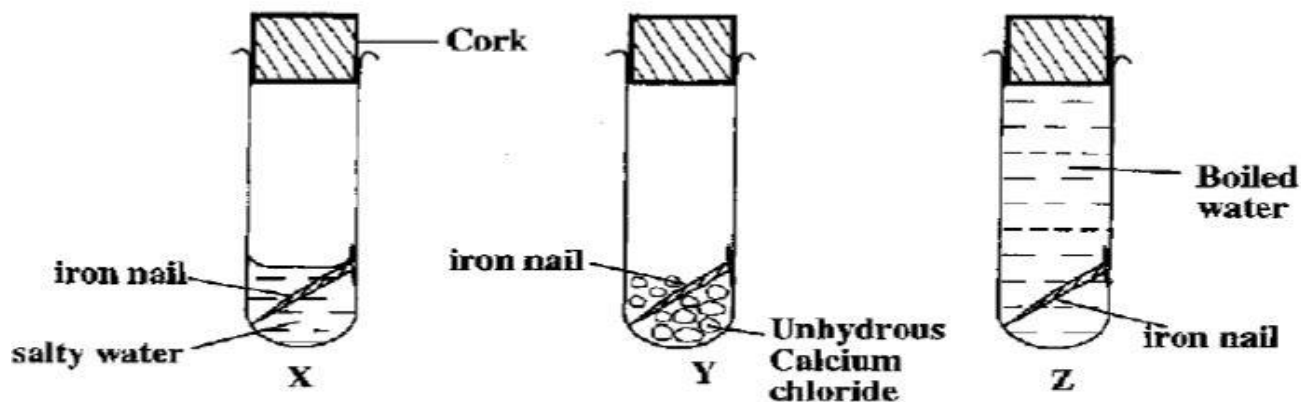
Define oxidation in terms of oxygen content in a substance. **1 mark**

The chemical equation below shows displacement reaction between zinc (Zn) and lead nitrate ( $\text{Pb}(\text{NO}_3)_2$ ).



Name the reducing and oxidizing agents in the reaction. **2 marks**

- b. Figure below is diagram showing the setup of an experiment investigate conditions for rusting of iron.



Why was anhydrous calcium chloride used in tube Y? **1 mark**

Why was water in tube Z boiled? **1 mark**

State any two conditions necessary for rusting of iron. **2 marks**

- c. With aid of a labeled diagram, explain how a silver spoon could be electroplated using copper. In the explanation, include the half equation for the reaction at the cathode. **10 marks**

**2011**

- a. Define “molar volume” of a gas. **1 mark**

Calculate the number of moles of Sulphur dioxide occupying  $120\text{dm}^3$  at room temperature and pressure. (Molar volume at room temperature and pressure is  $24\text{dm}^3$ ) **3 marks**

- b. Define an acid according to Lowry Bronsted theory. **1 mark**

Describe how a hydronium ion ( $\text{H}_3\text{O}^+$ ) is formed. **2 marks**

- c. Explain why bonding breaking is endothermic while bond making is exothermic. **4 marks**

- d. Mention any two ways of preventing corrosion in metals.

Calculate the oxidation number of nitrogen (N) in nitrate ion ( $\text{NO}_3^-$ ) given that the oxidation number of oxygen is -2.

## 2012

a. Define “electroplating”

Iron (Fe) displaces copper (cu) from copper sulphate solution ( $\text{CuSO}_4$ )

Write down a balanced chemical equation for the reaction. **3 marks**

What is the reducing agent in the reaction? Reason for the answer **2 marks**

b. What is difference between oxidation and reduction? **2 marks**

c. Define concentration of a solution. **1 mark**

The volume of sodium hydroxide solution ( $\text{NaOH}$ ) of concentration  $20\text{g/l}$  is increased from  $60\text{cm}^3$  to  $600\text{cm}^3$  by adding distilled water. Calculate the concentration of the new solution in  $\text{g/l}$ . **3 marks**

## 2013

a. What is an “*empirical formula*” **1 marks**

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

b. State any two ways of expressing concentration of a solution. **2 marks**

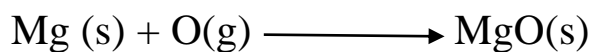
State any two ways of preventing rusting. **2 marks**

Explain how rusting occurs. **3 marks**

**2014**

a. Define “mole” **1 mark**

Magnesium (Mg) reacts with oxygen (O<sub>2</sub>) according to the following equation:



What does “s” stand for in the equation? **1 mark**

Balance the equation. **2 marks**

If 120g of magnesium reacts completely in excess oxygen, how many moles of oxygen are used? (RAM: Mg=24, O=16). **4 marks**

b. What is a “**weak acid**”?

State any one way of determining the strength of an acid.

The conjugate acid-base pair for the reaction between water molecules are  ***$H_2O/H_3O^+$  and  $H_2O/OH^-$*** . Write an equation for the reaction. **3 marks**

**2015**

a. Give two ways of determining the strength of an acid. **2 marks**

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

c. Which metal is used to galvanize iron? **1 mark**

Explain how a scratched galvanized iron sheet is protected from rusting. **3 marks**

- d. In term of electrical conductivity, explain the difference between “polar” and “non-polar” covalent molecules. **4 marks**

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### TOPIC 3: ORGANIC CHEMISTRY 1 & 2.

**2003**

- a. Draw and name all the isomers of pentane ( $C_5H_{12}$ ). **6 marks**

- b. Name the compound  $C_7H_{15}OH$ . **1 mark**

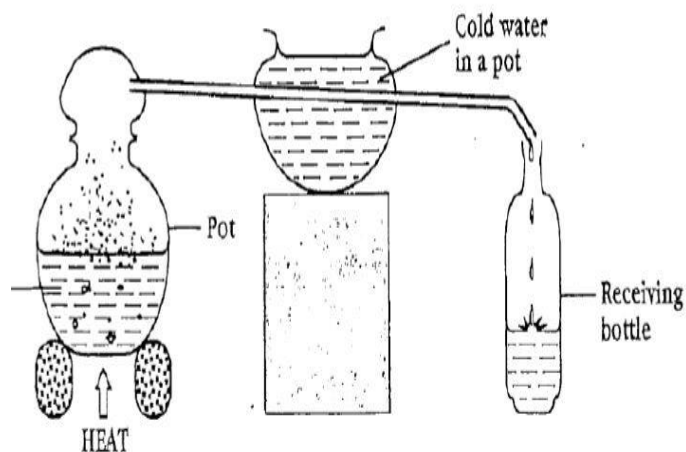
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State the general formula for the above compound. **1 mark**

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Draw structure of compound  $C_7H_{15}OH$ . **1 mark**

- c. **Below** is figure showing indigenous way of preparing alcohol.



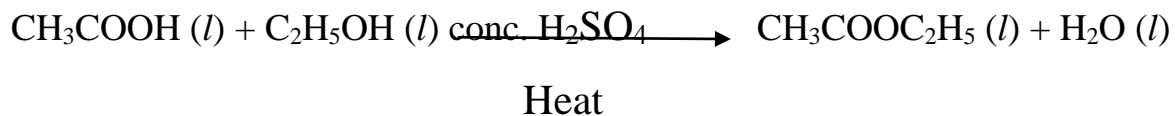
Name the process shown above. **1 mark**

Name the alcohol collected in the receiving bottle. **1 mark**

Define fermentation. **2 marks**

Write a word equation for the fermentation of sugar. **3 marks**

d. Ethanoic acid ( $\text{CH}_3\text{COOH}$ ) reacts with ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) according to the following equation.



What is the name of this reaction? **1 mark**



Name the two products of this reaction. **2 marks**

---

Give one use of  $\text{CH}_3\text{COOC}_2\text{H}_5$ . **1 mark**

---

**2004**

a. State one use of each of the following polymers. **2 marks**

Plastic\_\_\_\_\_

Carbohydrate\_\_\_\_\_

b. State any two ways of disposing of plastic to avoid polluting the environment. **2 marks**

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c. Table shows molecular formulae and boiling points of some compounds.

Compound	Molecular formulae	Boiling point °C
A	$\text{C}_2\text{H}_4$	-104
B	$\text{C}_2\text{H}_5\text{OH}$	79
C	$\text{CH}_3\text{COOH}$	118
D	$\text{H}_2\text{O}$	100
E	$\text{C}_2\text{H}_6$	-89

Which compounds in the table are hydrocarbons? **1 mark**

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Which compounds are soluble in water in the table. **1 mark**

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Explain why the boiling point of compound D is higher than that of E. **4 marks**

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Describe the test that could be used to distinguish compounds C and D. **4 marks**

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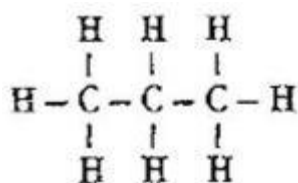
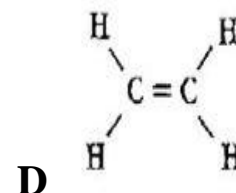
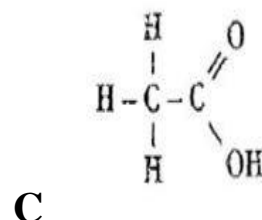
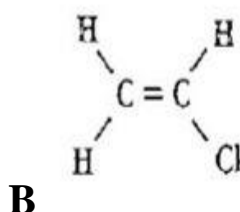
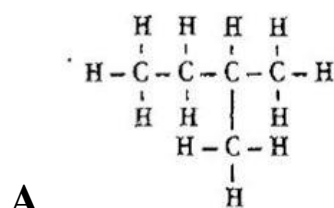
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**2005**

a. The following is structure of some organic compounds.



Compound B is a monomer. Write an equation to show its polymerization. **2 marks**

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Give the name of the kind of polymerization. **1 mark**

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Give one use of the substance formed in the polymerization of compound.

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Write the other isomers of substance A. **2 marks**

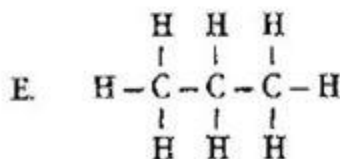
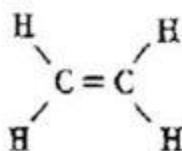
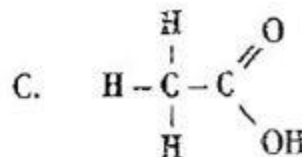
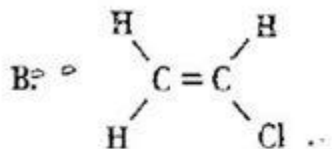
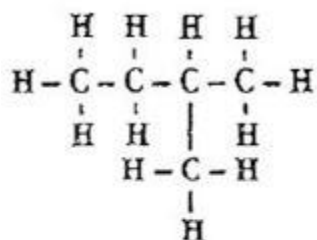
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Give two advantage of thermoplastics. **2 marks**

b. The following is structure of some organic compounds.



Name compound A. 1 marks

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

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

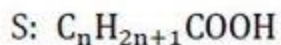
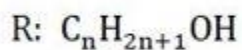
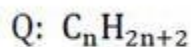
Which one of the two compound A and E would have a lower boiling point? Give a reason. 2 marks

What is the state of D at room temperature?

Describe a test that could be done to distinguish the compound D and E.

**2006**

a. Give below is the general formulae of some homologous series.



Name the homologous series represented by letters Q and S. **2 marks**

---

Which general formulae represent hydrocarbons? **2 marks**

---

Draw the structure of a compound with three carbon atoms in homologous series p. **3 marks**

---

Name the compound drawn.

---

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

---

Ethane  $C_2H_6$  reacts with bromine  $Br_2$  in addition reaction.

Draw the structure of the product formed. **1 mark**

---

Name the product formed. **1 mark**

---

Why are addition reactions important in industries? Give two reasons **2 marks**

---



---

**b.** Write down all structural isomers of pentane. **3 marks**

---

Name the isomers above. **3 marks**

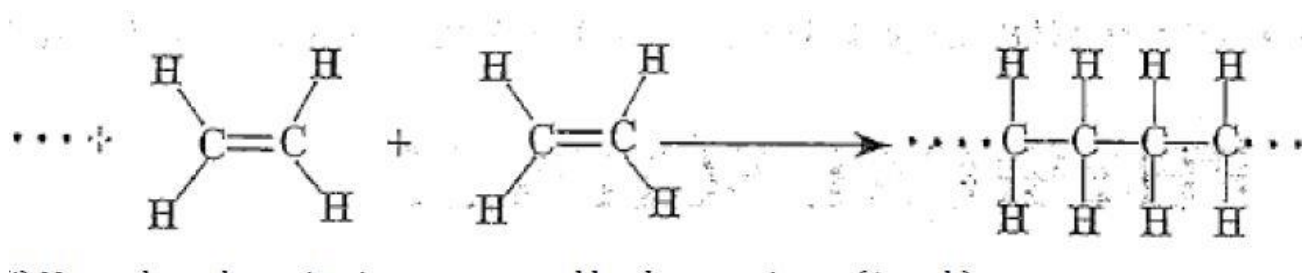
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**2007**

a. Polymerization of ethane can be represented by the following equation.



Name the polymerization represented by the equation. **1 mark**

---

Describe how the polymer is formed from ethane molecules. **3 marks**

---



---



---

Give two examples of artificial polymers. **2 marks**

---



---

**b.** The following are formulae of some organic compounds:

- A.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
- B.  $\text{CH}_3\text{CH}_2\text{CH}_3$
- C.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$
- D.  $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
- E.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$

Identify one compound which is an alkanol. **1 marks**

---

Which compounds belong to the same homologous series? **1 marks**

Explain why solution of compound C conducts electricity. **2 marks**

---

---

Draw a full structure of compound D and name the compound.

Give three differences between thermosetting and thermoplastic polymers. **3 marks**

---

---

State two ways of disposing off plastic waste to avoid pollution. **2 marks**

---

Give three advantage of plastic materials over metallic materials. **3 marks**

---

---

c. Draw full structures of ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) and water ( $\text{H}_2\text{O}$ ). **2 marks**

Explain the difference in boiling points between ethanol and water. **5 marks**

---

---

With aid of labeled diagram, describe an experiment that can be done to separate a mixture of ethanol and water. **8 marks**

---

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**2008**

a. Define "*isomer*". **1 mark**

---

Draw structural formulas for the isomers of butane ( $C_4H_{10}$ ). **2 marks**

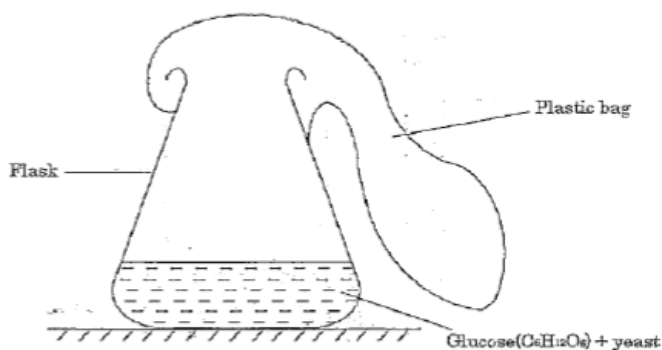
Name the isomers drawn. **2 marks**

---

b. State any two disadvantages of synthetic polymers. **2 marks**

---

Figure is a diagram of an experiment set up.



Name the process that could occur in the flask. **1 mark**

Write down a balance equation of the process named above. **3 marks**

c. Describe an experiment that can be done to distinguish octane from octane. **5 marks**

What is the difference between “oxidation” and “reduction” in terms of electron transfer? **1 mark**

Explain how each of the following prevents rusting of iron. **9 marks**

**Painting**



**Galvanizing**

---

---

---

Explain why candle wax melts when it is heated. **3 marks**

---

**2009**

a. Explain any three characteristics of thermoplastics. **3 marks**

---

---

Explain any two advantage of recycling organic compounds. **2 marks**

---

---

Explain why thermosetting plastics can be heated and moulded only once. **2 marks**

---

---

b. State any three uses of ethanoic acid. **3 marks**

---

Why is ethanoic acid regarded as a weak electrolyte? **2 marks**

---

Write down the ionization equation of ethanoic acid ( $\text{CH}_3\text{COOH}$ ) in water ( $\text{H}_2\text{O}$ ). **2 marks**

---

Why does sodium metal react with ethanol in the same way as it does with water? **2 marks**

Write down the general formula for carboxylic acids. **1 marks**

---

State any three ways of managing plastic wastes. **3 marks**

---

---

**2010**

a. What are *polymers*? **1 mark**

---

Mention any two uses of polythene. **2 marks**

---

---

Give any three properties of plastics. **3 marks**

---

---

b. Give any three properties of carboxylic acids. **3 marks**

---

---

Mention any two natural sources of carboxylic acids. **2 marks**

---

---

c. Define isomers. **1 marks**

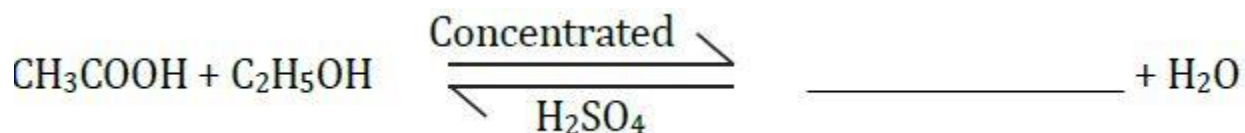
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Draw structural formulae for the four isomers of butanol ( $C_4H_9OH$ ) **4 marks**

Write down the condensed formula of pentane. **2 marks**

---

- d. Ethanol ( $\text{CH}_3\text{OH}$ ) reacts with ethanoic acid ( $\text{CH}_3\text{COOH}$ ) according to the following equation.



Complete the equation. **1marks**

---

Name the process in which ethanol reacts with ethanoic acid. **1 mark**

---

- e. Explain why propanoic acid ( $\text{C}_2\text{H}_5\text{COOH}$ ) conducts electricity when dissolved in water while propanol ( $\text{C}_3\text{H}_7\text{OH}$ ) does not. **2 marks**
- 
- 

Explain how polythene is formed. **3 marks**

---

---

**2011**

- a. Give any two properties of polymers. **2 marks**
- 

Explain how condensation polymerization occurs. **3 marks**

---

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- b. Mention any two properties of alkanols. **2 marks**

c. Ethanol ( $\text{CH}_3\text{CH}_2\text{OH}$ ) change to ethanoic acid ( $\text{CH}_3\text{COOH}$ ) in the presence of atmospheric oxygen ( $\text{O}_2$ ).

What is the function of atmospheric oxygen in the reaction? **1 mark**

---

Write a balanced equation for the reaction. **3 marks**

---

**2012**

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

**A.  $\text{C}_n\text{H}_{2n+1}\text{COOH}$**

**B.  $\text{C}_n\text{H}_{2n+1}\text{OH}$**

To which family does compound B belong? **1 mark**

---

Mention any three properties of compound A. **3 marks**

---

---

State any three uses of compound B. **3 marks**

---

---

Mention the product formed when compound A and B react. **2 marks**

---

---

Work out the molecular formula of compound A if  $n$  is 5. **3 marks**

---

Describe how compound A could be distinguished from compound B. **5 marks**

**2013**

- a. Explain how ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) could be distinguished from hexane ( $\text{C}_6\text{H}_{14}$ ) **3 marks**
- 
- 

**2014**

- a. What are *hydrocarbons*? **1 mark**
- 

- b. Figure shows formulae of some compounds A, B, C and D.



**A**

**B**

**C**

**D**

Which compound are hydrocarbon? **1 mark**

---

Name compound A. **1 mark**

---

Draw molecular structure of compound C. **2 marks**

- c. State any three properties of synthetic polymers. **3 marks**

Draw the structures of the two isomers of butane ( $C_4H_{10}$ ). **2 marks**

**2015**

- a. Name the product formed during the fermentation of sugar by yeast.  
**2 marks**
- 

Describe how fermentation of sugar by yeast occurs. **2 marks**

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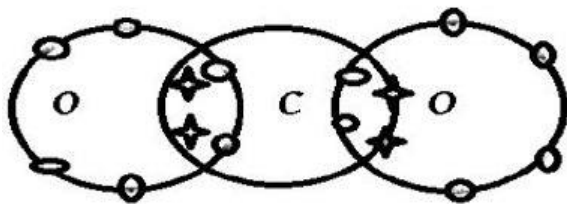
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- b. Explain why thermosetting plastics do not melt when heated. **3 marks**
- 
- 

# Solutions

**ELEMENTS AND CHEMICAL BONDING****2003**

- a. 14  
 b. 2,8,8,1  
 c.



- d. By losing three electrons.  
 e. The more the atomic number increases, the more the mass increases. As the mass increases, intermolecular force increases therefore the melting points increases.  
 f. Bromine  
 g. Because it has most number of electron shells  
 h. -1  
 i. They exist as diatomic molecules/ they react with hydrogen/ they react with metal.

**2004**

ELEMENT	PROTONS	NEUTRONS	ELECTRONS	MASS NUMBER
Hydrogen (H)	1	<u>0</u>	<u>1</u>	1
Carbon (C)	<u>6</u>	<u>6</u>	6	12
Nitrogen (N)	7	7	<u>7</u>	<u>14</u>
Sodium (Na)	<u>11</u>	12	11	<u>23</u>

- a.  
 b. Sodium  
 - Sodium has 11 electrons and the valance shell will contain only one electron which easily be lost, so that anionic compound will be formed.  
 c. Relative atomic mass of C is 12 and that of H is.

Therefore, total =  $12 + 1 \times 4 = 16$

d. Covalent bonds

- Because they are bounded by sharing electrons in  $\text{CH}_4$

**2005**

a.  $\text{Al}_2\text{O}_3$

b. Ionic bond because this compound is made of metal atoms and non-metal atoms.

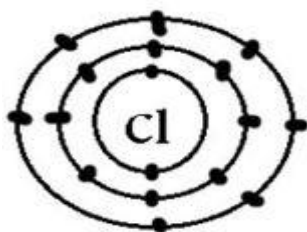
c. Are elements that exist in more than one physical form in the same state.

d. Rhombic and monoclinic Sulphur

e. Chlorine

- Iodine and bromine.

f.



g. Because its atomic number is 14 which means it has 4 electrons on the most outer therefore it is in 4<sup>th</sup> group.

- Si

**2006**

a.  $\text{Br}_2$ : NaBr or KBr

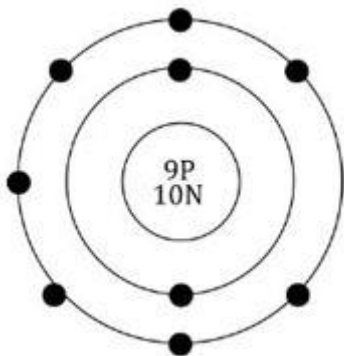
- $\text{Cl}_2$ : NaCl or KCl

- $\text{I}_2$ : NaI or KI

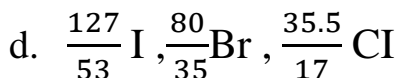
b. –they are all coloured, colours darken as we go down the group.

- They react with metals to form metal halides.





c.

*diagram of Fluorine.*

- e. *The order of reactivity decreases on going down the group. When these elements react they gain one electron per atom to attain stability. Chlorine is more reactive than bromine because the incoming electron is being more strongly attracted into the outer energy level of the smaller atom. The attraction force on it will be greater than in case of bromine and iodine since the outer energy level of chlorine is closer to the nucleus.*
- f. *Sulphur reacts with oxygen to form Sulphur dioxide.*
- *Sulphur reacts with metals to form metal sulphides. ( $\text{MgS}$ )*
  - *Sulphur reacts with hydrogen to form hydrogen sulphide. ( $\text{H}_2\text{S}$ )*
- g. *In rhombic Sulphur the molecules are packed more closely than in the monoclinic form. This explains why rhombic Sulphur is stable below  $96^\circ\text{C}$  and monoclinic Sulphur is stable above  $96^\circ\text{C}$ .*

**2007**

- a. *F*
- b. *C and D*
- *They can easily lose out their outermost electrons.*
- c. *– it is non-metal*
- *It is gas at room temperature*
  - *It is non-reactive*
  - *It is colorless*
  - *It does not conduct heat and electricity*

**2008**

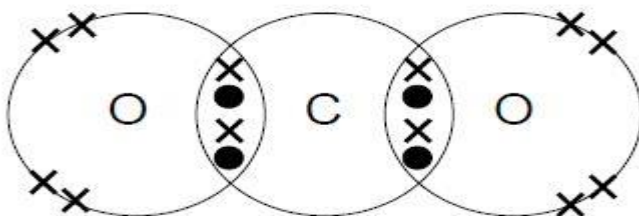
a. – 19 protons.

*Element X would react with water. Just because element X is an alkali metal. It has one electron in its outermost shell and can react with water.*

b. Valency of magnesium is 2 and that of chlorine is 1.

-  $\text{MgCl}_2$

c.



- Covalent bonding, because valency electrons are shared.

d. Carbon - water vapour - Sulphur dioxide.

- For making fertilizer -for manufacturing dye - it is used in car batteries as electrolytes. - for manufacturing of medicine - for making paint

**2009**

a. Electron configuration is the number and arrangement in the shells of an atom.

b. – group 6

- Because it has 6 electrons in its outer shell and the number of electrons in the outer shell determines the group number.

- Element F belongs to period 2 and has 2 shells while Na belongs to period 3. This means that the more number of shells the atom has, the bigger atomic radius it is.

- The atomic radius of F is smaller than that of Cl. This means that the effective nuclear charge is greater in F than in Cl hence F is more reactive than Cl.

- Bonding in lithium metal (metallic) is stronger than bonding in chlorine gas.

*Bonding in lithium involves attraction of positive ions and free electrons while bonding in chlorine gas involves sharing of electrons to form a bond.*

- c. – production of sulphuric acid*
- *Manufacturing of matches, fireworks, fungicides*
  - *Vulcanizing rubber*
  - *Used in medicine*

*Properties are*

- *Yellow and brittle solid at room temperature*
- *Insoluble in water*
- *Do not conduct electricity.*

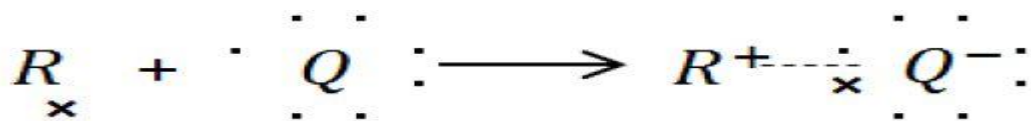
*d. -By gaining 3 electrons into its outer shell. Because it has valence of 3.*

- *Li<sub>2</sub>O*
- *+2*

**2010**

- a. Potassium loses its valence electrons easily than sodium. This is so because potassium has more shells than sodium.*
- b. Electron configuration of R is 2, 8,1 and that of Q is 2,8,7.*

*R belongs to period 3 and group.*



- c. Helium has a full number of electrons in its energy level and therefore it is inert.*
- d. – used as fertilizer   - used as medicine   - used in plasters of paris   - making sulphuric acid.*

**2011**

- a. – by losing outer most electrons*
- *By sharing its valence electrons with other atoms.*

- *By gaining electrons*

*Ionic bonding occurs between a metal and non-metal in which a metal loses its outer most electrons and it's a positively charged ion and a non-metal gain electron and becomes a negatively charged atoms. These ions then attract to form an ionic bond.*

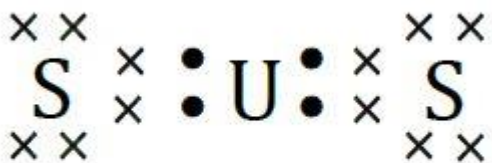
- b. – Q, T and X

- X
- Ionic bonding or electrovalent bonding
- $2D + T \longrightarrow D_2T$

**2012**

- a. – R and U

- They both have two energy shells.
- S and T
- The diagram for the compound formed when S combines with U is as follows;



- b. – they form diatomic molecule

- They have smell
- They are only slightly soluble in water.

- c. Chlorine replaces bromine and formed potassium chloride.

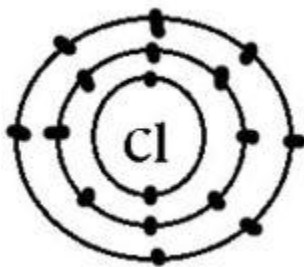
**2013**

- a. Polar compounds are soluble in water while non-polar not

- Polar have high melting and boiling points while non-polar low.

- b. – fluorine and chlorine

The diagram of chlorine is shown below.



*atomic structure of chlorine*

- As we go down the group of halogens, the intermolecular forces increase due to increase in molecular size.

*Calculations below for number of electrons in iodine.*

$$N = A - Z$$

$$N = 127 - 53$$

**74 answer**

**2014**

- a. Proton and neutrons
- b. Atomic number = 23-13  
= 10

*Its electron configuration is 2, 8.*

- c. Ionic are B and D
  - Molecular are A, C and E.

*Because ionic compounds conduct electricity in molten state while molecular substance does not.*

**2015**

- a.
  - Covalent bond

*Because bonding involves only non-metals and sharing of electrons.*

- Chemical formulae for ammonia is  $\text{NH}_3$

**Properties of metals are**

- High melting point
- Malleable
- Conduct electricity

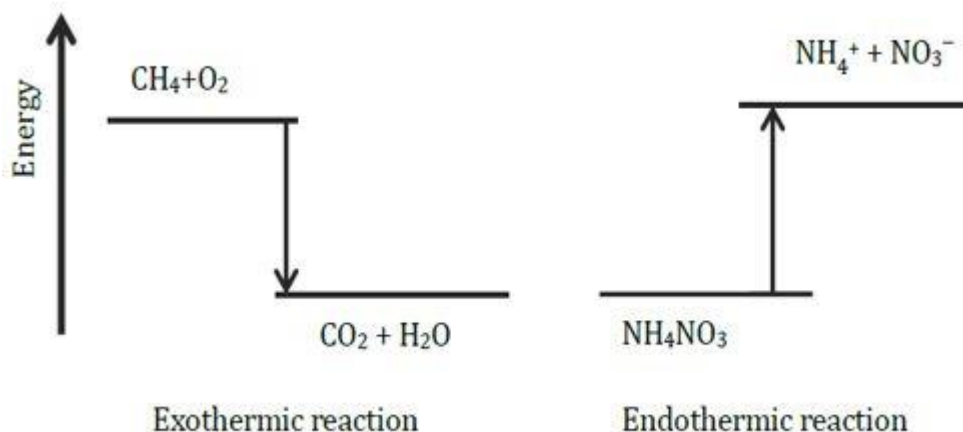
- Ductile
- High rusting resistance

*Metallic bonding occurs when metals release their loosely held electron and these get shared by attraction of the negatively charged electrons to the positively charged metal atom.*

## CHEMICAL REACTION 1 AND 2 ANSWERS

2003

- a. *Exothermic reaction gives out energy to surroundings whereas endothermic reaction absorbs energy from surrounding.*
- b.



- c. *Mole is quantity containing  $6.02 \times 10^{23}$  particles with their RAM expressed in grammes.*

*Calculations of molarity.*

*Mass of 1 mol of NaOH is  $23 + 16 + 1 = 40\text{g}$*

*8g of NaOH is  $8/40 = 0.2\text{mol}$ .*

*It is dissolved in 100cm<sup>3</sup> of water which is 0.1L*

*The molarity of this solution is  $0.2\text{mol}/0.1\text{L}$*

*$= 2\text{mol/L}$*

- d. *It is the simplest formula that shows the atoms that make up the compound in their lowest ratio.*

Calculation of empirical formula

	C	H	O
% by mass	40	6.67	53.33
In 100g	40g	6.67g	53.33g
Moles	40/12	6.67/1	53.33/16
Ratios of moles	1	2	1
Empirical formula is <b>CH<sub>2</sub>O</b>			

- e. *Number of moles of copper sulphate in 250cm<sup>3</sup> of 1M copper solution is*

$$250\text{cm}^3 = 0.25\text{L} \quad 0.25\text{L} \times 1\text{M} = 0.25\text{mol}$$

*1 mole of CuSO<sub>4</sub>·5H<sub>2</sub>O contain 1 mole of CuSO<sub>4</sub>.*

*0.25 mol of CuSO<sub>4</sub>·5H<sub>2</sub>O contains 0.25mol of CuSO<sub>4</sub>*

*Molar mass of CuSO<sub>4</sub>·5H<sub>2</sub>O is (64x1) + (32x1) + (16x4) + 5 (1x2) + (16x1)*

*=250g/mol therefore, mass of 0.25mol of CuSO<sub>4</sub>·5H<sub>2</sub>O is*

$$250\text{g/mol} \times 0.25\text{mol} = 62.5\text{g}$$

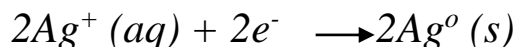
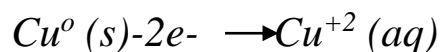
*Therefore, measure 62.5g of CuSO<sub>4</sub>·5H<sub>2</sub>O using beam balance*

*Then, add the distilled water until the volume of 250cm<sup>3</sup> and stir slowly.*

*This solution prepared is 1M copper sulphate solution.*

f.

- *It means it is neutral charged.*
- *Oxidizing agent is Cu and reducing agent is Ag*
- *Half equations*

**2004**

- a. Take 20cm<sup>2</sup> of sodium chloride solution, put in a beaker. Heat it gently till the solution changes in to sodium chloride crystals. Measure the mass of these crystals, then divide it with the molar mass or relative formula mass of sodium chloride. This will give you the number of moles. Divide this number of moles by 0.02dm<sup>3</sup> (20cm<sup>3</sup>). The result gives you the concentration of sodium chloride in 20cm<sup>3</sup>.
  - b. Error for measuring volume of solution/ error for measuring mass of sodium chloride.
- 

**2005**

- a.
  - Phenolphthalein is used to check the existence of sodium hydroxide.
  - Sodium hydroxide is a standard solution because it has known concentration.
  - $\text{HCl} + \text{NaOH} \longrightarrow \text{NaCl} + \text{H}_2\text{O}$
  - Calculation of concentration

$$20\text{cm}^3 = ? \quad 25\text{cm}^3 = 0.2\text{M}$$

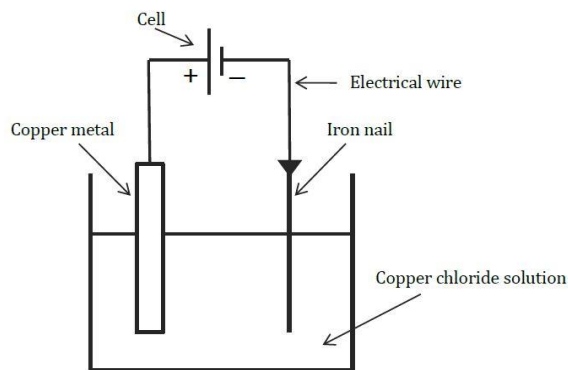
$$25x = \frac{20 \times 0.2}{25}$$

$$25$$

$$= \underline{\underline{0.16\text{M answer}}}$$

b.



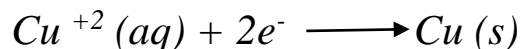


- *Diagram*

- *Copper metal as anode ionizes according to the half equation*



*The electrons travel from anode to cathode through the electrical wire. Copper ions in the solution are attracted to iron nail as cathode. The copper ions gain electrons on the surface of iron nail according to the half equation.*



*The copper atoms accumulate on the surface of iron nail. As the result, the iron nail becomes electroplated with copper.*

*c. is the proton donor.*

## 2006

a. *Hydrogen ion ( $\text{H}^{+}$ )*

- *Carbonic acid partially ionizes in water and releases a few hydrogen ions whereas hydrochloric acid completely ionizes in water and releases a lot of hydrogen ions (protons).*

b. *-Copper will not react with a solution of  $\text{MgSO}_4$*

*Copper is less reactive than magnesium, as a result copper cannot displace the ions of magnesium in a solution of  $\text{MgSO}_4$*

- *Sodium ( $\text{Na}$ )*

*Sodium is easily and readily gives away its outermost electron as compared to the metals in the activity series.*

-  *$\text{Na(s)} \longrightarrow \text{Na} + (\text{aq}) + \text{e}^{-}$*

*$\text{Ag} + (\text{aq}) + \text{e}^{-} \longrightarrow \text{Ag (s)}$*

*Na (s) is the reducing agent,  $\text{Ag}^+$  is the oxidizing agent.*

c.  $C_b V_b = C_a V_a$

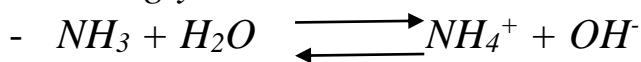
$$V_b = \frac{C_a V_a}{C_b} = \frac{0.1M \times 20\text{cm}^3}{0.1M} = 20\text{cm}^3 \text{ volume answer}$$


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**2007**

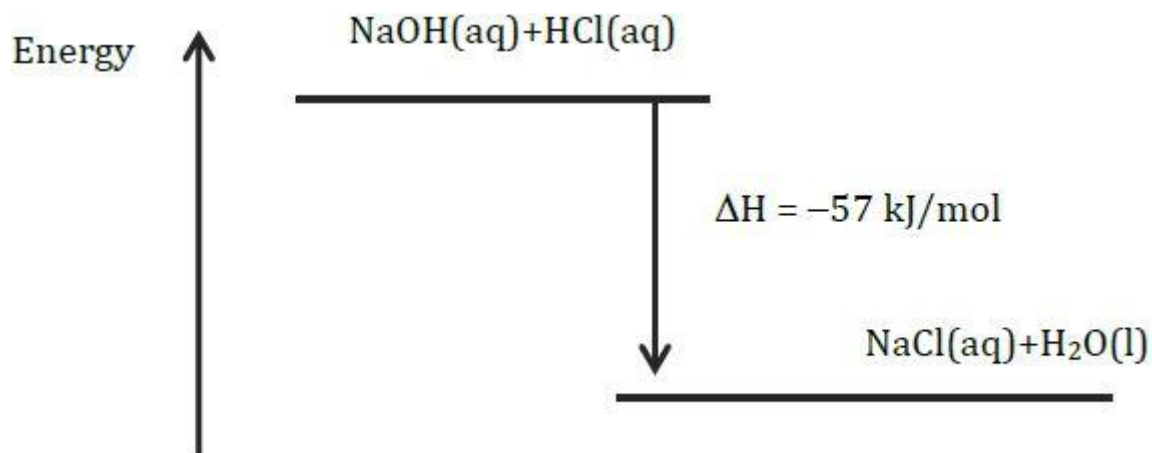
a.

- *This is a species which accepts protons more readily and hold them strongly*



-  $\text{NH}_4^+/\text{NH}_3$  or  $\text{H}_2\text{O}/\text{OH}^-$

b.



- *Exothermic reaction just because the system is losing heat to the surrounding and its energy content decreases and gives a negative heat change.*

c. *Number of moles in the tablet:*

$$\text{Number of moles (n)} = \frac{\text{mass of the tablet of a drug (m)}}{\text{Molar mass of the drug (M)}}$$

*Molar mass of the drug (M)*

$$\text{Molar mass of the drug (M)} = \text{RFM of } \text{C}_9\text{H}_8\text{O}_4$$

$$= (9 \times 12) + (8 \times 1) + (4 \times 16) = 180$$

But  $n = \frac{m}{M}$  where  $m$  is in grams ( $300\text{mg} = 0.3\text{g}$ ) and  $M$  is in g/mol

Then  $n = \frac{0.3\text{g}}{180\text{g/mol}}$   $n = 0.00167\text{mol}$  answer

Calculation of concentration

Concentration (C) =  $\frac{\text{number of moles (n)}}{\text{Volume (V)}}$

But  $n = 0.00167\text{mol}$

$V = 10\text{ml} = 10/1000 = 0.01\text{dm}^3 = 0.01\text{l}$

$C = \frac{0.00167}{0.01}$

$C = 0.167\text{mol/l}$

d. Magnesium and Aluminium

- Mg and Al are more reactive than zinc (Zn) as a result they can displace Zn from its solution.

e.

-  $2\text{Ag}^+ (\text{aq}) + \text{Mg}^0 (\text{s}) \longrightarrow 2\text{Ag} (\text{s}) + \text{Mg}^{2+} (\text{aq})$

-  $2\text{Ag}^+$  is oxidizing agent and  $\text{Mg}^0(\text{s})$  is reducing agent.

2008

a.

-  $V_1 = C_2 V_2$

$C_2 = \frac{C_1 V_1}{V_2}$

$C_2 = \frac{15\text{g/cm}^3 \times 60\text{cm}^3}{V_2}$

$$80\text{cm}^3$$

$$C_2 = 11.25\text{g/cm}^3 \text{ answer}$$

*Calculation of empirical formula*

	<i>C</i>	<i>H</i>	<i>O</i>
<i>mass</i>	48	12	32
<i>number of moles</i>	48/12	12/1	32/16
	4	12	2
<i>Simplest ratio</i>	4/2	12/2	2/2
	2	6	1

*Therefore, the empirical formula is **C<sub>2</sub>H<sub>6</sub>O***

---

**2009**

*a.*

- *It means that  $\text{Fe}^{2+}$  is appositive ions from when iron metal loses 2 electrons.*
  - *+1*
  - *Silver ions ( $\text{Ag}^+$ )*
  - *This because it has gained 1 electron to from  $\text{Ag}^0$  and its oxidation number has decreased from +1 to 0.*
- 

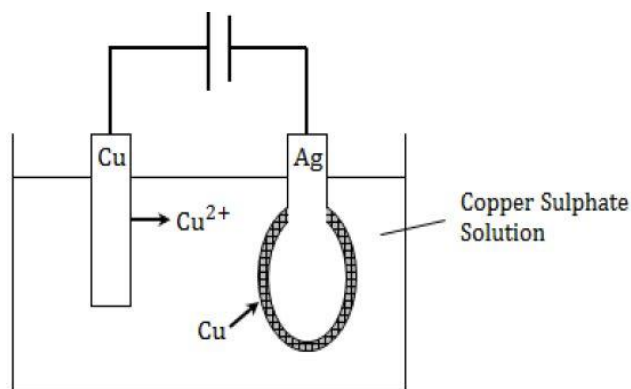
**2010**

- a. It prevents a metal from corrosion or rusting and it improves the appearance of the metal.*
- *Calcium metal*

*Because calcium is more reactive than rest of the metals; as a results it would displace other metals from their solutions.*

- *Copper would be displaced from the copper sulphate solution.*

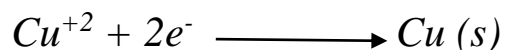
- It is the increase in oxygen content in a substance.
- Zinc (Zn) is reducing agent and lead (Pb) is oxidizing agent.
- b. – to absorb moisture present in the tube.
- To remove dissolved oxygen in the water.
- Presence of water and oxygen.
- c. The diagram below for electroplate.



To electroplate a silver spoon using copper, a solution of copper sulphate ( $\text{CuSO}_4$ ) is poured into the beaker. The silver spoon is connected to the cathode of the electrolysis cell. Copper metal is connected to the anode. When the switch is closed current flows and copper get ionized to copper ions.



At the cathode, copper ions gain electrons and form a precipitate of copper on the silver spoon according to the half equation below;



When the layer of thick enough, the spoon is removed. Thus in effect, the copper is transferred from the anode to the cathode of the cell.

## 2011

- a. Molar volume is the volume occupied by 1 mole of any gas particles at standard temperature or room temperature.

- $n = V/M$  where  $n$  = number of moles,  $V$  is volume of  $SO_2$  and  $M$  = molar volume =  $24\text{dm}^3$  at rtp
- $n = 120\text{dm}^3 / 24\text{dm}^3 = 5$ .
- b. An acid is a proton donor.
  - Hydronium ion ( $H_3O^+$ ) is formed when water ( $H_2O$ ) molecules has gained a proton ( $H^+$ ).
- c. Bond breaking is endothermic because it requires energy to break the old bonds while making is exothermic because energy is not needed during bond formation since it occurs naturally.
- d. – by painting metals – by electroplating – by galvanizing – by oiling
  - Calculation of oxidation number

Let the oxidation number be  $x$

Since the overall charge is  $-1$

$$x + 3(-2) = -1$$

$$x - 6 = -1$$

$$x = -1 + 6$$

$$x = 5 \quad \text{therefore, oxidation number of N is } +5$$

## 2012

- a. Is the process of coating a metal by another metal using electricity/electrolysis.
  - $Fe + Cu^{2+} \longrightarrow Fe^{2+} + Cu$
  - The reducing agent is iron ( $Fe$ ) because it reduces  $Cu^{2+}$  to  $Cu$  by donating two electrons.
- b. Oxidation is the loss of electrons while reducing is the gain of electrons.
- c. Concentration of a solution is the amount of solute dissolved in a given volume of a solvent.
  - $C_1V_1 = C_2V_2$

$$C_2 = \frac{C_1 V_1}{V_2}$$

$$V_2$$

$$C_2 = \frac{20\text{g/l} \times 60\text{cm}^3}{600\text{cm}^3}$$

$$600\text{cm}^3$$

$$C_2 = \underline{2\text{g/l answer}}$$

### 2013

a. It is a simplest molar ratio of atoms in a compound.

- Number of moles of Cu =  $32/64 = 0.5\text{mol}$

Number of moles of O =  $8/16 = 0.5\text{mol}$

Molar ratio, Cu =  $0.5/0.5 = 1$

Therefore, empirical formula = **CuO**

b. – moles per liter – percentage – grams per liter

- By painting – by greasing – by electroplating – by galvanizing – by covering with plastic.

- Rusting occurs when an iron metal reacts with water and oxygen in the air.

---

### 2014

a. A mole is the amount of substance that has same number of particles as in 12g of carbon -12.

- S stands for solid

-  $2\text{Mg (s)} + \text{O}_2 \text{ (g)} \longrightarrow 2\text{MgO (s)}$

- Calculation of moles

RAM of Mg = 24 and RFM for  $\text{O}_2 = 32$

From the balance equation 2Mg has reacted completely with  $\text{O}_2$

Thus, 48g of Mg has reacted with 32g of  $\text{O}_2$

120g of Mg will require =  $\frac{120\text{g} \times 32}{48}$

$$48$$

$$= 80\text{g of O}_2$$

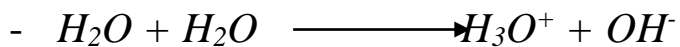
Since  $32\text{g} = 1\text{ mole of O}_2$

Therefore,  $80\text{g} = 80\text{g}/32\text{g moles of O}_2$

=2.5 moles of  $O_2$

b. Weak acid is an acid which dissociate partially and release few hydrogen ions into the solution.

- Using conductivity test and using PH scale.



**2015**

a. Using conductivity test and using PH scale

b. – moles per liter – percentage – grams per liter

c. Zinc

- This involves dipping iron sheets in molten zinc. Zinc reacts with air forming a thin coating of zinc oxide which protects iron from rusting.

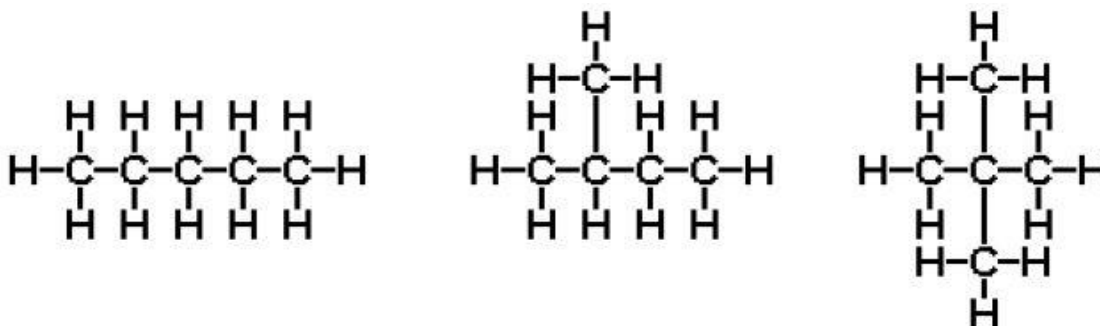
d. Polar conduct electricity just because they have ions that move freely to transfer current while non-polar does not conduct just because they do not have free ions for conduction.

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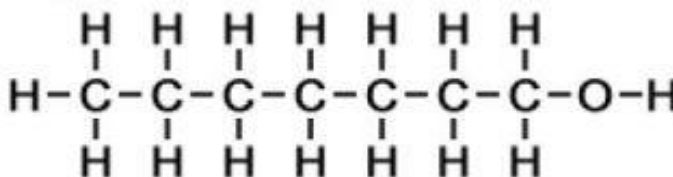
**ORGANIC CHEMISTRY ANSWERS****2003**

a.

*n-Pentane**2-methylbutane**2,2-dimethylpropane*

b.

- *Heptanol*
- $C_nH_{2n+1}OH$
- 



c.

- *Distillation*
- *Ethanol*
- *Fermentation is the decomposition of complex compounds into simpler compounds by the help of micro-organisms or enzymes in the absence of oxygen.*
- *Glucose  $\longrightarrow$  ethanol + carbon dioxide*

d. – *esterification*

- *Ethyl ethanoate and water.*
- *Food flavoring/ perfume.*

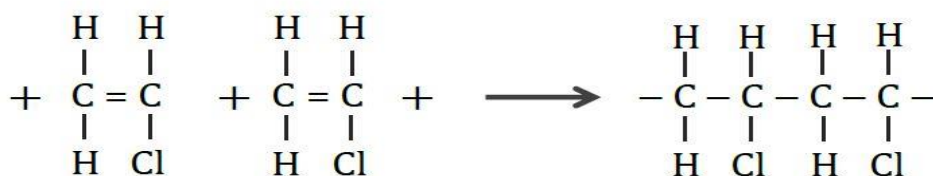
**2004**

- a. – *plastic bag*  
 - *Energy source*
- b. *Recycle / burn of plastic/ reusing*
- c.
- *A & E*
  - *B & C*
  - *Because water molecules are attracted by hydrogen bonding.*
  - *Compound C is acid while D is neutral, when put blue litmus paper into compound C, then color is changed from blue to red. While there is no color change in case of compound D. therefore, we can distinguish.*

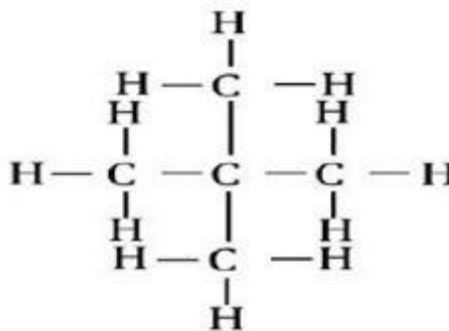
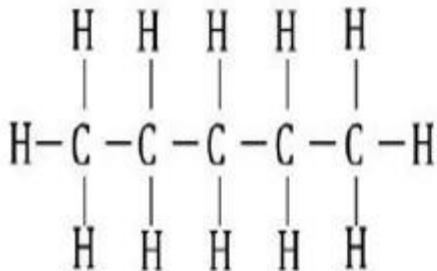
**2005**

a.

-



- *Additional polymerization*
- *Making PVC pipes*
- *Other isomers of A*



- *Thermoplastics are reusable and are lighter and cheaper than metallic.*

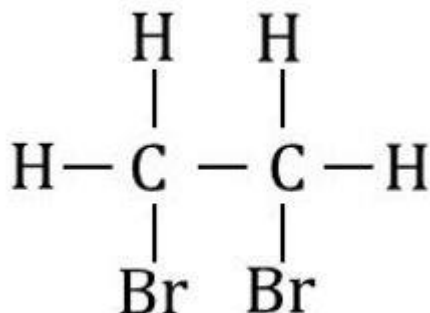
b. 2, methyl-butane

- Compound C is soluble because it has  $-OH$  function group.
- A, D and E
- E have a lower boiling point because it is smaller in size as such its intermolecular force of E will be weaker than of A.
- Gas
- A few drops of bromine solution are put in two test tube. To one test tube, few drops of compound D are added, and another few drops of compound E. The color of bromine will disappear for test tube where there is compound D.

2006

a.

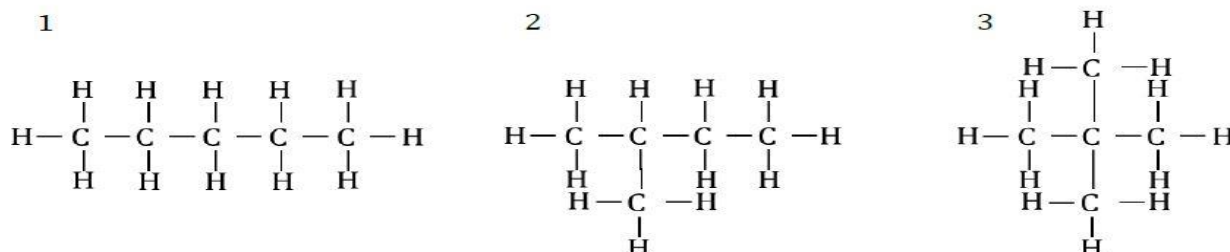
- Alkane
- P ( $C_nH_{2n}$ ) and Q ( $C_nH_{2n+2}$ )
- $C_3H_6$
- Propene
- By carrying out solubility test, a few drops of each sample are added to a few drops of distilled water separately. The mixtures are gently shaken, where one layer is observed then it must be a compound R this indicates solubility, where two layers indicating insoluble.
- 



- Dibromoethane

- *Used in the production of plastics/ used in the production of alkanols, alkanes and haloalkanes.*

b.



1 *n*-pentane

2 2-methylbutane

3 2,2-dimethylpropane

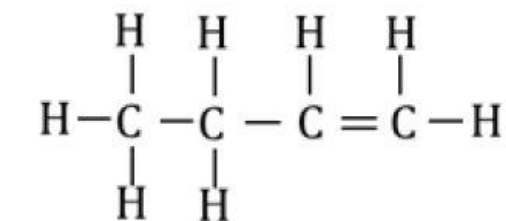
**2007**

a.

- *Addition polymerization*
- *Ethene molecules join themselves to form a polymer due to existence of carbon double bond. Under favourable conditions, such as high temperature and pressure in the presence of a catalyst, the double bond of ethene molecules breaks and monomers join to form long chains.*
- *Polythene - poly vinyl chloride - Nylon - Terylene*

b.

- *Compound A*
- *Compound B & E*
- *Because it dissociates into ions when dissolved in water.*



*Butene or But-1-ene or 1-Butene*

<i>Thermosetting polymer</i>	<i>Thermoplastic polymer</i>
- <i>Do not melt when heated</i>	- <i>Melts when heated</i>
- <i>Have cross links</i>	- <i>Do not have cross links</i>
- <i>Do not soften when heated</i>	- <i>Soften when heated</i>
- <i>Can be moulded only once</i>	- <i>Are easily moulded</i>

- Reusing    - recycling    - incineration

They are chemical resistance

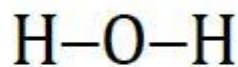
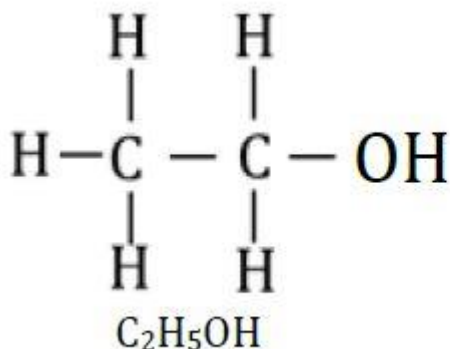
They are light hence potable

They are cheap

They can be recycled

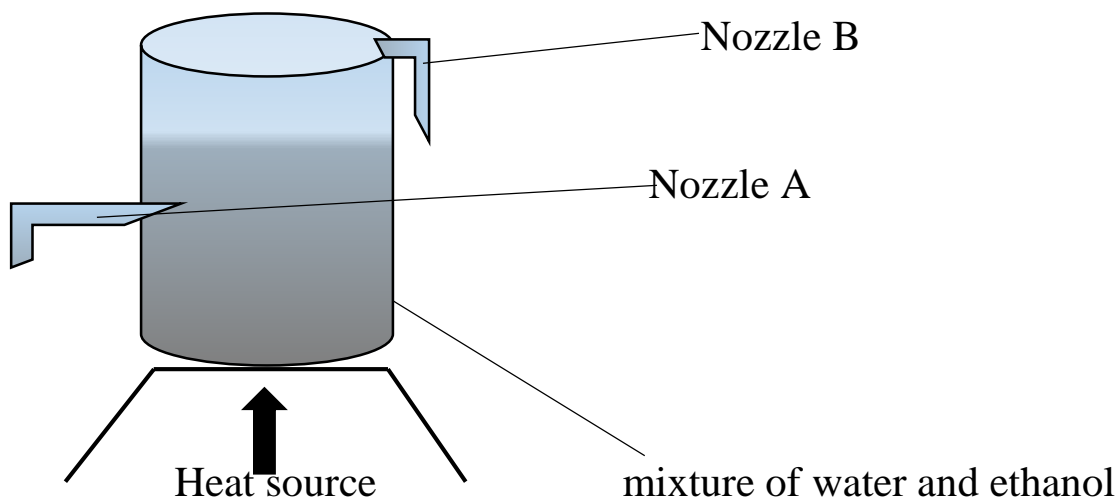
They are bio-degradable hence long lasting

c.



- The relative ratio of –OH group in the molecules is larger in H<sub>2</sub>O than in C<sub>2</sub>H<sub>5</sub>OH. The –OH group is the one responsible in the hydrogen bonding and it is stronger in water than in ethanol. As a result, a lot of heat energy is required to break the intermolecular forces in water than in ethanol. This makes water to have higher boiling point than ethanol.

- Diagram below

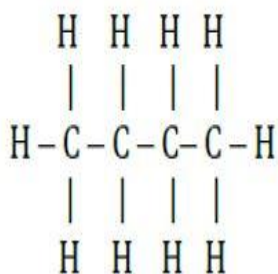


The apparatus above could be used to separate a mixture of ethanol and water by fractional distillation. This process demands on the liquid having different boiling points. When the mixture is heated the vapour produced at first is mainly ethanol. This moves up the column into the condenser, where it condenses into liquid ethanol. It is collected in the receiving bottle through nozzle A. when all ethanol vaporizes, the temperature rises to 100oC. At this point, the distillate is water. It is collected in the receiving bottle through nozzle B.

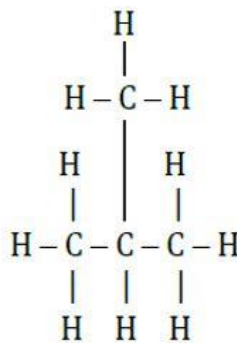
**2008**

- a. Isomers are molecules with the same molecular formula but different structural formula.

Isomer A:



Isomer B:



- Butane
- 2-methyl propane
- b. –since they are non-biodegradable they lead to sanitation problem.
  - When burnt they produce harmful gases
  - Can easily catch fire

Fermentation process



- c. Pour equal volumes of each test liquid into different test tubes. Add few drops of bromine into each test tube and shake gently. The sample that changes from red brown to colourless is octene an alkene. The other liquid remains red brown showing negative results. This is octane an alkane.
- Oxidation involves the loss of electrons while reduction involves the gain of electrons.
  - **Painting**, prevents iron from contact with water and oxygen. Since rust is the oxidation of iron, painting does not allow this to occur.
  - **Galvanizing**, involves dipping the iron metal into molten zinc such that iron metal is coated with zinc. The zinc forms a barrier against water and air. This prevents the iron from rusting since rusting takes place in the presence of air and water.
  - When candle wax is heated the intermolecular forces weaken and the solid structure collapses. This causes the molecules to separate from each other, resulting in the change of state from solid to liquid.

**2009**

- a. - *They are easily moulded – have no crosslinks –they soften and melt when heated*
- *They are cheap*
  - *Reduces pollution to the environment*

*The thermosetting plastics have cross links which hold firmly the polymer chains in place hence no melting or softening when heating.*

- b. *Used in production of esters – used in the production of salt – used in production of vinegar – used as neutralizer of bases in the laboratory.*

- It partially ionizes in water and releases a few hydrogen ions.  
 $\text{CH}_3\text{COOH} (l) + \text{H}_2\text{O} (l) \longrightarrow \text{CH}_3\text{COO}^- (aq) + \text{H}_3\text{O}^+ (aq)$
- Sodium metal reacts with both water and ethanol because both ethanol and water have OH group of which hydrogen is substituted for sodium.
- $\text{C}_n\text{H}_{2n+1}\text{COOH}$

By incineration (burning to ashes) – reusing - recycling - by land filling.

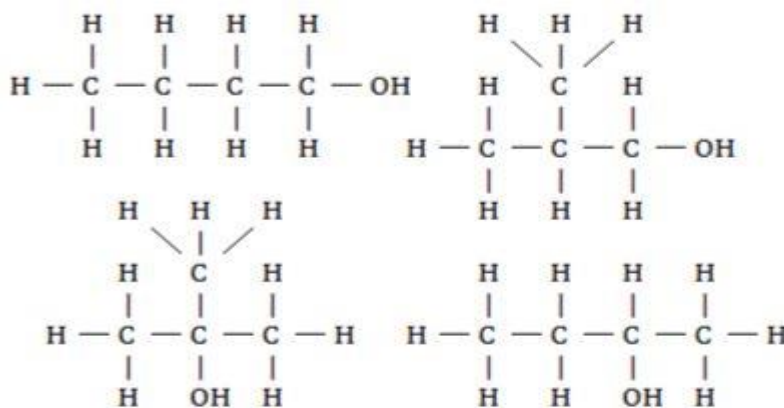
## 2010

- a. These are large molecules made of many sub-molecular units joined together through organic reactions.
  - Used for making plastic bags – used for making dustbins – for making plastic basins – for making insulators.
  - Can be easily moulded – does not corrode – it is lighter – excellent electrical insulator.
- b. -Small molecules of carboxylic acids are soluble in water
  - They change the blue litmus paper red.
  - They react with alcohols to give esters
  - React with bases to form salt and water.

Natural sources are – stings of ants – citrus fruits – vinegar – apples

- c. Isomers are molecules with the same molecular formula but different structure formulae.

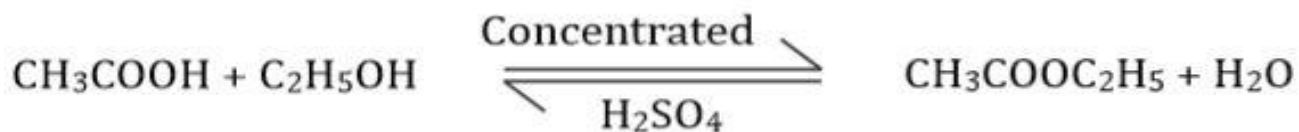
-







d.



- Esterification

e. Propanoic acid ionizes in water and the ions produced are responsible for conductivity while propanol does not release ions in water hence does not conduct electricity.

- Polythene is formed by chain addition reactions between monomers of ethene molecules. When ethene molecules are heated under high pressure, the double bond breaks and molecules join to form a long chain called polythene.

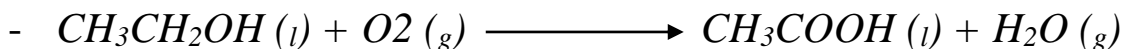
## 2011

a. – *do not conduct electricity – plastic polymers do not corrode – they are tough*

- *Condensation polymerization occurs when small different monomers join to give a polymer and usually a small molecule such as water is released.*

b. – *they react with organic acids to give esters – they react with sodium to give metal oxide – they undergo combustion reaction – they undergo dehydration*

c. *Atmospheric oxygen acts as an oxidizing agent.*



## 2012

a. It belongs to alkanols.

- Reacts with alkanols to form esters
- React with base to form salt and water
- Reacts with metals to release hydrogen gas
- They conduct electricity

Used as a solvent – used for making lipsticks, body lotion, paints and varnishes  
 – used as medicine – used as alternative fuels

- The product are esters and water.

General formula of alkanolic acid is  $C_nH_{2n+1}OH$

When **n= 5**, we have

$$= C_5H_{2(5) + 1}COOH$$

$$= \underline{\underline{C_5H_{11}COOH \text{ answer}}}$$

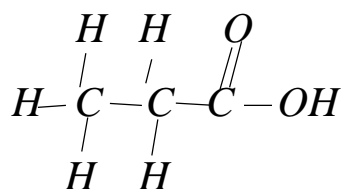
- Compound **A** could be distinguished from compound **B** by using acid test. The test involves mixing sodium hydroxide (base) and phenolphthalein indicator. This changes the colour of the mixture to pink. When substance **A** is mixed with the mixture, it will turn colourless and when **B** is mixed; it will remain pink.

### 2013

- a. *By pouring 3cm<sup>3</sup> of each test liquid into separate test tube. Add 2-3cm<sup>3</sup> of water and shake gently. One liquid show one layer. This is ethanol since it is soluble in water while the other will shows two layer. This is ethanol since it is soluble in water while the other will shows two layers giving negative results. This is hexane.*

### 2014

- a. *These are organic compounds that are made up of carbon and hydrogen atoms only.*
- b. – **B & D**
- Propanol

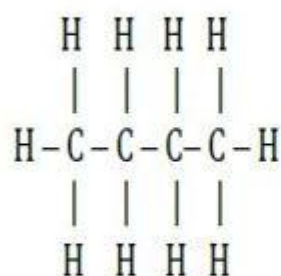


c. – *they melt when heated*

- *They are light*
- *They are insulators*
- *They are coloured.*

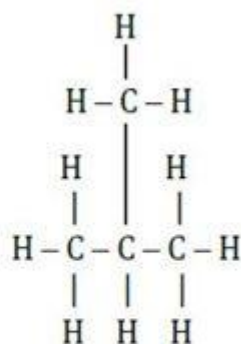
Two isomers of butane

Isomer A:



- Butane

Isomer B:



2-methyl propane

---

**2015**

a. *Ethanol and carbon dioxide*

- *In the fermentation of sugars, such as glucose and fructose, yeast is used to provide enzymes which decompose the sugar into ethanol and carbon dioxide.*

b. *Because they have cross-links which hold firmly the polymer chains in place hence no melting or softening when heated.*

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*Reference books:*

*Target chemistry*

*Excel & succeed*

*Samuel kalea*