VIDYAJYOTHI

(2019 - 2020)

CHEMISTRY

(Support Material for Teaching & Learning)

CLASS X

District Institute of Education and Training (DIET)

Thiruvananthapuram

Vidyajyothi

Chemistry

(Support Material for Teaching & Learning)

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Message

Dear students

Kerala has made many strides in the field of education. The foundation of our success in this field is that we are able to attain academic excellence along with school excellence. Local authorities and people's committees are very supportive for the development of the school. Meaningful interventions by the Kerala Government and the Department of Public Instruction have become critical in this field. The role of teachers in organizing activities according to new perspectives on learning is not a trivial one. The use of ICT has enabled the collection and dissemination of information and thus facilitated learning. All of you are preparing for a very crucial exam. Systematic study is required to approach the exam with confidence and achieve high success. Everyone is here to help you. Vidyajyothi, the study materials prepared by the District Panchayat, Thiruvananthapuram and DIET Thiruvananthapuram will no doubt be an effective tool to ensure your greater success. An updated book which includes the revised lessons is now in your hands. Make use of it, the maximum. Wishing you all the best.

With love

V.K.Madhu

President, District Panchayath,
Thiruvananthapuram

Dear children

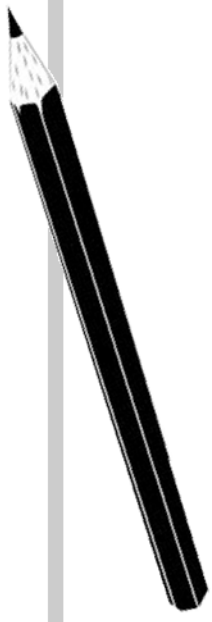
The report by NITI Aayog, which states that Kerala is the number one in Education in India is a source of great excitement for the education sector. The perspectives and activities based on secular democratic principles helped us achieve this aim. The General Education Rejuvenation Mission is another exemplary Kerala model. Many of the initiatives proposed by the new National Education Policy under the leadership of Dr. Kasturirangan have been implemented in Kerala. The fact that Kerala is on a par with the educational standard of many developed countries is a visible manifestation of the will power of the Kerala community. You have made many strides in education by self learning, following the guidelines suggested by your teachers who are research oriented in their approach. Now it's time for you to prepare for the public examination. You need not be afraid of exams. Consider your exam as an opportunity to apply the knowledge and skills you have acquired in the classrooms. Remember to take necessary preparations to face the exam well. The Vidyajyothi study materials prepared by the District Panchayat Thiruvananthapuram and DIET Thiruvananthapuram serves as a real guide for you. Make use of the study materials to the extent possible. Wish you all the best.

Wishing you all success

C. Manojkumar
Deputy Director of Education,
Thiruvananthapuram

T.V.Gopakumar
Principal, DIET
Thiruvananthapuram

Members participated in the workshop



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PREFACE

Dear friends

All the progress in the field of education in Kerala is the result of effective changes in the curriculum and activities and approaches undertaken and adopted in accordance with the ongoing changes in our modern world. Examples of these include the idea of organizing learning activities considering each child as a single unit, and awareness that there is always a social environment for learning. Similarly, Kerala has adopted a new humanitarian approach towards culture. The idea to value the cultural background of each student in the class and to provide a perspective that culture of each individual is lofty. These are assessed as stepping stones to development. So, we have taken the right and integrated approach encompassing the cultural diversity of each individual. There have been continuous effort in this sector to dismantle traditional notions of education and create a genuinely civic-minded generation. The District Panchayat, Thiruvananthapuram has implemented various exemplary models which are helpful for achieving this aim. The most important among these is the Vidyajyothi learning materials, prepared for six subjects, which are intended to increase the pass percentage of students in class 10 and help them to face the exams with more confidence. A lot of hard work is behind this venture. We express our sincere gratitude to the Honourable District Panchayat President V.K. Madhu, District Panchayat members, District Panchayat Secretary, Standing Committee Officers for their invaluable suggestions. We also thank the Principal, DIET Thiruvananthapuram, Faculty Members, Deputy Director of Education, Headmasters, Teachers, Teacher Organizations and PTA / SMC members for their wholehearted cooperation.

With love

V. Renjith

Standing Committee Chairman –
Health and Education, District Panchayath,
Thiruvananthapuram

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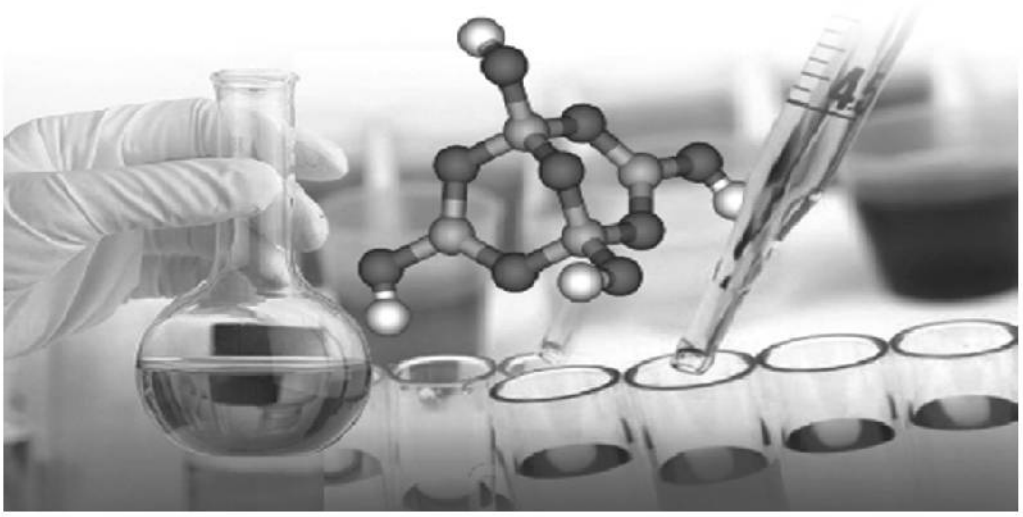
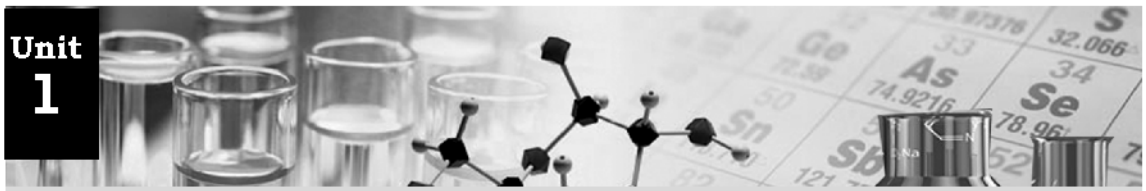


Unit 1

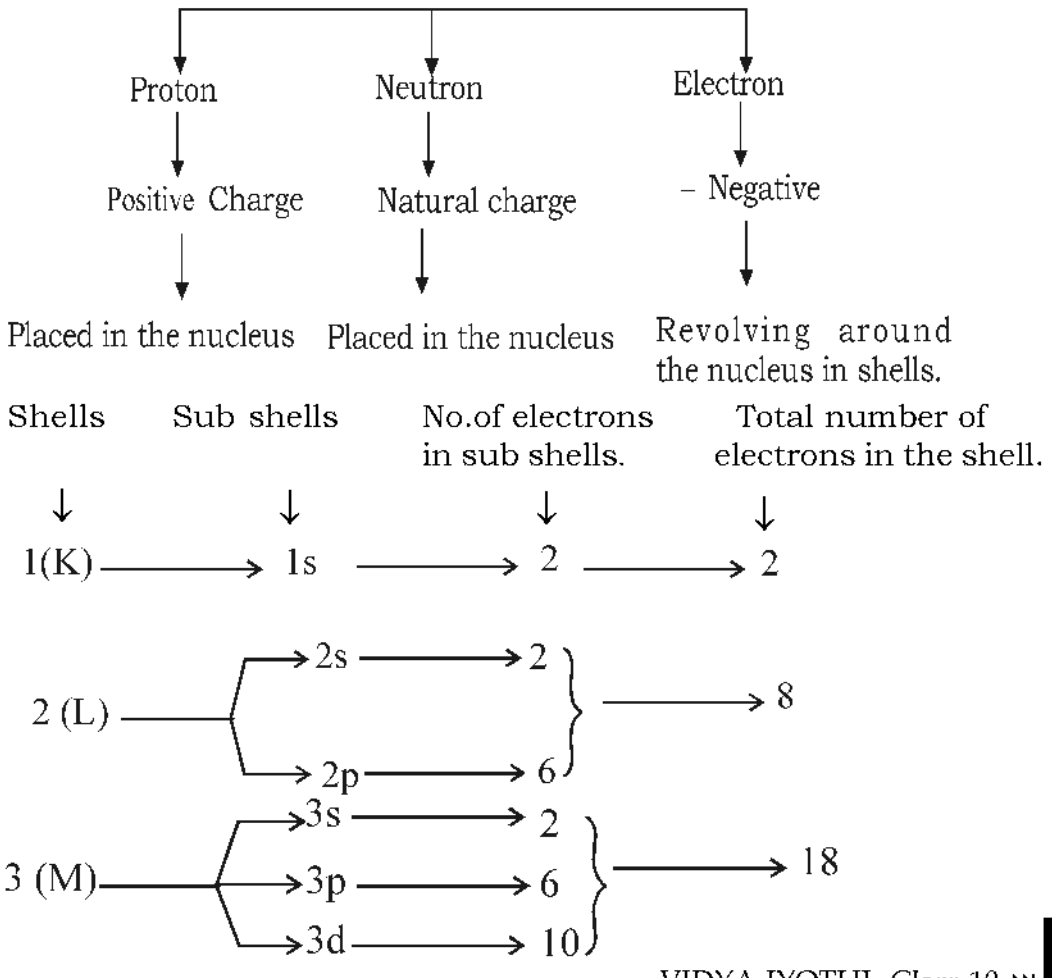


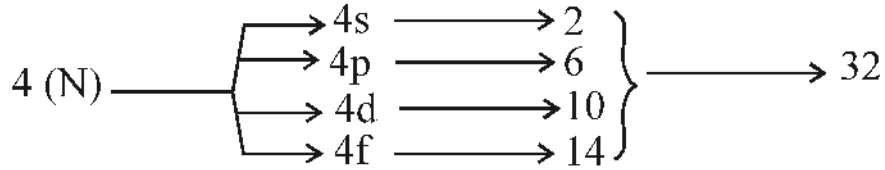
PERIODIC TABLE AND ELECTRONIC CONFIGURATION

The classification of elements by Antoine Lavoisier to Henry Mosely is one of the milestones in the history of chemistry. In this chapter, we are analysing the arrangement of electrons in an atom of different elements.

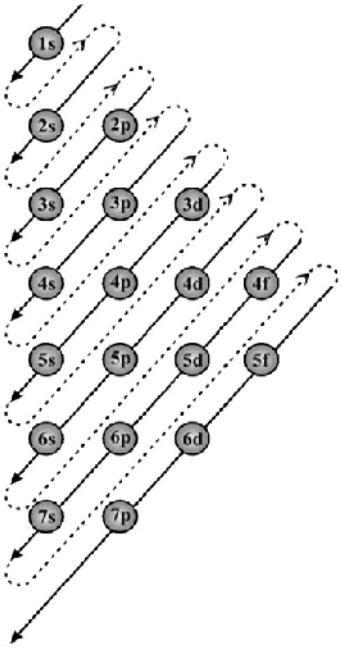
Main concept

Fundamental particles of an atom





⇒ Filling up of electrons in the sub shells is based on the increasing order of their energies.



The arrangement of electrons in the increasing order of their energies in sub shells are

$Is < 2s < 2p < 3s < 3p < 4s < 3d$.....

Activity 1

Fill in the blanks.

Shell	1(K)	2 (L)	3 (M)	4 (N)
Subshell	1s	2s, ...	..., 3p,...	4s,..., 4d,...

Activity 2

Complete the table

Shell	1(K)	2 (L)		3(M)			4(N)			
Subshell	1s	2s	2p	–	3p	–	–	4p	–	–
Maximum number of electrons in each subshell	2	2	....	2	....	10		6	...	...
Maximum number of electrons in each shell	2	8		18			32			

Activity 3

Complete the following table by finding the total number of electrons present in the given elements atoms and then write the subshell electronic configuration. (The symbols are not real)

Element	Number of electrons	Subshell electronic configuration
$_{7}A$	7	$1s^2\ 2s^2\ 2p^3$
$_{11}B$		
$_{21}C$		
$_{27}D$		
$_{20}E$		

While writing the subshell electronic configuration of elements with higher atomic numbers, the symbol of the noble gas preceding that element may be shown with in the square brackets followed by the electronic configuration of the remaining subshells.

Example: While writing subshell electronic configuration

upto $2p^6$ - use [Ne]

upto $3p^6$ - use [Ar]

upto $4p^6$ - use [Kr]

Activity 4

Fill up suitably

Element	Sub shell electronic configuration	Subshell electronic configuration using the symbol of preceding noble gas
$_{21}Sc$	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^1\ 4s^2$	[Ar] $3d^1\ 4s^2$
$_{12}Mg$	.....	[ ] $3s^2$
X	.....	[Ar] $3d^3\ 4s^2$
$_{27}Y$	.....	.....
$_{15}Z$	.....	.....

d-sub shell can accommodate a maximum of 10 electrons. The completely filled configuration (d^{10}) or the half filled configuration (d^5) of this the sub shell is more stable than partially filled d subshell.

Activity 5

The subshell electronic configuration of an element X is.

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4\ 4s^2$

a) What is the atomic number of this element ?

b) Find the number of electrons present in this element?

c) Is the given electronic configuration of X correct? If not, correct it..

d) Write the electronic configuration of element having atomic number - 29 ?

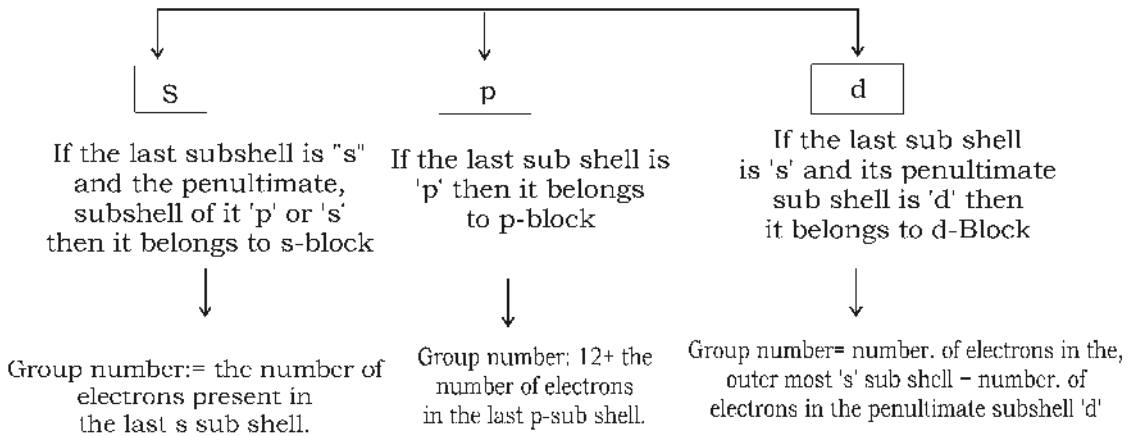
How to find Period, Block and Group of an element, if its subshell electronic configuration is given?

The highest shell number in the sub shell electronic configuration gives the period number.

Example : $1s^2\ 2s^2\ 2p^6\ 3s^1$ Period = 3

To find the Block and Group number

Subshell electronic configuration of an element

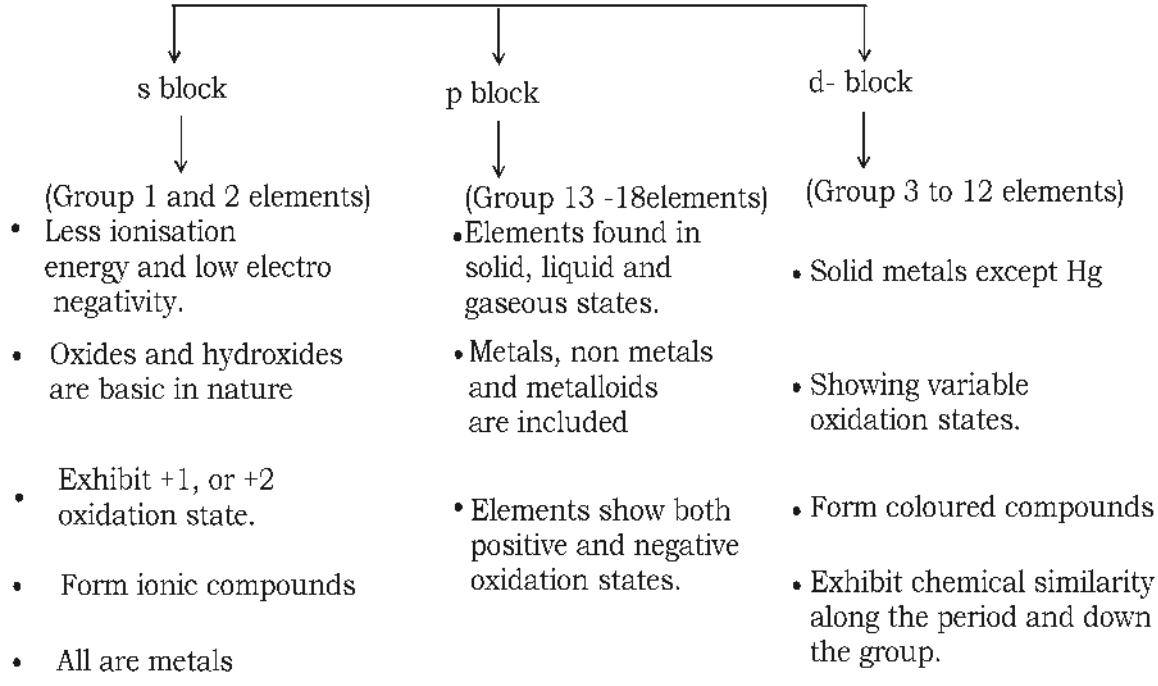


Activity 6

Complete the table

Elements	Sub Shell Electronic Configuration	Period	Block	Group
$_{17}A$	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$	3	p	5+12= 17
$_{11}B$	$1s^2\ 2s^2\ 2p^6\ 3s^1$	3	s	1
$_{22}C$	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2\ 4s^2$	4	d	2+2 = 4
$_{10}D$				
$_{27}E$				
$_{20}F$				

Classification of elements based on their blocks



Activity 7

Match the following

A	B	C
s- block elements	Most of them are radio active	Include metalloides
p- block elements	Alkali metals	Used as catalyst in petroleum industry
d- block elements	Include elements in solids, liquid and gaseous states	Form ionic compounds
f-block elements	From coloured compounds	Show similarity both in period and group

Activity 8

Atomic number of Mn is 25. Its electronic configuration is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^2$. Based on this, complete the following table.

Compound	Oxidation state	Electronic configuration of Manganese ion
$MnCl_2$	+2	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5$
MnO_2		
Mn_2O_7		
Mn_2O_3		

Activity 9

Element X shows an oxidation state of +3. The electronic configuration of X^{3+} is [Ar] $3d^7$. [Valency of chlorine is 1]

a) Find the atomic number of X ?

b) Write the subshell electronic configuration of element X?

c) Write the chemical formula of compound forming between X and *Cl*.

Activity 10

Symbols of two elements and their atomic numbers are given

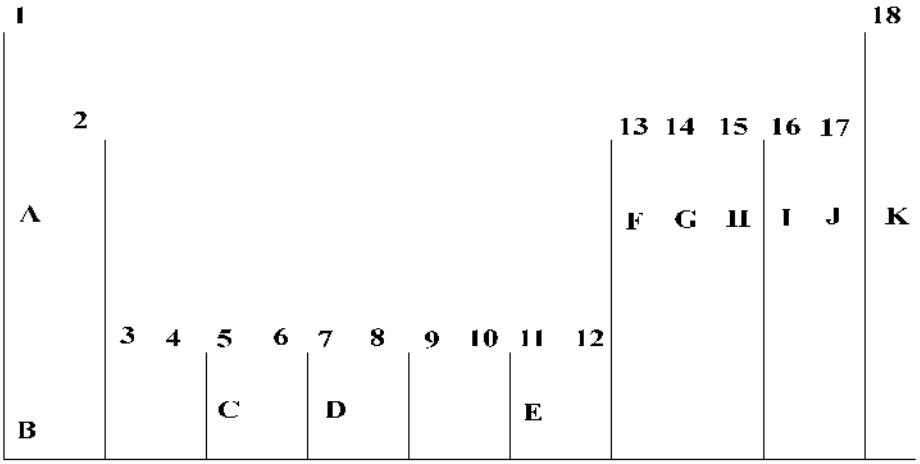
Na - 11, O - 8

a) Write the electronic configuration of these elements

b) Find the oxidation number of sodium and oxygen

c) Write the chemical formula of the compounds formed between sodium oxygen

Activity 11



a) Which elements show +1 oxidation state?

b) Which is the element containing 4 electrons in the outermost shell?

c) Which element has the highest ionisation energy?

d) Which element shows -1 oxidation state?

e) Which is the most highest reactive non metal?

ANSWER KEY

1.

Shell	**1 (K)**	**2 (L)**	**3 (M)**	**4 (N)**
Sub shell	1S	2s, 2p	3s, 3p, 3d	4s, 4p, 4d, 4f

2.

Shell	**1 (K)**	**2 (L)**		**3 (M)**			**4 (N)**			
Sub Shell	1s	2s	2p	3s	3p	3d	4s	4p	4d	4f
Maximum number	2	2	6	2	6	10	2	6	10	14
	2	8		18			32			

3.

Element electrons	Number of Configuarion	Subshell Electronic
$_{7}A$	7	$1s^2$ $2s^2$ $2p^3$
$_{11}B$	11	$1s^2$ $2s^2$ $2p^6$ $3s^1$
$_{21}C$	21	$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^1$ $3s^2$
$_{27}D$	27	$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^7$ $4s^2$
$_{20}E$	20	$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $4s^2$

4.

Element	Subshell Electronic Configuration	Subshell Electronic Confriguration using the symbol noble gas
21^{SC}	$1s^2$ $2s^2$ $2p^6 2p^6$ $3s^2$ $3p^6$ $3d^1$ $4s^2$	(Ar) $3d^1$ $4s^2$
12^{Mg}	$1s^2$ $2s^2$ $2p^6$ $3s^2$	(Ne) $3s^2$
23X	$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^3$ $4s^2$	(Ar) $3d^3$ $4s^2$
27 Y	$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^7$ $4s^2$	(Ar) $3d^7$ $4s^2$
15 Z	$1s^2$ $2s^2$ $2p^6$ $3s^2$ sp^3	(Ne) $3s^2$ $3p^3$

5. a) 24

b) 24

c) No, $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^5$ $4s^1$ or (Ar) $3d^5$ $4s^1$

d) $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^{10}$ $4s^1$ or (Ar) $3d^{10}$ $4s^1$

6.

Element	Subshell Electronic Configuration	Period	Block	Group
17^{A}	$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^5$	3	p	5 + 12 = 17
11^{B}	$1s^2$ $2s^2$ $2p^6$ $3s^1$	3	s	1
22^{C}	$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^2$ $4s^2$	4	d	2+2 = 4
10^{D}	$1s^2$ $2s^2$ $2p^6$	2	p	6+12 = 18
27^{E}	$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^7$ $4s^2$	4	d	2+7=9
20^{F}	$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^7$ $4s^2$	4	s	2

7.

s - Block elements	Alkalimetalas	Form ionic compounds
p- Block elements	Included elements insolid liquid and gaseous state	Include metalloids
d-Block elements	From coloured compounds	Shows similarity both in period and groups
f - Block elements	Most of them are radio active elements	Used as catalysts in petroleum petroleum industry

8.

Compound	**Oxidation state**	**Electronic configuration of Managemention**
Mn Cl_2	+2	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5$
Mn O_2	+4	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5$
$Mn_2\ O_7$	+7	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$
$Mn_2\ O_3$	+3	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4$

9. a) 28

b) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^8\ 4s^2$

c) X Cl_3 (If X is in +3 oxidation state)

10. a) Na - 2, 8, 1/ $1s^2\ 2s^2\ 2p^6\ 3s^1$ O – 2, 6/ $1s^2\ 2s^2\ 2p^6$

b) Na = +1 O = $^-$ 2

c) Na_2O

11. a) A and B

b) G

c) K

d) J

e) J

UNIT TEST

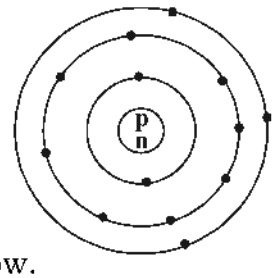
Score : 20 Time : 40 min

Answer any four from questions 1 to 6.

1. Which among the following sub shells has the highest energy? 2s, 4s, 3d
2. Find the maximum number of electrons that can be accommodated in 3p subshell?
3. How many subshells are there in the 4^{th} shell?
4. Find the oxidation state of Fe in $FeCl_3$?
5. Which one is impossible in the sub-shell 2s, 2d, 3d and 5s.
6. In which block most of the elements showing positive oxidation state and negative oxidation state are included? (1 × 4 = 4)

Answer any five from questions 7 to 13

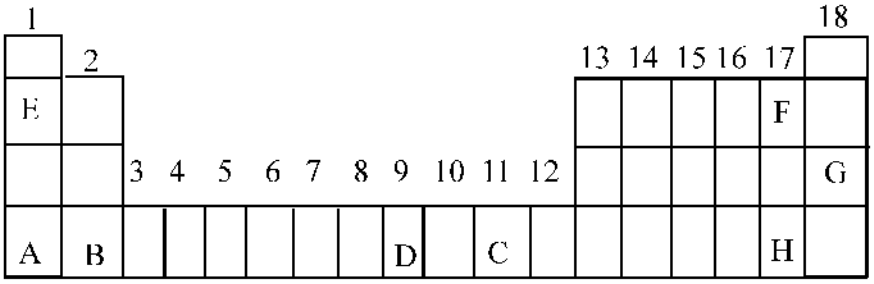
7. Bohr model of an atom of element 'A' is given.



   a. What is the atomic number of this element 'A'.
   b. Write the subshell electronic configuration of A.
8. Electronic configuration of atom 'B' is given below.
   B = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4\ 4s^2$.
   a. Find the atomic number of B.
   b. Is the given electronic configuration of B correct? If not, correct it and give the reason.
9. d-block elements show horizontal and vertical similarity in periods and groups. Why?
10. Write the electronic configuration of elements having atomic number 17 and 21. Then find the period, group and block of these elements?
11. What are the possible sub shells in N shell? Write the maximum number of electrons that can be accommodated in each sub shell?
12. 'X' is an element showing +2 oxidation state. The electronic configuration of X^{2+} is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2$. Then
   a. Write the atomic number of X?
   b. Write its electronic configuration?
13. Write the subshell electronic configuration of element having atomic number 23, using the symbol of preceding noble gas (2 ×5 = 10)

Answer any two from the questions 14 to 16.

14. Analyse the following table and answer the questions given below.



a. Find elements having one electron in 4s sub shell?

b. Find the s-block element having the smallest atom size?

c. Which are the elements that form coloured compounds?

d. In which family the element is G included?

15. Match the following.

s-block Elements	Mostly radio active elements	Included in the 6 th period
p-block elements	Exhibit only +1 or +2 oxidation state.	Included in the 7th period
d block elements	last electron fills in 4f subshell	Exhibit variable oxidation state
Lanthanoids	Include elements showing +ve oxidation state or -ve oxidation state	Form Ionic compounds
Actinoids	Form coloured compounds.	Included metalloids

16. Complete the table.

Elements	Sub shell electronic configuration	Sub shell electronic configuration using the name of the Preceeding noble gas.
$_{21}Sc$	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^1 4s^2$	[Ar] $3d^1 4s^2$
$_{12}Mg$	.....	[ ] $3s^2$
$_{.....}X$	.....	[Ar] $3d^3 4s^2$
$_{27}Y$	.....	.....
$_{15}Z$	.....	.....

ANSWER KEY

1. 3d
2. 6
3. 4
4. +3
5. 2d
6. p
7. a) 13

   b) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$
8. a) 24

   b) No, $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$
   (Half filled configuration is more stable)
9. In 'd' block elements, the outer most subshell electronic configuration is the same in a roup a group and also along a period. Hence they show similary in groups and in periods.
10. Atonic number = 17

    Subshell Electronic Configuration

    = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

    Period = 3

    Block = P

    Group = 17

    Atonic number = 21

    Subshell Electronic Configuration

    = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^1\ 4s^2$

    Peiod = 4

    Block = d

    Group = 3
11. 4s, 4p, 4d, 4f

    4s = 2, 4p = 6, 4d = 10, 4f = 14

12. a) 22

    b) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2\ 4s^2$

13. (Ar) $sd^3\ 4s^2$

14. a) A, C

    b) E

    c) D, C

    d) Noble gas (Inert gas)

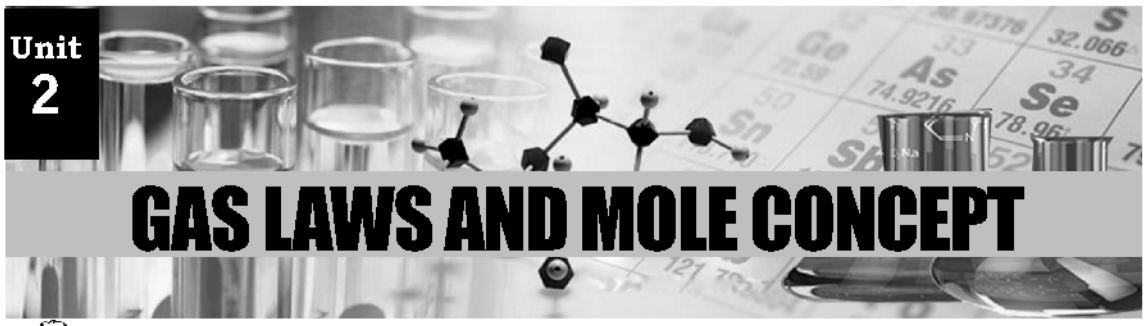
15.

s - Block elements	Exhibit only + 1 or +2 oxidation state	Form ionic compounds
p - block elements	Include elements showing positive or negative oxidation state	Include Metalloids
d- Block elements	Form coloured compounds	Exhibits variable oxidation state
Lanthanoids	Last electron fills in 4 f subshell	Included in the 6^{th} period
Actinoids	Mostly radio active elements	Included in 7^{th} period

16.

Element	**Subshell Electronic Configuration**	**Subshell Electronic configuration using the name of the prceeding noble gas**
$_{21}$ Sc	$1s^2\ 2s^2\ 2p^6\ 3s^2\ \ 3p^6\ \ 3d^1\ \ 4s^2$	(Ar) $3d^1\ 4s^2$
$_{12}$Mg	$1s^2\ 2s^2\ 2p^6\ 3s^2$	(Ne) $3s^2$
$_{23}$X	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3\ 4s^2$	(Ar) $3d^3\ 4s^2$
$_{27}$ Y	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^7\ 4s^2$	(Ar) $3d^7\ 4s^2$
$_{15}$ Z	$1s^2\ 2s^2\ 2p^6\ 3s^2\ sp^3$	(Ne) $3s^2\ 3p^3$

Unit 2



GAS LAWS AND MOLE CONCEPT

At a Glance

- Each gas contains numerous minute molecules.
- When compared to the total volume of a gas the real volume of molecules is very less.
- The molecules of a gas are in a state of rapid motion in all directions.
- As a result of the random motion of the gas molecules, they collide with each other and also collide with the walls of the container in which it is kept. This collision with the walls account for the pressure of a gas.
- As the collision of molecules perfectly elastic in nature, there is no loss of energy.
- There is no attraction between the gas molecules and with the walls of the container.

Activity 1

If a gas which is kept in a cylinder having a volume of 1 litre, is completely transferred to another 5 litre cylinder, what will be its volume ?

(5 litres , 10 litres, Volume does not change)

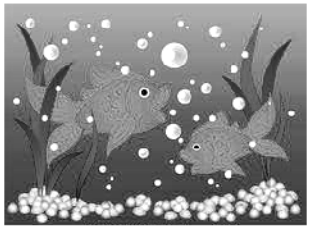
Actvity 2

When gases are heated, the temperature and kinetic energy of the molecules change. Select the most suitable alternative from the following to justify the statement .

- Temperature decreases , kinetic energy increases
- Temperature increases , kinetic energy decreases
- Temperature and kinetic energy increase
- Temperature and kinetic energy decrease

Activity 3

Observe the figure.The size of air bubbles rising from the bottom of an aquarium increases. Give reason.



Boyle's law states that at a constant temperature, volume of a definite mass of gas is inversely proportional to its pressure. If P is the pressure and V the volume, then P x V is a constant.

Activity 4

Analyse the data given below. Temperature and number of molecules are same.

Pressure (P)	Volume (V)
1 atm	100 L
4 atm	25 L
5 atm	20 L
10 atm	10 L

(a) Find P x V

(b) Which gas law is related to this?

(c) What will the volume of the gas if the pressure is changed to 2 atm under the same conditions ?

Activity 5

The table given below shows relation between volume and temperature of a fixed mass of a gas.(Pressure is kept constant)

Volume V	Temperature T (In Kelvin scale)
900 mL	300K
960 mL	320 K
819 mL	273 K

(a) Find V/T

(b) Which gas law is related to this?

(c) What will the volume of the gas if the temperature is changed to

310 K under the same conditions ?

Charle's law states that At constant pressure, the volume of a definite mass of a gas isdirectly proportional to the temperature in Kelvin Scale.If V is volume and T the temperature, Then V/T will be a constant.

Activity 6

Analyse the situations given below. Which gas law is related to each situation ?

(a) When a balloon is inflated ,its volume increases (temperature and pressure are constant)

(b) If an inflated balloon is kept in sunlight, it will burst.(pressure is constant)

Activity 7

The properties of certain gases which are kept under same temperature and pressure are given below.

Gas	Volume	Number of molecules
Nitrogen	20 L	x
Oxygen	40 L	.....
Ammonia	10 L	.....
Carbon dioxide	.....	4 x

(a) Complete the table

(b) Identify the gas law which agrees with the data .

Avagadro's Law

At constant temperature and pressure, the volume of a gas is directly proportional to the number of molecules.

MOLE CONCEPT

Activity 8

Complete the following table

Element	Atomic Mass	Given mass	Number of Atoms
Hydrogen	1	1g	6.022×10^{23}
Carbon	.....(a).....	12g	6.022×10^{23}
Oxygen	14	14g	.....(b).....
Nitrogen	16	16g	6.022×10^{23}
Sodium	23	.....(c).....	6.022×10^{23}

The mass of an element in grams equal to its atomic mass is called 1 Gram Atomic Mass(1 GAM) of the element. This may also be shortened as 1 Gram Atom.

One gram atomic mass (1 GAM) of any element contains 6.022×10^{23} atoms.This number is known as Avagadro number. This is indicated as N_A .

Activity 9

Complete the following table

Element	Atomic Mass (g)	Given Mass	Number of GAM	Number of Atoms
Hydrogen	1	.....	1	.....
Hydrogen	1	2g	.....	$2 \times 6.022 \times 10^{23}$
Carbon	12	.....	1	6.022×10^{23}
Carbon	12	.....	2	$2 \times 6.022 \times 10^{23}$
Nitrogen	14	14 g	1	6.022×10^{23}
Nitrogen	14	14 g	.....	.....
Oxygen	16	16 g	1	6.022×10^{23}
Oxygen	16	80 g	.....	.....
Sodium	23	.....	.....	6.022×10^{23}
Sodium	23	.....	10	.....

$$\text{Number of Gram Atomic Mass} = \frac{\text{Given Mass in grams}}{\text{GAM of element}}$$

Activity 10

How many GAM is present in the following

(a) 70 g of Nitrogen

(b) 160 g of Oxygen

Hint

Number of Atoms = Number of GAM $\times$ 6.022×10^{23}

Activity 11

Complete the table given below.

Element	Atomic Mass (g)	Given Mass (g)	Number of GAM	Number of Atoms
Hydrogen	1	4	.....a.....	.....b.....
Carbon	12	.....c.....	5	.....d.....
Nitrogen	14	42	.....e.....	.....f.....
Oxygen	16	.....	.....h.....	$5 \times 6.022 \times 10^{23}$

One mole of atoms

One mole of atoms = 6.022 × 10 23 atoms = 1GAM

Activity 12

Complete the table given below.

Element	Atomic Mass	Given Mass	Number of Atoms	Number of Mole Atoms
Hydrogen	1	1g	6.022×10^{23}	1
Carbon	12	12g	6.022×10^{23}	1
Nitrogen	14	14g	6.022×10^{23}	.....
Oxygen	16	16g	6.022×10^{23}	1
Sodium	23	23g	6.022×10^{23}	.....
Hydrogen	1	2g	6.022×10^{23}	2
Carbon	12	36g	6.022×10^{23}	3
Nitrogen	14	70g	6.022×10^{23}	5
Oxygen	16	160g	.....	.....
Sodium	23	11.5g	.....	0.5

Molecular Mass and Gram Molecular Mass

Activity 13

The atomic masses of certain elements are given below.

(H=1 ,C =12 , N=14 , O= 16 , Na = 23 , S= 32)

Find the Molecular Mass and GMM of the following

1) H_2 2) O_2 3) N_2 4) H_2O 5) NH_3

6) CO_2 7) NaOH 8) $C_6H_{12}O_6$ 9) Na_2CO_3 10) H_2SO_4

Number of Molecules

Activity 14

Fill in the blanks of the following table.

Element / Compound	Molecular Mass	Mass in grams	GMM	Number of molecules
Hydrogen (H_2)	2	2 g	1	6.022×10^{23} H_2 molecules
Oxygen(O_2)	32	32 g	1	$6.022 \times 10^{23} O_2$ molecules
Nitrogen(N_2)	28	28g	.....	6.022×10^{23} N_2 molecules
Water(H_2 O)	18	18g	1	6.022×10^{23} H_2O molecules
Ammonia(NH_3)	17	17g	1	
Carbon dioxide (CO_2)	44	44g	.....	.....

The amount of a substance in grams equal to its molecular mass is called One Gram Molecular Mass(1 GMM)

One gram molecular mass of any substance contains Avogadro number of molecules.

Activity 15

One GMM Nitrogen is 28 g Nitrogen.

(a) How many GMM are there in 56 g Nitrogen?

(b) How many molecules are present in it?

$$\text{Number of Gram Molecular Mass} = \frac{\text{Mass given in grams}}{\text{Gram Molecular Mass (GMM)}}$$

Activity 16

Calculate the number of GMM and number of molecules in each of the following samples

(a) 170 g of Ammonia (Molecular mass = 17)

(b) 200 g of Sodium hydroxide (Molecular mass = 40)

Hint : Number of Molecules = Number of GMM × 6.022×10^{23}

6.022×10^{23} molecules are called one mole molecule.1 GMM = 1

Mole = 6.022×10^{23} molecules.

Activity 17

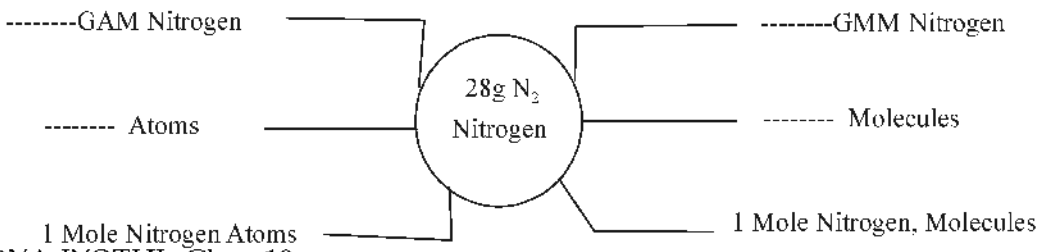
Complete the following table

Element/ Compound	Molecular Mass	Given Mass	GMM	Number of molecules	Number of moles of molecules
Hydrogen (H_2)	2	2 g	1	6.022×10^{23} H_2 molecules	1
Oxygen(O_2)	32	32 g	1	6.022×10^{23} O_2 molecules	1
Nitrogen(N_2)	28	28g	.....	6.022×10^{23} N_2 molecules	.....
Water(H_2O)	18	18g	1	6.022×10^{23} H_2O molecules	.....
Ammonia(NH_3)	17	17g	1	.....	1
Carbon dioxide (CO_2)	44	44g	.....	.....	.....
Hydrogen (H_2)	2	4 g	2	$2 \times 6.022 \times 10^{23}$ H_2 molecules	2
Oxygen(O_2)	32	64 g	.....	.....	2
Nitrogen(N_2)	28	140g	5	.....	.....
Water(H_2O)	18	180g	.....	$10 \times 6.022 \times 10^{23}$ H_2O molecules	.....
Ammonia(NH_3)	17	8.5g	0.5	.....	.....
Carbon dioxide (CO_2)	44	220g	.....	.....	.....

Activity 18

N_2 is a diatomic molecule. The molecular mass of nitrogen is 28.

Complete the word diagram given below.



Activity 19

Find the number of molecules , number of atoms and the number of electrons in 22 grams of carbon dioxide.

Volume of a gas and Moles

273 K temperature and 1 atm pressure are known as standard temperature and pressure or STP.That is, at STP one mole of any gas will occupy a volume of 22.4 L. This is called molar volume at STP.

Activity 20

The volumes of certain gases at STP are given below. Find the number of moles in each.

Volume	Number of moles
22.4 Litres	.....
44.8 Litres	.....
67.2 Litres	.....
112 Litres	.....
224 Litres	.....

$$\text{Number of moles of a gas at STP} = \frac{\text{Volume of the gas in litres at STP}}{22.4 \text{ L}}$$

Activity 21

Examine the samples given.

a) 24 g C b) 22.4 L of NH_3 at STP c) 4 mol of H_2SO_4

d) 54 g of Water e) 112 L of CO_2 at STP f) 1 Kilogram of $CaCO_3$

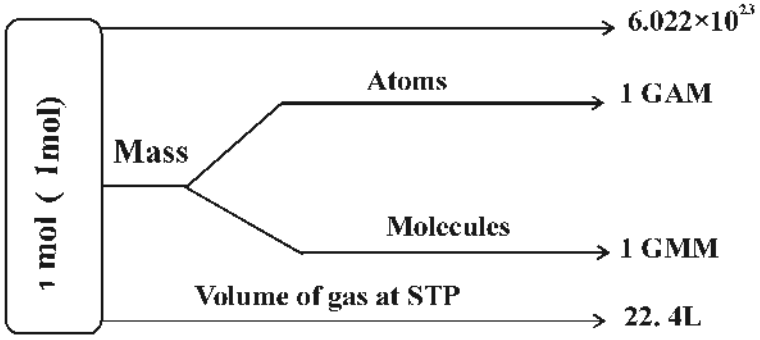
i) Arrange the samples in the increasing order of the number of molecules in each.

ii) What will be the ascending order of the number of atoms the samples given above.

At a Glance

For Atoms	For Molecules	For Gases @ STP
Number of GAM = $\frac{\text{Given mass in grams}}{\text{GAM of the element}}$	Number of GMM = $\frac{\text{Given mass}}{\text{GMM}}$	Number of moles at STP = $\frac{\text{Volume of gas at STP in litres}}{22.4 \text{ litres}}$

Number of Atoms = Number of GAM × 6.022×10^{23}	Number of Molecules = Number of GMM × 6.022×10^{23}	Number of Molecules = Number of moles × 6.022×10^{23}



ANSWER KEY

1. 5 Litre
2. Temperature and kinetic energy increase
3. Here the temperature is constant. From bottom to top, the external

   pressure decreases. Hence volume of the bubble increases. (Boyle's law).
4. (a) 100

   (b) Boyle's Law

   (c) 50 L
5. (a)3

   (b) Charle's Law

   (c) 930 mL
6. (a)Avogadro's Law

   (b) Charle's Law
7.

Gas	Volume	Number of molecules
Nitrogen	20 L	x
Oxygen	40 L	2x
Ammonia	x/2	x/2
Carbon dioxide	80 l	4 x

8. Complete the following table

Element	Atomic Mass	Given mass	Number of Atoms
Hydrogen	1	1g	6.022×10^{23}
Carbon	12	12g	6.022×10^{23}
Oxygen	14	14g	6.022×10^{23}
Nitrogen	16	16g	6.022×10^{23}
Sodium	23	23g	6.022×10^{23}

9. Complete the following table

Element	Atomic Mass	Given mass	Number of GAM	Number of Atoms
Hydrogen	1	1g	1	6.022×10^{23}
Hydrogen	1	2g	2	$2 \times 6.022 \times 10^{23}$
Carbon	12	12g	1	6.022×10^{23}
Carbon	12	24g	2	$2 \times 6.022 \times 10^{23}$
Nitrogen	14	14 g	1	6.022×10^{23}
Nitrogen	14	42g	3	6.022×10^{23}
Oxygen	16	16 g	1	6.022×10^{23}
Oxygen	16	80 g	5	$5 \times 6.022 \times 10^{23}$
Sodium	23	230g	1	6.022×10^{23}
Sodium	23	.....	10	$10 \times 6.022 \times 10^{23}$

10. How many GAM is present in the following

(a) 70 grams of Nitrogen

(b) 160 grams of Oxygen

Answer:

(a) 70 grams of Nitrogen

Number of GAM = Given Mass in grams / GAM of element

=70 g / 14 g

=5

(b) 160 grams of Oxygen

Number of GAM = Given Mass in grams / GAM of element

=160 g /16g

= 10

11.

Element	Atomic Mass	Given mass	Number of GAM	Number of Atoms
Hydrogen	1	4g	4	$4 \times 6.022 \times 10^{23}$
Carbon	12	60g	5	$5 \times 6.022 \times 10^{23}$
Nitrogen	14	42g	3	$3 \times 6.022 \times 10^{23}$
Oxygen	16	80g	5	$5 \times 6.022 \times 10^{23}$

12.

Element	Atomic Mass	Given Mass	Number of Atoms	Number of Mole atoms
Hydrogen	1	1g	6.022×10^{23}	1
Carbon	12	12g	6.022×10^{23}	1
Nitrogen	14	14g	6.022×10^{23}	1
Oxygen	16	16g	6.022×10^{23}	1
Sodium	23	23g	6.022×10^{23}	1
Hydrogen	1	2g	6.022×10^{23}	2
Carbon	12	36g	6.022×10^{23}	3
Nitrogen	14	70g	6.022×10^{23}	5
Oxygen	16	160g	$10 \times 6.022 \times 10^{23}$	10
Sodium	23	11.5g	$0.5 \times 6.022 \times 10^{23}$	0.5

13. 1) 2 2) 3 3) 28 4) 18 5) 17

6) 44 7) 40 8) 180 9) 106 10) 98

14. Fill in the blanks of the following table .

Element / Compound	**Molecular Mass**	**Mass in grams**	**GMM**	**Number of molecules**
Hydrogen (H_2)	2	2 g	1	6.022×10^{23} H_2 molecules
Oxygen(O_2)	32	32 g	1	$6.022 \times 10^{23} O_2$ molecules
Nitrogen(N_2)	28	28g	1	6.022×10^{23} N_2 molecules
Water(H_2 O)	18	18g	1	6.022×10^{23} H_2O molecules
Ammonia(NH_3)	17	17g	1	6.022×10^{23} NH_3 molecules
Carbon dioxide (CO_2)	44	44g	1	6.022×10^{23} CO_2 molecules

15. One GMM Nitrogen is 28 g Nitrogen.

(a) How many GMM are there in 56 g Nitrogen?

(b) How many molecules are present in it?

Answer:

(a) 2

(b) 2 × 6.022 × 10 23

16. a) 10, 10 × 6.022 × 10 23

b) a) 5, 5 × 6.022 × 10 23

17.

Element/ Compound	**Molecular Mass**	**Given Mass**	**GMM**	**Number of moles of molecules**	**Number of molecules**
Hydrogen (H_2)	2	2 g	1	1	6.022×10^{23} H_2 molecules
Oxygen(O_2)	32	32 g	1	1	6.022×10^{23} O_2 molecules
Nitrogen(N_2)	28	28g	1	1	6.022×10^{23} N_2 molecules

Water(H_2 O)	18	18g	1	1	6.022×10^{23} H_2 O molecules
Ammonia(NH_3)	17	17g	1	1	6.022×10^{23} NH_3 molecules
Carbon dioxide (CO_2)	44	44g	1	1	6.022×10^{23} CO_2 molecules
Hydrogen (H_2)	2	4 g	2	2	$2 \times 6.022 \times 10^{23}$ H_2 molecules
Oxygen(O_2)	32	64 g	2	2	$2 \times 6.022 \times 10^{23}$ O_2 molecules
Nitrogen(N_2)	28	140g	5	5	$5 \times 6.022 \times 10^{23}$ N_2 molecules
Water(H_2 O)	18	180g	10	10	$10 \times 6.022 \times 10^{23}$ H_2O molecules
Ammonia(NH_3)	17	8.5g	0.5	0.5	$0.5 \times 6.022 \times 10^{23}$ NH_3 molecules
Carbon dioxide (CO_2)	44	220g	5	5	$5 \times 6.022 \times 10^{23}$ CO_2 molecules

18. For the answer , scan the QR code given below

6FMLUU

19. Number of molecules = $0.5 \times 6.022 \times 10^{23}$

Number of atoms = $3 \times 0.5 \times 6.022 \times 10^{23}$

Number of Electrons = $22 \times 0.5 \times 6.022 \times 10^{23}$

(Number of electrons in one molecule of CO_2 = 6+8+8=22)

20.

Volume	Number of moles
22.4 Litres	1
44.8 Litres	2
67.2 Litres	3
112 Litres	5
224 Litres	10

21. a) 24 g C = $2 \times 6.022 \times 10^{23}$
b) 22.4 L of NH_3 at STP = 6.022×10^{23}
c.) 4 mol of H_2SO_4 = $4 \times 6.022 \times 10^{23}$
d) 54 g of Water = $3 \times 6.022 \times 10^{23}$
e) 112 L of CO_2 at STP = $5 \times 6.022 \times 10^{23}$
f) 1 Kilogram of $CaCO_3$ = $10 \times 6.022 \times 10^{23}$
Answer: b<a<d<c<e<f

22. a. 24 g C = $2 \times 6.022 \times 10^{23}$
b. 22.4 L of NH_3 at STP = $4 \times 6.022 \times 10^{23}$
c. 4 mol of H_2SO_4 = $7 \times 4 \times 6.022 \times 10^{23}$
d. 54 g of Water = $3 \times 3 \times 6.022 \times 10^{23}$
e. 112 L of CO_2 at STP = $3 \times 5 \times 6.022 \times 10^{23}$
f. 1 Kilogram of $CaCO_3$ = $5 \times 10 \times 6.022 \times 10^{23}$
Answer: a<b<d<e<c<f

UNIT TEST

Score: 20
Time : 20minute

(Answer any four questions from 1-6)

1. Gas molecules are in a state of rapid random motion in all directions. What happens to the energy of molecules during this motion?
2. Analyse the situation given situation and identify the gas law which is associated with it.
± The size of an inflated balloon decreases when it is immersed in cold water
(Pressure and number of molecules are same)
3. 1 mole = ———————— molecules
4. 128 g O_2 = ————————GMM (Molecular mass of O_2 = 32)
5. Calculate the mass of 5 GAM of carbon (Atomic mass of carbon = 12)
6. What is the mass of 5 mole molecules of nitrogen(Molecular mass of

nitrogen = 28) **(4 × 1 = 4)**

(Answer any five questions from 7-13)

7. Among 50 g of carbon and 50 g of He , which one contains more number of atoms?
8. calculate the number of GAM of the following
   a) 200 g of Calcium b) 140 g of Nitrogen
   (Atomic mass : Ca =40, Na=14)
9. Find out the number of molecules in 90 g of Water. Also calculate the total number of atoms. (Atomic mass : H=1, O=16)
10. Arrange the following in the increasing order of number of molecules 100 g H_2O, 100 g HCl , 100 gH_2SO_4
    (Molecular mass : H_2O= 18 HCl=36.5 H_2SO_4= 98)
11. Calculate the number of molecules present in 67.2 litre of CO_2 at STP
12. The volume occupied by one mole of a gas is called the molar volume of the gas .
    (a) What is the molar volume of gases at STP
    (b) Find the mass of 224 L of NH_3 at STP
13. Find the number of atoms and number of molecules in 142 g of Chlorine
    (Atomic mass of Chlorine = 35.5 g)

(5 × 2 = 10)

(Answer any two questions from14-16)

14. Arrange the following in the ascending order of the number of atoms.
    a) 120 g of Mg b) 80 g of Ca c) 2.3 g of Na
    (Atomic Mass : Na = 23, Mg=24 ,Ca=40)
15. Equal volumes of two gases kept under STP are given below.
    (Molecular mass of NO_2 = 46)
    264 g of CO_2 .....g of NO_2
    a. Fill in the blanks
    b. Calculate the number of molecules in NO_2
16. The data showing the relation between the pressure and volume of fixed mass of a gas is given below.(Temperature is constant).

Pressure	Volume
1 atm	80 L
.....	40 L
4atm	.....
8atm	.....

a) Complete the table.

b) State the gas law is applicable here. **(2 × 3 = 6)**

ANSWER KEY

1. The energy does not change
2. Charles law
3. 6.022×10^{23} molecules
4. 4 GMM
5. 60 g
6. 140 g
7. 50 g of He
8. a) 5 b) 10
9. $5 \times 6.022 \times 10^{23}$
10. 100 g H_2SO_4<100 g HCl <100 g H_2O
11. $3 \times 6.022 \times 10^{23}$
12. (a) 22.4 L
    (b) 170 g
13. Number of atoms = (142 g / 35.5 g) × 6.022×10^{23}
    = $4 \times 6.022 \times 10^{23}$
    Number of molecules = (142 g / 71g) × 6.022×10^{23}
    = $2 \times 6.022 \times 10^{23}$
14. 2.3 g of Na < 80 g of Ca < 120 g of Mg
15.

a. 264 g of CO_2	276 g of NO_2

    b. $6 \times 6.022 \times 10^{23}$

16. a.

Pressure	Volume
1 atm	80 L
2 atm	40 L
4atm	20 L
8atm	10 L

    b. Statement of Boyle's Law

Unit 3

REACTIVITY SERIES AND ELECTRO CHEMISTRY

Ability to participate in a chemical reaction for each and every metal is different. Electro chemical series is based on this difference in reactivity of metals. Metals having low reactivity are displaced from their salt solution by metals of high reactivity. This reaction is called displacement reaction. These reactions invlove electron movement and there by production or utilization of electrical energy as in the galvanic cell and electrolytic cell. Galvanic cell converts chemical energy to electrical energy and electrolytic cell converts electrical energy to chemical energy. In this chapter we discuss about the chemistry behind these.

At a glance

- Metals react with air, water and acid in completely different manner.
- Metals are arranged in the reactivity series based on their ability to react.
- Displacement reaction - Metals with low reactivity are displaced from their salt solution by metals of high reactivity.
- Oxidation and reduction takes place in displacement reaction.
- Oxidation is the loss of electron
- Reduction is the gain of electron
- In Redox reaction oxidation and reduction takes place simultaneously.

Activity 1

(a) Same quantity of sodium, magnesium and copper are given. Complete the following table on the basis of their reaction with same amount of cold and hot water taken in different test tubes.

Metal	Cold water	Hot water
Sodium		
Magnesium		
Copper		

b) Which metal reacts vigorously?

c) Which gas is formed in this reaction?

d) Write the Chemical equations of these reactions?

e) Arrange these metals in the increasing order of their reactivity with water.

Activity 2

(i) A fresh Magnesium ribbon losing it's luster when kept exposed in air for some days. Why ?

(ii) Write down the balanced Chemical equation of this reaction.

Activity 3

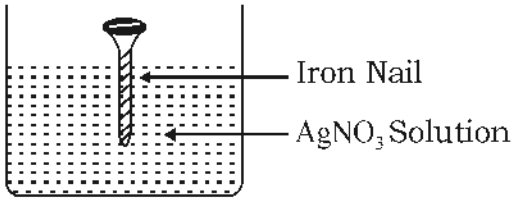
Read the hints carefully

- Freshly cut metallic surfaces have a shiny appearance. This property is called metallic luster.
- The luster of a freshly cut Sodium loses immediately.
- Luster of Aluminium vessels diminishes after a long time.
- The shiny appearance of gold doesn't fade even after a long time.

(a) Why metals lose luster?

(b) Arrange these metals in the decreasing order of reactivity with atmospheric air.

Activity 4



a. Write the changes on the surface of the iron nail

b. Complete the chemical equation

$Fe + 2AgNO_3 \rightarrow Fe(NO_3)_2 +$ _____

c. In which metal does oxidation take place?

d. Name the metal ion which undergoes reduction.

e. Write the equation for oxidation.

f. Write the equation for reduction.

Activity 5

Some metals are placed in metallic salt solutions (Reactivity of metals $Zn > Fe > Cu > Ag$)

Metal / Salt solution	Zn	Fe	Ag
Zinc Sulphate ($ZnSO_4$)			
Copper sulphate ($CuSO_4$)			
Silver nitrate ($AgNO_3$)			

a. Put '✓' mark where displacement reaction takes place and '×' mark where it doesn't?

b. Write the chemical equation in which the displacement reaction takes place?

Activity 6

Complete the table by choosing suitable equation from the following.

- $Zn \rightarrow Zn^{2+} + 2\bar{e}$
- $Cu \rightarrow Cu^{2+} + 2\bar{e}$
- $Zn^{2+} + 2\bar{e} \rightarrow Zn$
- $Cu^{2+} + 2\bar{e} \rightarrow Cu$
- $Fe \rightarrow Fe^{2-} + 2\bar{e}$
- $Ag \rightarrow Ag^{+} + 1\bar{e}$
- $Fe^{2+} + 2\bar{e} \rightarrow Fe$
- $Ag^{+} + 1\bar{e} \rightarrow Ag$

Reaction	Oxidation	Reduction
$Zn + CuSO_4$	$Zn \rightarrow Zn^{2+} + 2e$	A
$Zn + AgNo_3$	B	C
$Fe + CuSO_4$	D	$Cu^{2-} + 2\bar{e} \rightarrow Cu$

Answer Key

Activity 1

(a)

Metal	Cold water	Hot water
Sodium	Reacts vigorously	
Magnesium	No reaction	Reacts
Copper	No reaction	No reaction

(b) Sodium

(c) Hydrogen

(d) $2Na + 2H_2O \rightarrow 2NaOH + H_2$

$Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$

(e) Copper < Magnesium< Sodium

Activity 2

a) This is due to the reaction of Magnesium with atmospheric air.

b) $2Mg + O_2 \rightarrow 2MgO$

Activity 3

(a) Because of reaction with atmospheric air.

(b) Na>Al>Au.

Activity 4

a. Deposits silver

b. 2 Ag

c. Fe

d. Ag^-

e. $Fe \rightarrow Fe^{2+} + 2\bar{e}$

f. $Ag^+ + 1\bar{e} \rightarrow Ag$

Activity 5

a)

Metal	Zn	Fe	Ag
Zinc sulphate	×	×	×
Copper sulphate	✓	✓	×
Silver sulphate	✓	✓	×

b) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

$Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag$

$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

$Fe + 2AgNO_3 \rightarrow Fe(NO_3)_2 + 2Ag$

Activity 6

$A - Cu^{2-} + 2\bar{e} \rightarrow Cu$

$B - Zn \rightarrow Zn^{2} + 2\bar{e}$

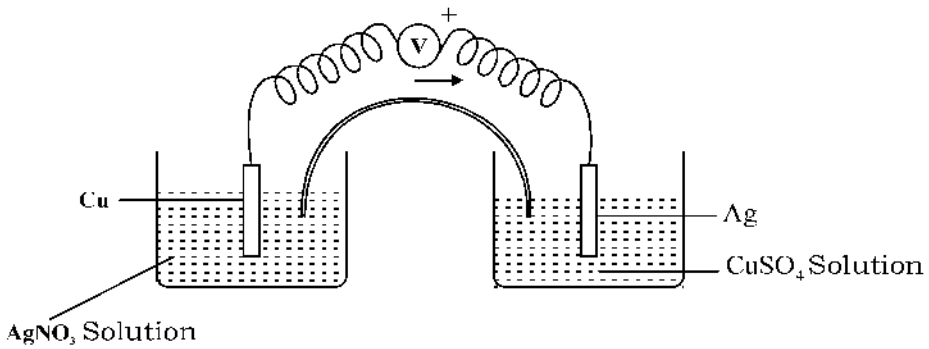
$C - Ag^{-} + 1\bar{e} \rightarrow Ag$

$D - Fe \rightarrow Fe^{2+} + 2\bar{e}$

At a glance

- The device used for the conversion of chemical energy to electrical energy through redox reaction is called Galvanic cell or Voltaic cell.
- Oxidation occurs at anode and reduction at cathode.

Activity 7



a. Illustrate the cell in the correct manner

b. Label anode and cathode

c. Write the chemical equation of the process at anode?

d. Write the chemical equation of the process at cathode?

e. Write the equation of the redox reaction?

Activity 8

a. Draw the picture of a galvanic cell using the following substances Also label the anode and cathode ($AgNO_3$ solution, $MgSO_4$ solution, $CuSO_4$ solution, Ag rod, Fe rod, Mg rod)

b. Write the chemical equation at anode and cathode of this cell.

Activity 9

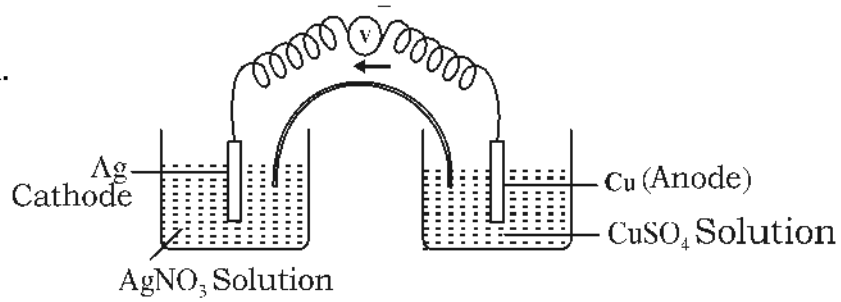
Complete the table

Cell	Anode	Cathode	Chemical reaction		
			Anode	Cathode	Redox Reaction
Fe - Cu	Fe	.....A.....	$Fe \rightarrow Fe^{2-} + 2\bar{e}$	.....B.....	....H....
Cu - Ag	C	Ag	.....D.....	$2Ag^{+} + 2\bar{e} \rightarrow 2Ag$	.....I.....
Mg-Ag	Mg	.....E.....	.....F.....	.....G.....	$Mg + 2Ag^{+} \rightarrow Mg^{2+} + 2Ag$

Answer Key

Activity 7

a.



b. Cathode (Ag), Anode (Cu)

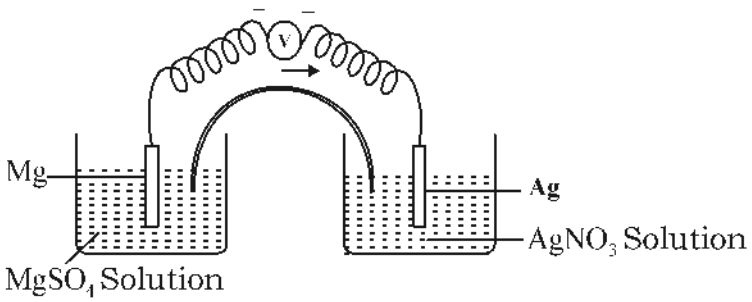
c. $Cu \rightarrow Cu^{2+} + 2\bar{e}$

d. $2Ag^{1} + 2\bar{e} \rightarrow 2Ag$

e. $Cu + 2Ag^{+} \rightarrow Cu^{2+} + 2Ag$

Activity 8

a)



b) $Mg \rightarrow Mg^{2+} + 2\bar{e}$ (Anode)

c) $2Ag^{+} + 2\bar{e} \rightarrow 2Ag$ (Cathode)

Activity 9

$A - Cu$

$B - Cu^{2+} + 2\bar{e} \rightarrow Cu$

$C - Cu$

$D - Cu \rightarrow Cu^{2} + 2\bar{e}$

$E - Ag$

$F - Mg \rightarrow Mg^{2+} + 2\bar{e}$

$G - 2Ag^{+} + 2\bar{e} \rightarrow 2Ag$

H - $Fe + Cu^{2|} \rightarrow Fe^{2|} + Cu$

$I - Cu + 2Ag^{|} \rightarrow Cu^{2|} + 2Ag$

At a Glance

- Electrolytes are substances which conduct electricity in molten state or in aqueous solutions and undergo a chemical reaction.

- Electrolytic cell is a device which converts electrical energy to chemical energy.

Activity 10

Molten Sodium Chloride undergoes electrolysis

a. What is the product at anode?

b. What is the product at cathode?

c. Sodium Chloride at solid state does not conduct electricity, Why?

Activity 11

Complete the table

Molten Sodium Chloride	Cathode	E	Na
	Anode	F	G
Sodium Chloride solution	Cathode	$2H_2O + 2\bar{e} \rightarrow H_2 + 2(OH)^-$	H
	Anode	I	Cl_2

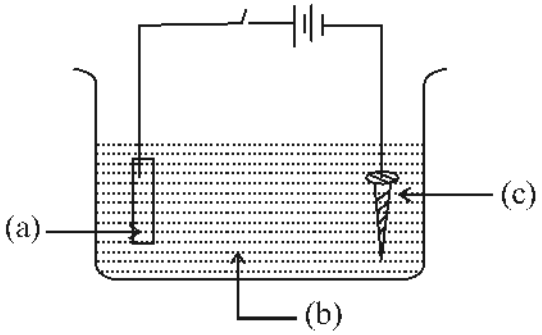
Activity 12

NaCl solution undergoes electrolysis

- Specify the reason why hydrogen evolves at cathode?

Activity 13

a) Write a, b & c in the picture which shows electroplating of Copper on an Iron nail.



b) Which reaction takes place at cathode? Write the chemical equation.

c) Complete the chemical equation of the reaction at anode.

$Cu \rightarrow ..... + 2\bar{e}$

What is the name of this reaction?

Activity 14

a) Silver rods and silver cyanide solution are given. Draw the picture of electroplating of silver on copper vessel.

b) Write down the chemical equations of the reactions at anode and cathode. (Oxidation state of silver (Ag) is +1)

Activity 15

List out the practical utility of electrolysis

Answer Key

Activity 10

a) Cl_2

b) Na

c) ions have no freedom of movement

Activity 11

$E \rightarrow Na^{1} + 1e \rightarrow Na$

$F \rightarrow 2Cl^{-} \rightarrow Cl_2 + 2\bar{e}$

$G \rightarrow Cl_2$

$H \rightarrow H_2$

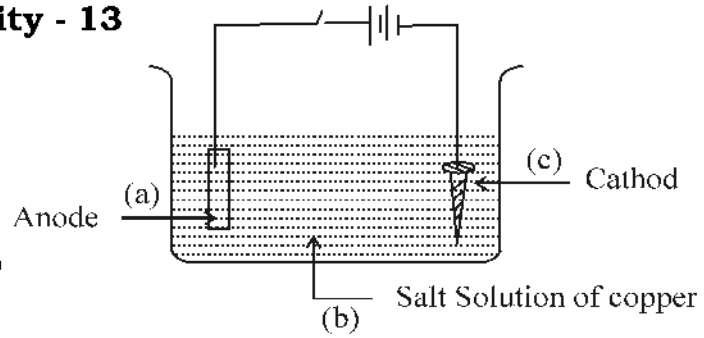
$I \rightarrow 2Cl^{-} \rightarrow Cl_2 + 2\bar{e}$

Activity - 12

Reducing tendency of H_2O is greater than Na^{1} ion

Activity - 13

a)



b) Reduction of Cu^{2+} ions.

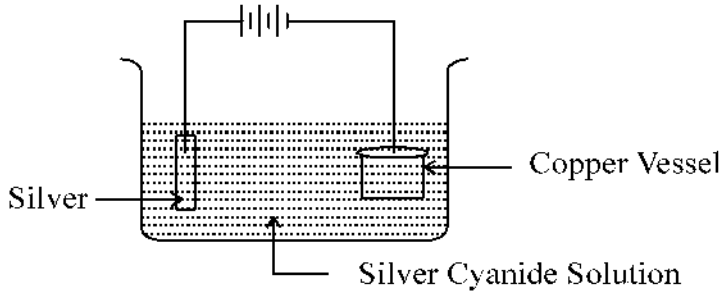
$Cu^{2} + 2\bar{e} \rightarrow Cu$

c) $Cu \rightarrow Cu^{2+} + 2\bar{e}$

Oxidation of copper

Activity 14

a)



b) Anode

$Ag \rightarrow Ag^{1} + 1\bar{e}$

Cathode

$Ag^{+} + 1\bar{e} \rightarrow Ag$

Activity 15

Production of metals
Production of nonmetals
Production of compounds
Refining of metals
Electroplating

UNIT TEST

Marks : 20 Time : 40 mts

(Answer all questions from 1 to 5) (5 × 1)

1. Which of the following metals cannot displace copper from copper sulphate solution ?

   Fe, Ag, Zn, Mg

2. Write the reaction which takes place at anode in Cu- Ag- Cell

   a) $Cu \rightarrow Cu^{2+} + 2\bar{e}$ b) $Cu^{2+} + 2\bar{e} \rightarrow Cu$

   c) $Ag \rightarrow Ag + 1\bar{e}$ d) $Ag^{+} + 1\bar{e} \rightarrow Ag$

3. Which of the following metals liberate H_2 While reacting with hot water?

   a. Silver b. Iron c. Magnesium d. Copper

4. Which of these elements is produced at cathode when sodium chloride solution is electrolysed?

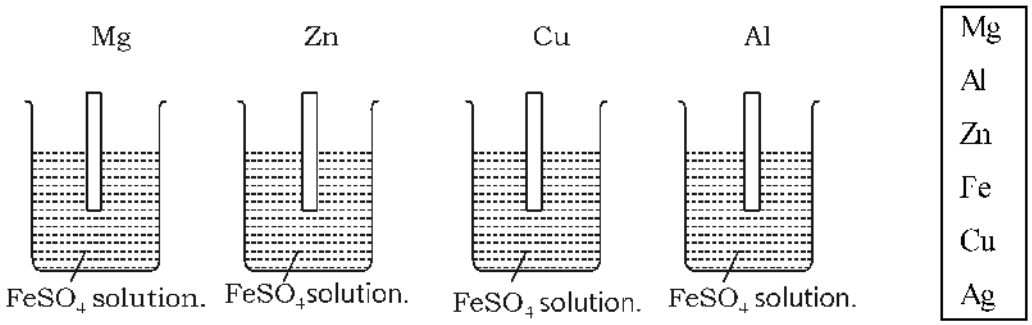
   a. sodium b. chlorin c. Oxygen d.Hydrogen

5. Which metal cannot displace Hydrogen from dil HCl?

   Pb, Cu, Sn, Ni

Answer any 4 questions from 6-10. (4×2 = 8)

6. Some metals in the reactivity series are given in the box. Observe the figure and answer the questions.

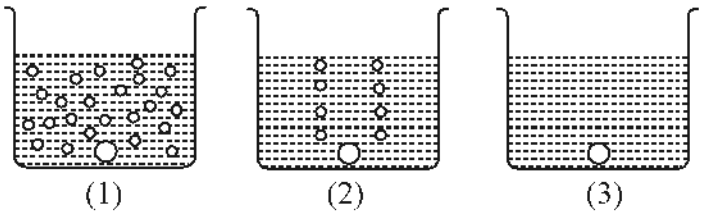


   a) Which metals can displace Fe from these solutions?

   b) Which metals cannot displace Fe from these solutions? Why?

7. Write the chemical equation taking place at anode and cathode when molten sodium chloride get electrolysed?

8. Following illustrations show the reaction of Fe, Cu and Mg with dil HCl



   a) Name the metal in the beaker that does not undergo any chemical reaction?

   b) Which is the metal in the first figure?

9. Write any two situations where electrolysis is useful in day to day life?

10. Classify the following as oxidation and reduction.

a) $Fe \rightarrow Fe^{2+} + 2\bar{e}$ b) $Fe^{2-} + 2\bar{e} \rightarrow Fe$

c) $Mg \rightarrow Mg^{2+} + 2\bar{e}$ d) $Mg^{2+} + 2\bar{e} \rightarrow Mg$

Answer any 4 questions from 11 - 15 (4×3 =12)

11. Take equal quanitity of Na, Mg, Zn, Cu, Fe and put it in cold water.
    a) Which metal rects with cold water?
    b) What do you observe if a drop of phenol phthalin is added to this solution? Write the reason.

12. Imagine Zn rod is dipped in $FeSO_4$ solution
    (i) Which of the following is correct?

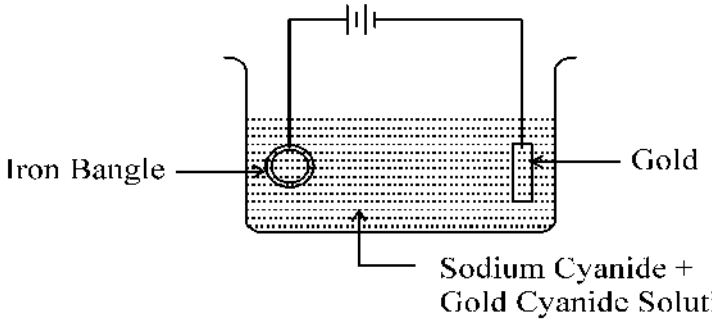
    a) $Fe \rightarrow Fe^{21} + 2\bar{e}$

    b) $Zn \rightarrow Zn^{21} + 2\bar{e}$ c) $Zn^{21} + 2\bar{e} \rightarrow Zn$

    (ii) Write the equation of redox reaction.

13. Some salt solutions and metal rods are given below.
    Salt soutions - Mg SO_4, $CuSO_4$, $AgNO_3$, NaC*l*
    Metal rods - Zn, Pt, Mg, Ag, A*l*
    a) Draw the picture of an electro chemical cell by using suitable requirements.
    b) Label anode and cathode
    (Reactivity $Na > Mg > Cu > Ag$)

14. a) The given picture shows electroplating of gold on an iron bangle. Correct if there are errors. (Oxidation state of gold (Au) is + 3)



b) Write the chemical equations of reactions at anode and cathode.

15. a) Write the chemical equations related to the reactions at a rode and cathode when an aqueous solution of sodium chloride undergoes electrolysis.

b) Sodium chloide in the solid state doesn't conduct electricity. Why?

Answer Key

1. Ag
2. $Cu \rightarrow Cu^{2+} + 2\bar{e}$
3. Magnesium
4. Hydrogen
5. Cu
6. a) Mg, Zn, Al

   b) Cu, Reactivity is less than Fe
7. Anode $2Cl^{-} \rightarrow Cl_2 + 2\bar{e}$

   Cathode $Na^{1} + 1\bar{e} \rightarrow Na$
8. a) Cu

   b) Mg
9. a) Production of metals and nonmetals

   b) Electroplating
10. a, c - Oxidation

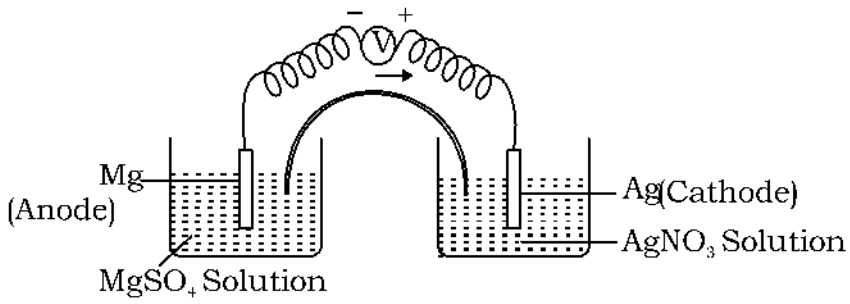
    b, d - reduction
11. a) Na

    b) Solution turns pink colour.

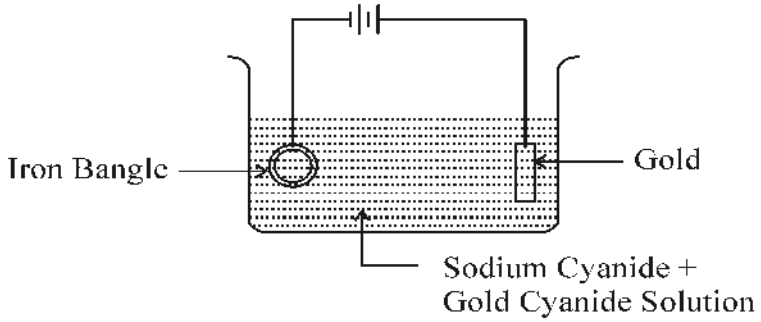
    Na OH (Alkali) formed
12. (i) b

    (ii) $Zn + Fe^{2+} \rightarrow Fe + Zn^{2+}$

13.



14. a)



b) Anode

c) $Au \rightarrow Au^{3+} + 3\bar{e}$

Cathode

c) $Au^{3+} + 3\bar{e} \rightarrow Au$

15. a) Anode

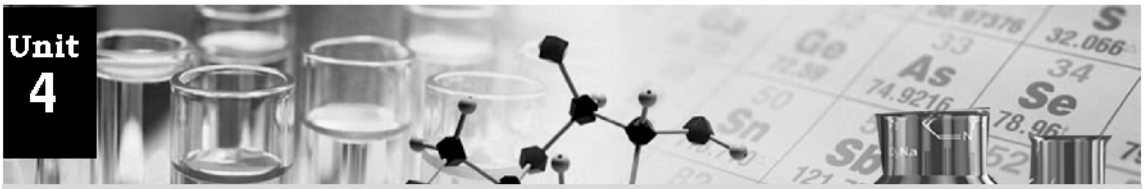
$2Cl \rightarrow Cl_2 + 2e$

Cathode

$2H_2O + 2\bar{e} \rightarrow H_2 + 2O\bar{H}$

b) Absence of freely moving ions.

Unit 4

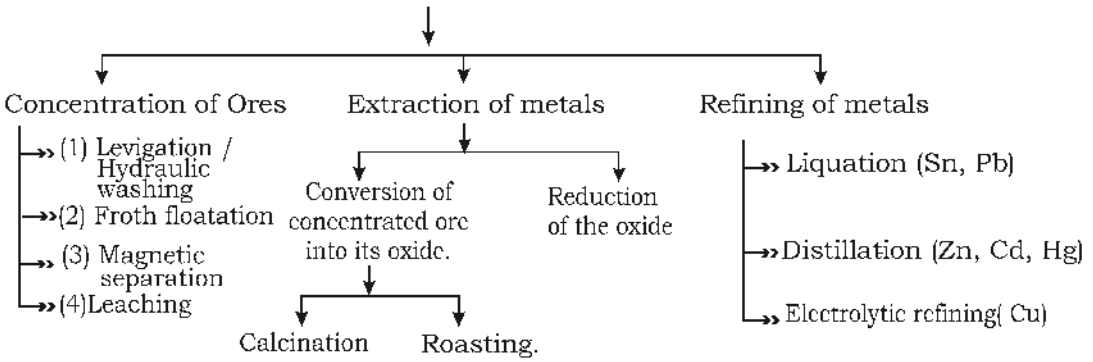


PRODUCTION OF METALS

Discovery of metals is very significant in the scientific development. Some metals are found free in nature. But majority of metals are extracted from the ores. Extraction of metals from it's ore, refining of the metals, manufacture of Iron and Aluminium are the main concepts in this chapter.

At a Glance

- Mineral, Ore
- Production of metals - Important steps



Activity 1

Some metals and ores are given. Pair them suitably.

Metals	Iron, Zinc, Aluminium, Copper
Ores	Cuprite, Bauxite, Magnetite, Calamine

Activity 2

Nature of certain ores and impurities are given below. Select the appropriate method of concentration of ores from the bracket

(Froth floatation, Leaching, Levigation, Magnetic separation)

(i) Either the ore or the impurity is magnetic in nature

(ii) Density of ore is greater than the impurity

(iii) Ore is soluble in appropriate solution

(iv) Density of impurity is higher than the ore.

Activity 3

Classify the following minerals as in the table.

Cu_2S, $ZnCO_3$, $Cu(OH)_2$, $CuFeS_2$

Minerals to be subjected to

Calcination	**Roasting**

Activity 4

Complete the table.

Method of separation	**Metal**
(i) Found in free state in nature	Gold, Silver
(ii) Metals separated by the electrolysis of molten ore	.....
(iii)	Iron, Zinc

Activity 5

In calcination and roasting the ores are to be heated below their melting points. Give reason.

Activity 6

Some metals are given below. Complete the table.

Metals	**Method of refining**
(i) Mercury	
(ii). Copper	
(iii). Tin	
(iv) Zinc	
(v) Lead	

Activity 7

The minerals of Aluminium are Bauxite and Clay

(a) Which is the ore of Aluminium?

(b) Write any two characteristics of an ore?

Activity 8

(a) Reducing agents are required for the extraction of metals from the ores. Why?

(b) Name two metals extracted using Carbon/ Carbon monoxide as reducing agent?

Activity 9

Which properties of metals are used in the following situations.

(a) Aluminium is used in making utensils for cooking.

(b) Copper is used in making electric wires.

(c) Gold is used in ornaments.

Activity 10

The method of separating iron tungstate from tin stone is ——

(froth flotation,Levigation, Magnetic separation, leaching)

Activity 11

Name the reducing agenet used in extracting potassium, a reactive metal, from its ore. (Electricity, Carbon, Carbon monoxide)

Activity 12

The ores of Zinc are Zinc Blende and Calamine. The chemical equations relating to the extraction are given below.

$2\ ZnS + 3O_2 \xrightarrow{Heat} 2\ ZnO + 2SO_2$

$ZnCO_3 \xrightarrow{Heat} ZnO + CO_2$

(a) Which chemical equation represents the process "roasting"?

(b)How calcination differs from roasting?

Activity 13

Some metals are given in the box.

Fe, Zn, Na, Au

(a) Arrange these metals in the order of decreasing reactivity.

(b) Which metal is extracted using electricity as the reducing agent?

(c) Which among these is seen free in nature?

(d) Name the metal which form the most stable compounds.

Activity 14

(a) Electrolysis is used for refining of copper. A small piece of pure metal is used as the negative electrode, impure copper as the positive electrode and Copper Sulphate solution as electrolyte. Draw the picture shows this process.

(b) Complete the table related to this process

Electrode	Chemical equations
Anode	
Cathode	

Activity 15

Some substances for refining of Copper by electrolysis are given. Arrange them suitably and complete the table. (Pure Copper, Impure Copper, Copper Sulphate solution)

Anode	
Cathode	
Electrolyte	
Equation of the reaction at anode	
Equation of the reaction at cathode	

ANSWER KEY

1. Iron : Magnetite
   Zinc : Calamine
   Aluminium : Bauxite.
   Copper : Cuprite.
2. (i) Magnetic separation (ii) Levigation / Hydraulic washing
   (iii) Leaching (iv) Froth floatation
3. Calcination - $ZnCO_3$, $Cu(OH)_2$
   Roasting - Cu_2S, $CuFeS_2$
4. (ii) Al, Na ii) Reducing metallic oxides using C/CO

5. a) Calcination – Above the melting point, metallic compounds melt and may undergo chemical reactions

   b) Roasting - Prevents ore from melting and also prevents the formation of compounds which could not be reduced.

6. Liquation - Tin, Lead

   Distillation - Zinc, Mercury

   Electrolytic refining - Copper

7 (a) Bauxite

   (b) * Abundance * Easily and cheaply separable * High metal content

8 (a) Metal ores are convered into its oxide in metallurgy. So a reducing agent is needed for the removal of oxygen from the oxide.

   (b) Fe, Zn

9. (a) High Thermal Conductivity

   (b) High electrical conductivity

   (c) High maleability of gold, lustere, low chemical reactivity

10. Magnetic separation

11. Electricity

12. (a) $2\ ZnS + 3O_2 \xrightarrow{heats} 2\ ZnO + 2SO_2$

   (b) Calcination - Heating in the absence of air

   Roasting - Heating in the presence of air.

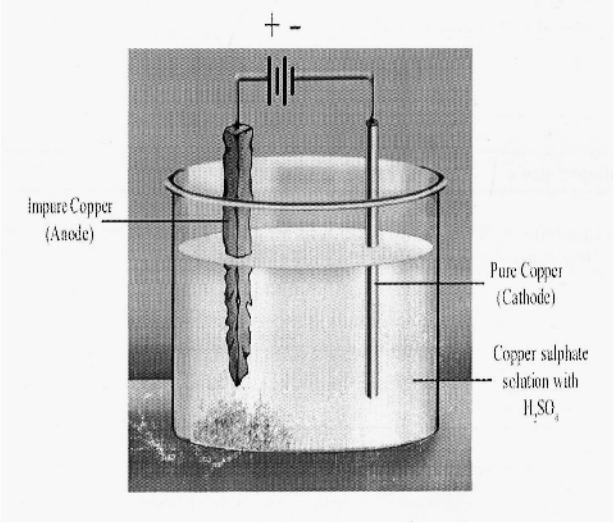
13. a. Na > Zn > Fe > Au

   b. Na

   c. Au

   d. Na

14. (a)



b)

Electrode	Chemical equations
Anode	$Cu \rightarrow Cu^{2-} + 2\bar{e}$
Cathode	$Cu^{2+} + 2\bar{e} \rightarrow Cu$

15.

Anode	Impure Copper
Cathode	Pure Copper
Electrolyte	$CuSO_4$ solution
Equation of the reaction at anode	Oxidatin of Copper $Cu \rightarrow Cu^{2+} + 2\bar{e}$
Equation of the reaction at cathode	Reduction of Cu^{2+} $Cu^{2} + 2\bar{e} \rightarrow Cu$

At a Glance

Manufacture of Iron - Blast Furnace

(i) Haematite, Coke, Limestone

$C + O_2 \rightarrow CO_2$

$CO_2 + C \rightarrow 2CO$

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

(ii) Role of Limestone

$CaCO_3 \rightarrow CaO + CO_2$
(flux)

$CaO + SiO_2 \rightarrow CaSiO_3$
(flux) (gangue) (Slag)

(iii) Pig iron. : By cooling molten iron from Blast furnace

❖ Separation of Aluminium from Alumina _ Hall - Heroult Process.

(i) Concentration of Bauxite (Al_2O_3 $2H_2O$) - Leaching using NaOH (Preparation of Alumina (Al_2O_3) from Bauxite).

(ii) Separation of Aluminium from Alumina - Electrolysis

Cathode - Steel tank with carbon lining

Anode - Carbon Rods.

Electrolyte - Pure Alumina dissolved in molten cryolite.

Reaction at cathode – $Al^{3-} + 3e \rightarrow Al$

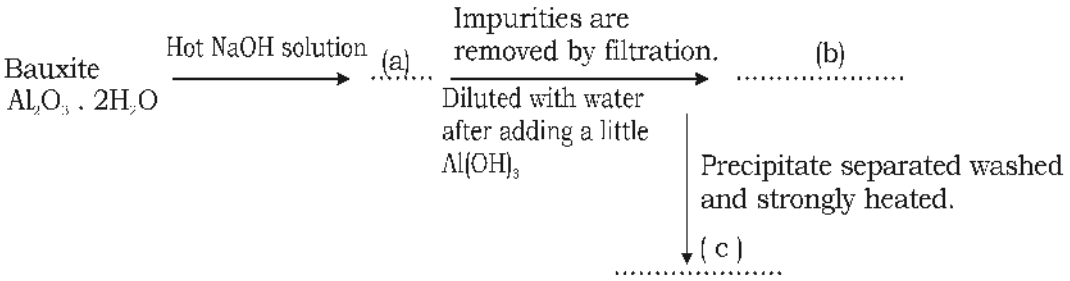
Anode _ $2O^{2-} - 4e \rightarrow O_2$

$C + O_2 \rightarrow CO_2$

(Due to this reaction anode is to be replaced from time to time.)

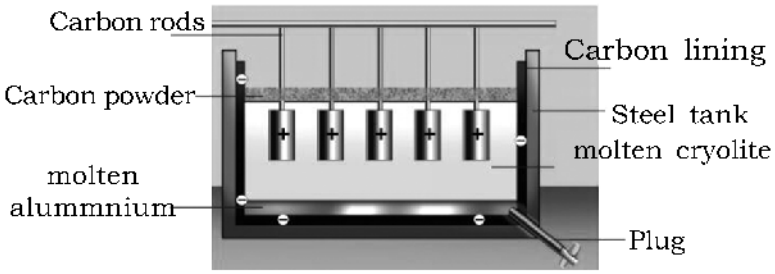
Activity 16

Flow chart of concentration of bauxite is given. Complete the chart.



Activity 17

The figure showing the extraction of Aluminium from Alumina is given.



(a) Name the reducing agent used in extacting Aluminium?
(b) What is the role of cryolite in the electrolyte.
(c) Give the chemical equation taking place at the cathode?
(d) What is the need of replacing anode at regular intervals

Activity 18

Reducing agents are used in separating metals from ores. Name the reducing agents used in obtaining the given metals.

Process / Metal	Reducing agent
(i) Sodium from molten Sodium Chloride	
(ii) Iron from Haematite	

Activity 19

(a) Three alloys of iron, their constituents and uses are given in table. Arrange them correctly

Alloy	Constituents	Use
Alnico	Fe, C	Heating coil
Nichrome	Al, Ni, Co, Fe	Agricultural purpose
Steel	Fe, C, Cr, Ni	making Permanent magnet

(b) Which characterestic of Nichrome is used for the selected purpose?

Activity 20

Analyse the following reactions taking place in the blast furnace and answer the questions.

$CaCO_3 \rightarrow CaO + CO_2$ $\quad\quad$ $C + O_2 \rightarrow CO_2$

$CO_2 + C \rightarrow 2CO$ $\quad\quad$ $Fe_2O_3 + 3\,CO \rightarrow 2Fe + 3CO_2$

$CaO + SiO_2 \rightarrow CaSiO_3$

(a) Write the chemical formula of iron ore?
(b) Name the reducing agent used in the process.
(c) Identity the gangue and flux in this process.
(d) Write the chemical equation of slag formation.

Activity 21

Alnico is an alloy of Aluminium. Write the use of Alnico.

Activity 22

Complete the table related to the production of iron.

Gangue	
Flux	
Slag	
Equation of formation of slag	

Answer Key

16.a) Sodium Aluminate / $NaAlO_2$
b) $Al(OH)_3$ / Aluminium hydroxide.
c) Al_2O_3 / Aluminium oxide / Alumina

17.a) Electricity
b) Lower the melting point and increase the electrical conductivity.
c) $Al^{3+} + 3e \rightarrow Al$
d) Oxygen liberates from anode reacts with carbon.

18.i.) Electricity (ii) Carbon monoxide

19.a) Classifies accordingly
b) High electrical resistance.

20.a) Fe_2O_3 b) CO c) SiO_2, CaO (Gangue, Flux) d) $CaO + SiO_2 \rightarrow CaSiO_3$

21.For making Permanent magnets

22.

Gangue	SiO_2
Flux	CaO
Slag	$CaSiO_3$
Equation of formation of slag	$CaO + SiO_2 \rightarrow CaSiO_3$

UNIT TEST

Score : 20
Time : 40mts.

Questions 1– 6. Answer any four (1mark each)

1. From the following which is used as the flux when CaO is the gangue (FeO, SiO_2, Na_2O)
2. Identify the relation and complete.
   Cuprous Sulphide : Roasting
   Zinc Carbonate : ————
4. Why iron pyretis a mineral of iron known as fool's gold?
3. The reducing agent used in the extraction of iron is ————
5. Write the chemical formula of bauxite, the ore of Aluminium.
6. Select the method used in the refining of copper from the bracket. (Distillation, Electrolysis, Liquation)

Questions 7 – 13. Answer any five (2 marks each)

7. Write suitable methods for the concentration of following ores.
   (a) Copper Pyrites.
   (b) Ore of gold
   (c) Magnetite
   (d) Bauxite
8. Electrolytic process is used in the extraction of Aluminium from alumina
   (a) Why cryolite added to the electrolyte?
   (b) Write the chemical equation at the cathode.
9. Haematite, coke and limestone are used for the production of pig iron in blast furnace. What are the functions of limestone and coke?
10. Reactivity order of some metals are given. Analyse and answer the questions.

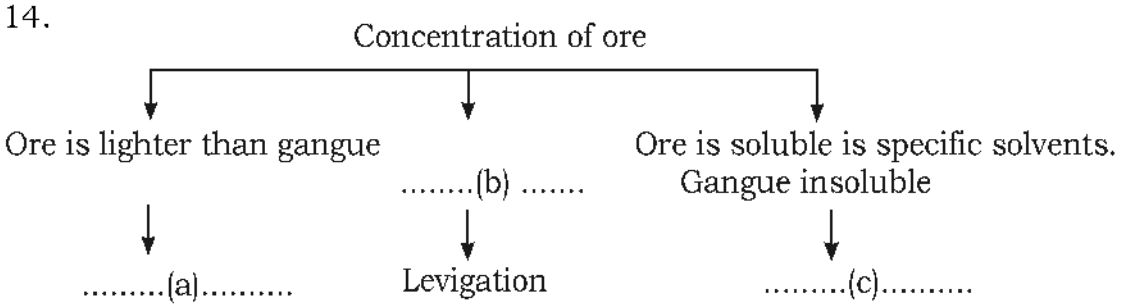
    Al > Fe > Cu > Au

    (a) Metal found free in nature.
    (b) Metal extracted by electrolytic process.
11. Minerals of aluminium are bauxite and clay. But aluminium is not extracted from clay. Give two reasons.
12. Reducing agents are necessary to extract a metal from its ore. Which reducing agent is used to extract sodium from sodium chloride. Why?
13. Complete the table.

Alloy	Characterestics	Use.
.....(a)	Magnetic property	Making permanent magnets
Nichrome	.....(b).....	Making heating coil

Questions 14-16. Answer any two (3 marks each)

14.



15. (a) List of some metals are given. Arrange them according to the method of refining in the given table. (Zinc, Tin, Copper, Cadmium)

Liquation	Distillation	Electrolysis

(b). Why are the selected methods used in refining Zinc and Tin?

16. a) Write the chemical equations in blast furnace relating to the role of limestone.

b) What are the constituents in stainless steel?

ANSWER KEY

1. SiO_2
2. Calcination
3. Carbon monoxide (CO)
4. Iron pyrites has a yellow brazen colour which resembles gold.
5. $Al_2O_3 . 2H_2O$
6. Electrolysis
7. a. Froth flotation process

   b. Hydrolic washing (levigation)

c. Magnetic Seperation or Hydrolic washing

d. Leeching

8. a. To decrease the melting point and to increase the electrical conductivity.

   b. $Al^{3+} + 3e^- \rightarrow Al$

9. **Limestone**

   To produce the flux CaO

   $CaCO_3 \rightarrow CaO + CO_2$

   Coke

   To produce the reducing ageat CO

   $C + O_2 \rightarrow CO_2$

   $CO_2 + C \rightarrow 2CO$

   $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

10. a. Au

    b. Al

11. Extraction of Al from clay is very difficult and costly.

    The content of Al in clay is very low

12. Electricity. Na is highly reactive. So strong reducing agents like electricity is needed for the reduction.

13. a. Alnico

    b. High restivity

14. a. Froth flotation process

    b. Ore is dencer than gangue

    c. Leaching

15. a.

Liquation	Distillation	Electrolysis
Tin	Zinc Cadmium	Copper

    b. Zn has low boiling point

    Sn is a metal with low melting point

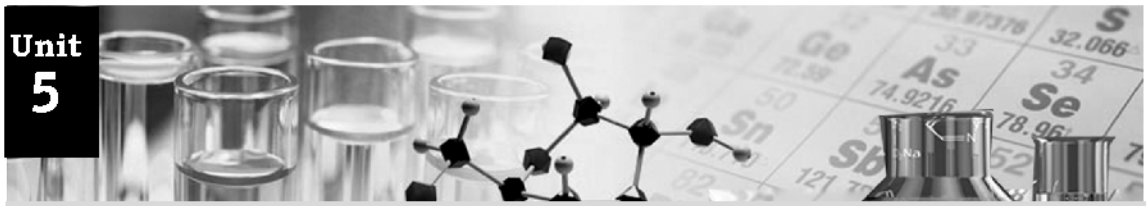
16. a. $CaCO_3 \rightarrow CaO + CO_2$

    $CaO + SiO_2 \rightarrow CaSiO_3$

    Flux gangue Slag

    b. Ni, Cr, Fe, C

Unit 5



COMPOUNDS OF NON-METALS

Ammonia and sulphuric acid are the chemicals have utmost important in the agricultural and industrial sector. Here we are familiar with the methods of production and properties of these compounds.

At a glance

- Ammonium chloride and calcium hydroxide are used in the laboratory to prepare ammonia
- Ammonia is basic in nature
- Solubility of ammonia in water in very high
- A highly concentrated aqueous solution of Ammonia - liquor Ammonia
- Ammonia gas can be liquified by applying pressure - liquid Ammonia

Activity 1

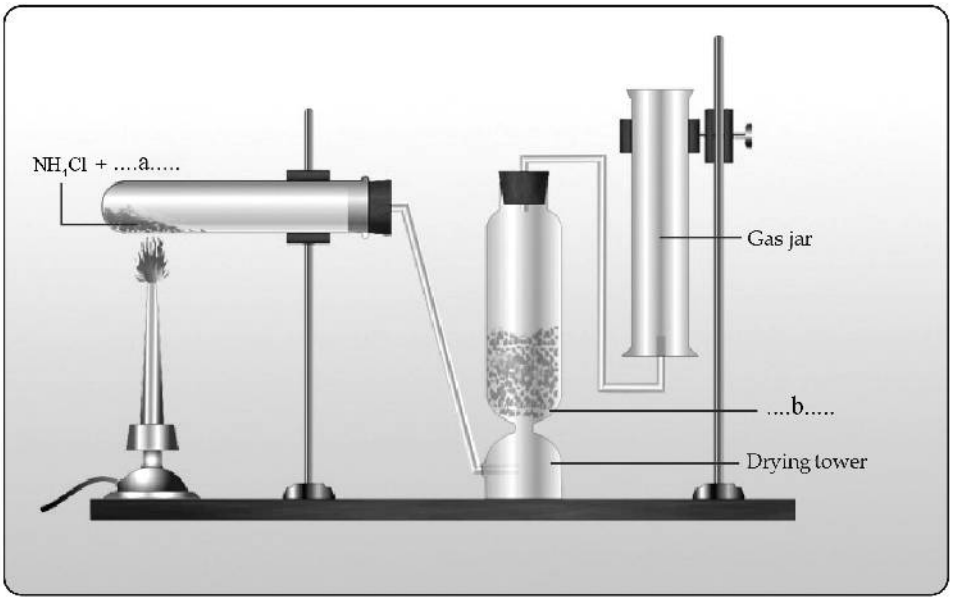
Take a little NH_4Cl in a watch glass, add a little $Ca(OH)_2$ to it and stir well .

1) Write the change happened when a wet red litmus paper show over the watch glass?

2) Write the reason behind this?

Activity 2

Look at the figure showing the preparation of Ammonia in the laboratory.



1) Find a and b

2) Complete the chemical reaction

$2NH_4Cl + \underline{\quad(a)\quad} \rightarrow CaCl_2 + 2NH_3 + \underline{\quad(c)\quad}$

3) Why did ammonia gas pass through a drying tower?

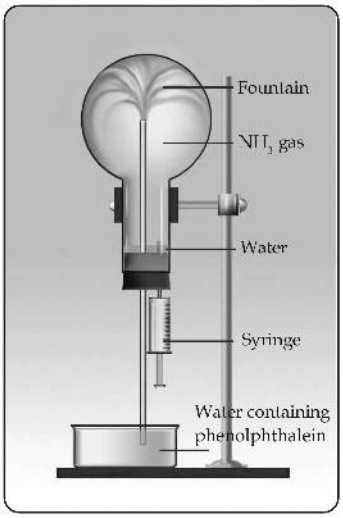
4. The gas jar used for collecting Ammonia is kept inverted why ?

Activity 3

i) Which property of ammonia shown through the experiment?

ii) Why does water entering the flask changes its colour?

ii) $NH_3 + H_2O \rightarrow$ .....



Activity 4

When an Ammonia tanker leaks, water is sprayed. What is the reason?

Activity 5

Write the difference between liquor Ammonia and liquid ammonia

Activity 6

Write any two uses of Ammonia?

At a Glance

Chemical reactions

↓

Irreversible reaction	Reversible reaction
(Chemical reactions in which reactants give products but the product do not give back the reactants under the same conditions)	(Reactions taking place in both directions In a reversible reaction the reaction in which the reactants change to the product is called forward reactions and that in which the products change back into the reactants is called the backward reaction.)
Eg: $C + O_2 \rightarrow CO_2$	Eg: $N_2 + 3H_2 \rightleftharpoons 2NH_3$

Reversible Reaction

$(N_2 + 3H_2 \rightleftharpoons 2\ NH_3)$

Forward reaction	Backward reaction
↓	↓
Reactants change to products	Products change back to reactants
$N_2 + 3H_2 \rightarrow 2NH_3$	$2NH_3 \rightarrow N_2 + 3H_2$

Chemical equilibrium

It is the change at which the rate of forward reaction becomes equal to the rate of backward reaction in a reversible reaction.

Le - Chateliers principle

When the concentration, pressure or temperature of a system at equilibrium is changed,the system will readjust itself so as to nullify the effect of that change and attain a new state of equilibrium.

Activity 7

⇨ Heat NH_4Cl in a boiling tube. Place a wet red litmus paper at the mouth of the test tube.

a) What change happens to the litmus paper ?

b) Which gas is responsible for this change? why ?

c) If the litmus paper is placed for a long time what will happen to the litmus paper ?

d) What is the reason for the change?

e) What can be inferred about the density of the gases formed from this experiment ?

f) Which is the white substance deposited at the side of the boiling tube ?

g) How is this substance formed ?

h) On the basis of this experiment choose the type of chemical reaction taking place here (Irreversible/ reversible)

i) Write the balanced equation of the chemical reaction.

Activity 8

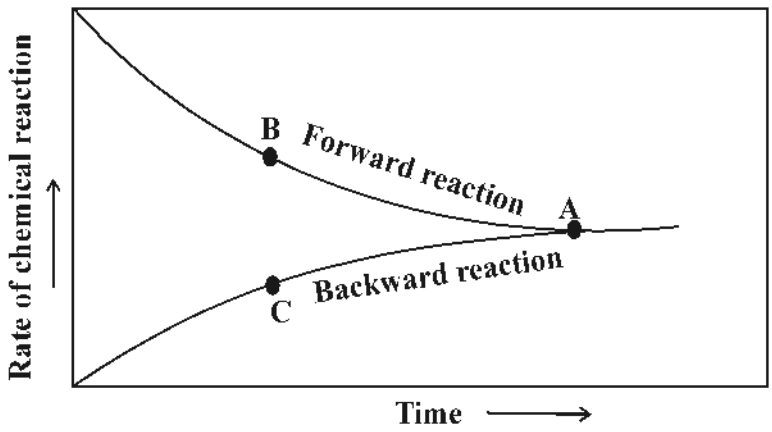
A reversible reaction is given below. Write the equation of forward and backward reaction

$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

..... Forward reaction

..... Backward reaction

Activity 9



a) What happens to the speed of forward reaction during the course of the reaction?

b) What about the speed of backward reaction?

c) At which point does the speed of forward and backward reaction become equal?

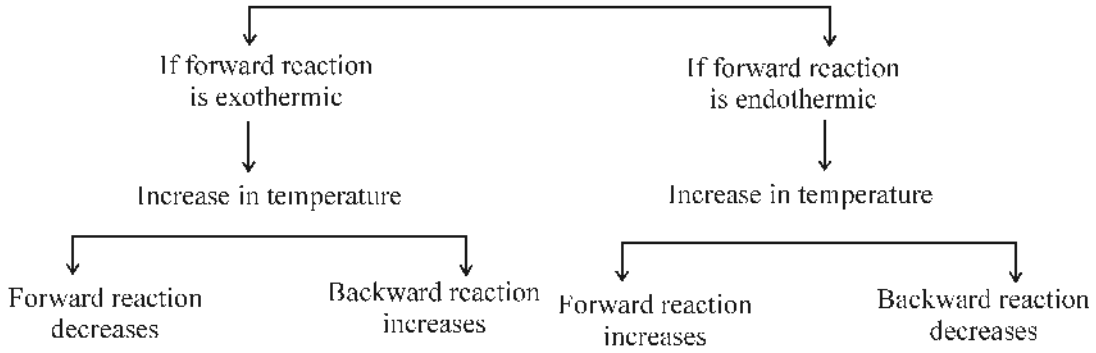
d) Name the state where the rate of forward and backward reactions become equal?

e) Did the reaction stop at this state?

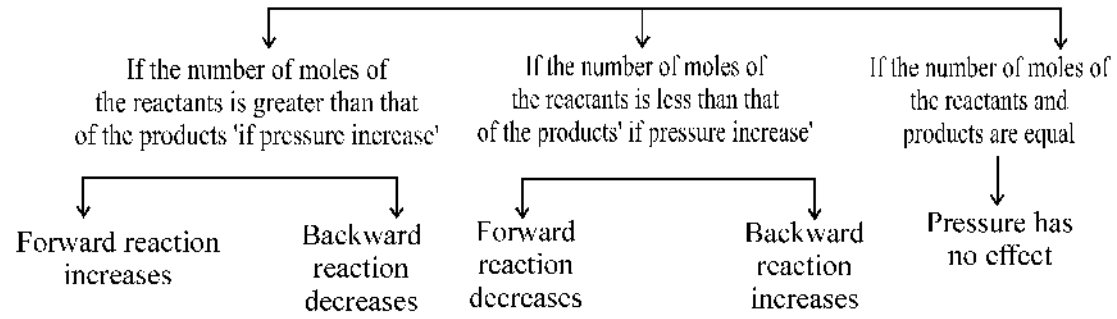
f) Chemical equilibrium is static in nature. why?

g) In which type of system is chemical equilibrium possible?

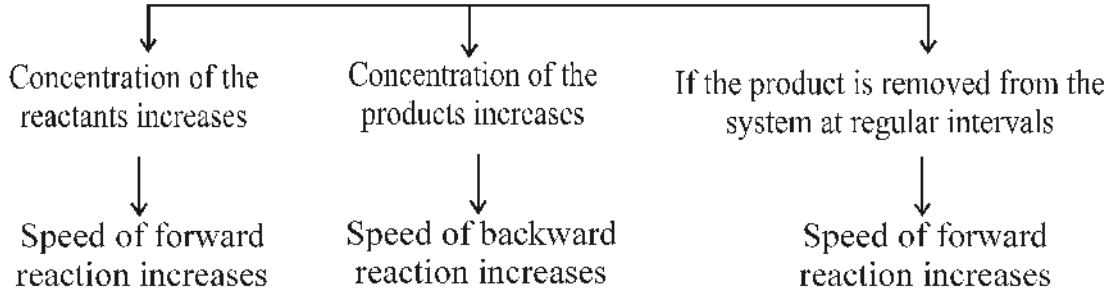
Influence of Temperature at equilibrium



Influence of pressure at equillibrium



Influence of concetration



Activity 10

⇨ $2SO_2 + O_2 \rightleftharpoons 2SO_3 + \text{Heat}$

a) Is the forward reaction exothermic or endothermic ?

b) What is the number of moles of the reactants and products in this reaction ?

c) What is the effect of increase in temperature in this reaction ?

d) What will happen to the speed of the forward reaction if SO_3 is removed at regular intervals from the system ?

e) What will happen if the amount of oxygen is increased in this reaction ?

f) What will happen if pressure is increased ?

Activity 11

⇨ $2SO_2 + O_2 \rightleftharpoons 2SO_3$

a) What will happen if the catalyst V_2O_5 is added to this system at equiliburium?

b) Give reason.

c) What is the advantage of adding the catalyst in the beginning itself ?

Activity – 12

$N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$

i) What is the influence of pressure in this reaction ?

ii) Write the reason.

Answer key

1. i) Turns blue

   ii) Ammonia is basic in nature

2. 1. a. $Ca(OH)_2$ b. CaO

   2. $2NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + 2NH_3 + 2H_2O$

   3. To remove water

   4. Density of Ammonia is less than air

3. i) Solubility in water

   ii) Basic nature of Ammonium hydroxide. (Ammonia dissolves in water forms ammonium hudroxide)

   iii) $NH_3 + H_2O \rightarrow NH_4OH$

4. Solubility of NH_3 in water in very high

5. A highly concentrated aqueous solution of Ammonia is liquor Ammonia. Ammonia gas can be liquified by applying pressure is liquid Ammonia

6. ➢ For the manufacture of chemical fertilisers like ammonium sulphate ammonium phosphate, urea etc.

   ➢ As a refrigerant in ice plants

   ➢ To clean tiles and window panes

   (Write any two uses)

7. a) Red litmus turns blue.

   b) Ammonia (NH_3). Basic nature of NH_3

   c) Blue litmus turns back to Red.

   d) Presence of HCl gas.

   e) The dencity of NH_3 is less than that of HC*l*. So the diffusion rate of NH_3 is greater than that of HCl. So NH_3 reaches first at the mouth of the test tube.

   f) NH_4Cl *(Ammonium Chloride)*

   g) NH_3 + HC*l* $\rightarrow NH_4Cl$ (HC*l* and NH_3 reacts)

   h) Reversible reaction

   i) $NH_4Cl \rightleftharpoons NH_3 + HCl$

8. $2SO_2 + O_2 \rightarrow 2SO_3$ Forward reaction

   $2SO_3 \rightarrow 2SO_2 + O_2$ Backward reaction

9. a) Decreases

   b) Increases

   c) at A

   d) State of equilibrum

e) No

f) Even at the state of equilibrum both forward and backward reactions go on continuously. (Only with the same rate)

g) In a closed system (No factors should change

10. a) Exothermic

b) Reactants - 3mol

products - 1 mol

c) Speed of forward reaction decreases and speed of backward reaction increases.

d) Speed of forward reaction increases

e) Speed of forward reaction increases

f) Speed of forward reaction will increase and speed of backward reaction will decrease

11. a) No change

b) There will be no influence of catalyst, when the system is at equilibrum.

c) Catalyst helps to attain equilibrum at the earliest.

12. 1. No influence

2. Total number of molecules in the reactants and total number of molecules in the products are equal.

Sulphuric Acid (H_2SO_4)

At a glance

- Industrial preparation of Sulphuric acid contact process
- Concentrated H_2SO_4 has the ability to absorb chemically combined water, or hydrogen and oxygen from substance in the ratio corresponding to that of water. This process is known as dehydration
- Drying agents are substances capable of absorbing the moisture present in a substance
- Sulphuric acid is called the king of chemicals.
- Concentrated Sulphuric acid can displace volatile acid from their salts.

- Concentrated Sulphuric acid react with metals and non metals and oxidises them.
- Sulphate salts react with Barium chloride to form a white precipitate of Barium sulphate. It is insoluble in hydrochloric acid.

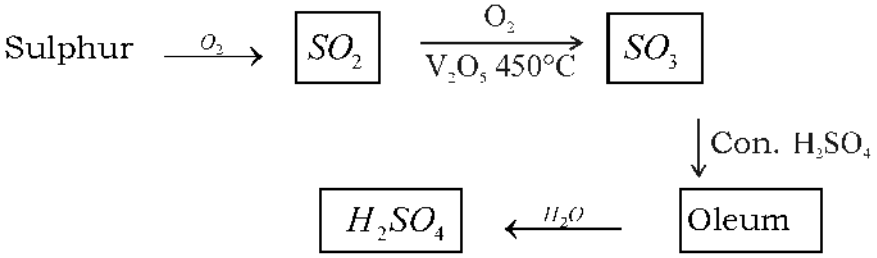
Activity 13

Some uses of Sulphuric acids and ammonia are given below. Tabulate correctly.

- As a refrigerant in ice plants
- Manufacture of explosives
- Manufacture of paints
- To clean tiles and window panes
- Refining of petroleum

Activity 14

Flow chart representing the industrial preparation of H_2SO_4 given below



Using the above flow chart find A, B, C, D, E from the below chemical equation and balance the equations.

$\underline{A} + O_2 \rightarrow \underline{B}$

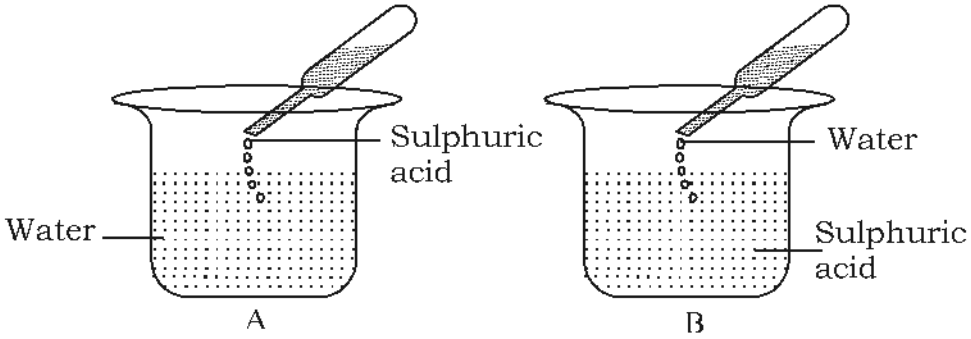
$\underline{B} + O_2 \rightarrow \underline{C}$

$\underline{C} + H_2SO_4 \rightarrow \underline{D}$

$\underline{D} + H_2O \rightarrow \underline{E}$

Activity 15

The process of dilution of H_2SO_4 conducted by two students



i) Which method is correct?

ii) Write the reason.

Activity 16

Take some sugar in a watch glass and add a few drops of concentrated sulphuric acid.

i) What is your observation?

ii) Which property of sulphuric acid is shown here?

iii) $C_2H_{22}O_{11} \xrightarrow{Con\ H_2SO_4} \underline{A} + \underline{B}$ (Find A and B)

Activity 17

Which property of sulphuric acid is shown in the following situations?

i) During the preparation of sulphuric dioxide the gas is passed through concentrated H_2SO_4

ii) Adding Con. H_2SO_4 on cotton

iii) $C + 2H_2SO_4 \rightarrow CO_2 + 2H_2O + 2SO_2$

iv) Adding con. H_2SO_4 on $CuSO_4$ Crystals

v) $Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2H_2O$

vi) $KNO_3 + H_2SO_4 \rightarrow KHSO_4 + HNO_3$

Activity 18

Why is concentrated sulphuric acid not used as a drying agent in the preparation of ammonia

Activity 19

i) Which of the substances from the below are used to identify the sulphate salt.

Sodium chloride , Nitric acid, Magnesium Sulphate, Barium chloride, Beaker, Water, Hydrochloric acid.

ii) Write the procedure

iii) Write the name of the white precipitate.

Answer key

13.

NH_3	H_2SO_4
❖ As a refrigement in ice plants ❖ To clean tiles and window Panes	❖ Manufacture of explosives ❖ Manufacture of paints ❖ Refining of petroleum

14. A – S

B – SO_2

C – SO_3

D – $H_2S_2O_7$

E – H_2SO_4

$S + O_2 \rightarrow SO_2$

$2SO_2 + O_2 \underset{450°C}{\overset{V_2O_5}{\rightleftharpoons}} 2SO_3$

$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$

$H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

15. i) A

ii) Dilution of sulphuric acid is an exothermic reaction. If water is added to the acid, it will result in spurting and may cause burns to our body.

16. i) Forms charcoal

ii) Dehydration property

iii) $C_{12}H_{22}O_{11} \xrightarrow{H_2SO_4} \underline{12C} + \underline{11H_2O}$

17. i) Drying nature
    ii) Dehydration property
    iii) Oxidation property
    iv) Dehydration property
    v) Oxidation property
    vi) Con.H_2SO_4 can displace volatile acids from their salts
18. Ammonia is basic in nature. Here it reacts with Sulphuric acid
19. i) Magnesium sulphate, Barium Chloride, Beaker, Water, Hydrochloric acid
    ii) Take a little Magnesium sulphate solution in a test tube and add three or four drops of Barium chloride solution to it. Add few drops of hydrochloric acid to this.
    iii) Barium sulphate.

UNIT TEST

Time : 40 min. **Score : 20**

I Answer any four questions from 1 to 6 **(1 x 4=4)**

1. In which type of system equilibrium is possible?
2. What is the effect of pressure in the reaction.

$$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$$

3. The gas that evolves first when NH_4Cl is heated is.....
4. Name the process of industrial preparation of Ammonia?
5. Which chemical is used to identify sulphate salts.
   (Barium chloride, Calcium chloride, Sodium chloride)

6 $NH_3 + H_2O \rightarrow$ .....

II. Answer any five questions from 7 to 13 **(2 x5=10)**

7. Write the forward and backward reaction of the reversible reaction given below.

$$H_2 + I_2 \rightleftharpoons 2HI$$

8. State Le-chateliers principle.
9. a) Ammonia is an important raw material for the production of nitrogenous fertilizers
   i) Why ammonia gas is passed through quick lime (CaO) ?
   ii) The ammonia collector is placed inverted, Why?
10. What is liquor Ammonia and liquid Ammonia

11. Sulphuric acid (H_2SO_4) is a chemical utmost important in industry

i) Write any two uses of sulphuric acid.

ii) Industrial preparation of sulphuric acid is known as _____

12. Using the material given below. Write an experiment to identify the sulphate salt,

Test Tube, Sodium Sulphate solution, Barium Chloride solution, Hydrochloric acid

13. Solubility of ammonia in water is very high.

When an Ammonia tanker leaks water is sprayed

a) Write the name of the solution formed?

b) What is the nature of the solution?

PART - 3

Answer any two of the following (2 x 3=6)

14. Different stages in the industrial preparation of H_2SO_4 is given below. Write the correct order.

$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$

$S + O_2 \rightarrow SO_2$

$II_2S_2O_7 + II_2O \rightarrow 2II_2SO_4$

$2SO_2 + O_2 \rightarrow 2SO_3$

15. $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ + heat

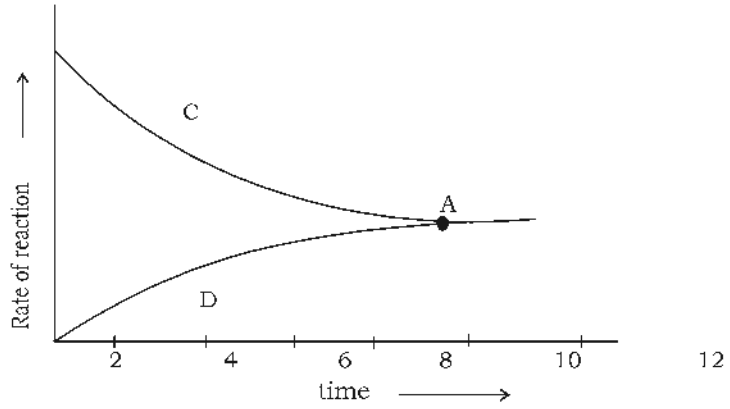
a) What happens to the volume when reactants change into products ?

b) What change should be done to the pressure to get more NH_3?

c) NH_3 should be removed at regular intervals of time from the system. Give reason ?

16. $2SO_2 + O_2 \rightleftharpoons 2SO_3$ Heat

The graph of this chemical reaction is given below.



a) Identify the reactions C and D and Write the chemical equation

b) The catalyst V_2O_5 should be used in the beginning itself. Why?

c) Draw the graph of the reaction if it takes place in the presence of the catalyst.

Answer keys

1. Closed system
2. No influence
3. NH_3
4. Harbour process
5. Barium chlorid
6. NH_4OH
7. Forward reaction

   $II_2 + I_2 \rightarrow 2III$

   backward react

   $2HI \rightarrow H_2 + I_2$
8. Le – Chatelier Principal
9. a) to remove moisture

   b) Density of NH_3 is less than air
10. Liquor ammonia

    Liquid ammonia
11. Refining of petroleum, Manufcature of paonts (any other)

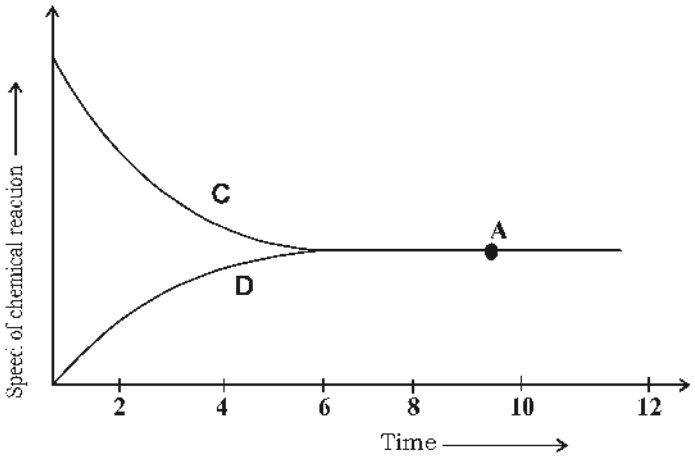
12. Take a little sodium sulphate solution in a test tube and add three or four drops of Barium chloride solution to it, a white precipitate is formed. Add few drops of hydrochloric acid to this. Precipitate is insoluble in HCl

13. a. Ammonium hydroxide
    b. Alkaline

14. 1. $S + O_2 \rightarrow SO_2$ 2. $2SO_2 + O_2 \rightarrow 2SO_3$ 3. $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$
    4. $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

15. a. decreases
    b. increase pressure
    c. to increase the forward reaction

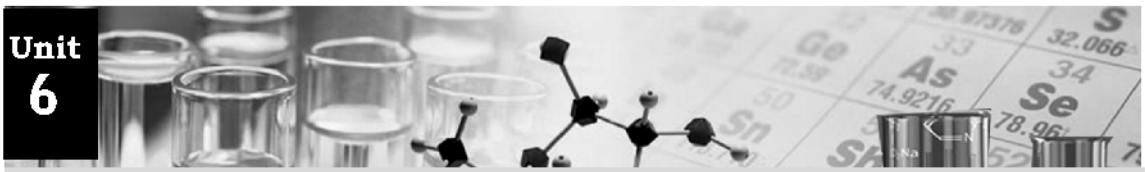
16.



a. C. forward reaction $2SO_2 + O_2 \rightarrow 2SO_3$
   D. backward reaction $2SO_3 \rightarrow 2SO_2 + O_2$

b. Catalyst helps to reache equilibrium at a faster rate.

Unit 6



NOMENCLATURE OF ORGANIC COMPOUNDS AND ISOMERISM

In earlier classes you have studied about the properties of carbon and organic compounds .In this unit we discuss the IUPAC naming and isomerism of different types of organic compounds. After understanding the topic,you will be able to write the structural formula and IUPAC name of an organic compound if its molecular formula is given and vice versa.

After realising the fact that there is a chance of forming different types of compounds having the same molecular formula , the concept isomerism can be achieved .

At a glance

- The valency of carbon is 4.
- Hydrocarbons are compounds containing hydrogen and carbon only
- Thee are compounds having single bond, double bond and triple bond between carbon atoms.
- Alkanes are open chain hydrocarbons in which the carbon atoms are joined together by single covalent bonds.

  Alkanes are saturated hydrocarbons.

  The general formula of alkanes is C_nH_{2n+2}
- A Series of compounds which can be represented by a general formula, having a common difference of CH_2 between successive members is called a homologous series. The members of homologous series show similarity in chemical properties. There is a regular gradation in their physical properties.
- Alkenes are hydrocarbons which contain at least one double bond between carbon atoms.

Alkenes are unsaturated hydrocarbons.

The general formula of alkenes is C_nH_{2n}

- Alkynes are hydrocarbons which contain at least one triple bond between carbon atoms.

Alkynes are also unsaturated hydrocarbons.

The general formula of alkynes is C_nH_{2n-2}

- Organic compounds are named according to the rules and regulations of IUPAC (International Union of Pure and Applied Chemistry)
- Atom or group of atoms which can replace a hydrogen atom of a hydrocarbon are called functional groups. Each functional group imparts characteristic properties to organic compounds.
- The phenomenon in which two or more organic compounds having same molecular formula and show different physical and chemical properties is called isomerism.

Activity 1

The structural formula of some organic compounds are given below. Complete the table.

Structural Formula	**Molecular Formula**
CH_3-CH_2-CH_3	
CH_3-CH_2-CH_2-CH_2-CH_3	
CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3	
CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3	

Activity 2

Identify the class of the compound CH_3-CH_2-CH_2-CH_3 from the following alternatives

(Alkane, Alkene, Alkyne, Cycloalkane)

Activity 3

Certain hints about an organic compound are given below.

- It is a hydrocarbon
- The main chain has six carbon atoms

- It has no branches
- All carbon atoms are connected by means of single bonds.

(a) What is the structural formula of the compound ?

(b) What is the molecular formula of the compound ?

(c) Write the IUPAC name of the compound.

Activity 4

Write the structural formula of the compound having molecular formula C_4H_{10} .

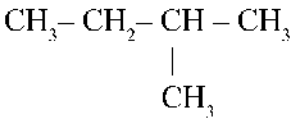
Activity 5

Complete the following .

Structural formula	**IUPAC Name**
$CH_3 - CH_3$	
$CH_3 - CH_2 - CH_3$	
$CH_3 - CH_2 - CH_2 - CH_3$	
$CH_3 - CH_2 - CH_2 - CH_2 - CH_3$	
$CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$	

Activity 6

The structure of an organic compound is given below.



(a) How many carbon atoms are present in the main chain of the compound ?

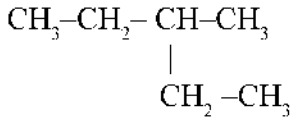
(b) What is the position number of the carbon which contains a branch?

(c) What is the name of the branch?

(d) Write the IUPAC name of the compound .

Activity 7

The structure of an organic compound is given below.



(a) How many carbon atoms are present in the main chain of the compound ?

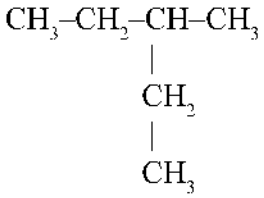
(b) What is the position number of the carbon which has the branch ?

(c) What is the name of the branch?

(d) Write the IUPAC name of the compound .

Activity 8

The structure of an organic compound is given .

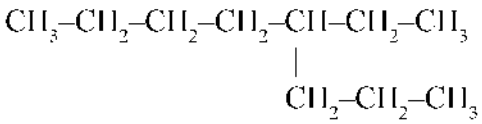


Given below are the IUPAC names of this compound , written by three students.

Student 1	2 – Ethyl butane
Student 2	3 – Methyl pentane
Student 3	2- Methyl butane

Which of the above is correct. Justify

Activity 9



(a) How many carbon atoms are present in the main chain of the compound ?

(b) What is the position of branch in the parent chain ?

(c) What is the name of the branch?

(d) Write the IUPAC name of the compound .

Activity 10

Complete the table.

IUPAC Name	Structural Formula
2 – Methyl butane	
.....	$CH_3–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–CH_2–CH_2–CH_2–CH_3$
3 – Ethyl pentane	
.....	$CH_3–CH_2–\underset{\displaystyle CH_2–CH_3}{\underset{\vert}{CH}}–CH_2–CH_2–CH_2–CH_3$

Activity 11

The structure of an organic compound is given below.

$$CH_3–CH_2–\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{\vert}{\underset{\vert}{C}}}}–CH_2–CH_2–CH_3$$

(a) How many carbon atoms are present in the main chain of the compound ?

(b) What are the position of branches in the parent chain ?

(c) What are the name of the branches ?

(d) Write the IUPAC name of the compound.

Activity 12

Write the IUPAC names of the organic compounds given below.

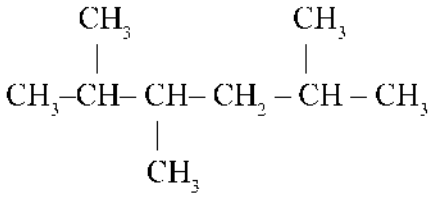
(a)

$$CH_3–CH–CH_2–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–CH_3$$

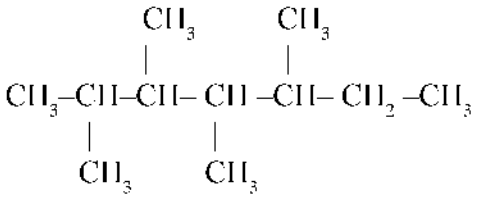
(b)

$$CH_3–\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{\vert}{\underset{\vert}{C}}}}–CH_2–CH_2–CH_3$$

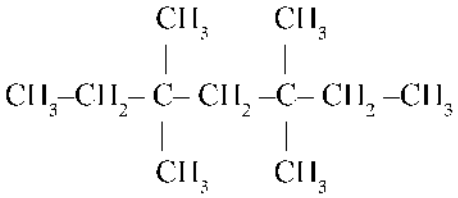
(c)



(d)



(e)



Activity 13

Find (a),(b),(c) and (d) in the following table

$CH_2=CH_2$	Ethene
(a)	Propene
$CH_3–CH_2–CH=CH_2$	But-1-ene
$CH_3–CH=CH–CH_3$	**(b)**
(c)	Pent-1-ene
$CH_3–CH=CH–CH_2–CH_3$	**(d)**

Activity 14

$CH_2=CH–CH_2–CH_3$

(a) Write the IUPAC name of the compound

(b) What will be its IUPAC name if the double bond is in between the second and third carbon?

Activity 15

An organic compound is given.

$CH_3–C\equiv C–CH_3$

(a) Write its molecular formula

(b) To which type of the following does it belong?
(Alkane, Alkene, Alkyne)

(c) What is the IUPAC name of the compound ?

Activity 16

Complete (a), (b), (c), (d), (e) and (f) suitably

$CH \equiv CH$	**(a)**
(b)	Propyne
$CH_3–CH_2–C \equiv CH$	**(c)**
$CH_3–C \equiv C–CH_3$	**(d)**
(c)	Hex-1-yne
$CH_3–C \equiv C–CH_2–CH_3$	**(f)**

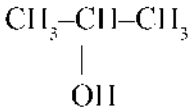
Functional Groups

- Hydrocarbons are organic compounds containing carbon and hydrogen atoms only.
- Atoms or atom groups which replaces hydrogen atom of an organic compound are called functional groups.

Activity 17

Identify the functional group of the compound $CH_3–CH_2–CH_2 – OH$?

Activity 18



(a) What is the name of the functional group of the compound given ?

(b) What is the common name of the compounds with this functional group?

(c) Write the IUPAC name of the compound.

1.Hydroxyl Group
IUPAC Name: Alkane –e + ol → Alkanol

Activity 19

Fill in the blanks as given in the example

Example CH_3-OH : Methanol

$CH_3–CH_2–OH$: _____

Activity 20

Write the IUPAC names of the following compounds.

(a) $CH_3–CH_2–CH_2–OH$

(b) $CH_3–\underset{\displaystyle OH}{\underset{|}{CH}}–CH_3$

(c) $CH_3–CH_2–CH_2–CH_2–OH$

(d) $CH_3–\underset{\displaystyle OH}{\underset{|}{CH}}–CH_2–CH_3$

(e) $CH_3–CH_2–\underset{\displaystyle OH}{\underset{|}{CH}}–CH_3$

Activity 21

Write the structural formula of the following

Pentan-2-ol

Pentan-3-ol

Activity 22

$$CH_3–CH_2–CH_2–\underset{\displaystyle OH}{\underset{|}{CH}}–CH_3$$

What is the IUPAC name of the compound ?

Activity 23

Complete column B by writing the IUPAC names of the compounds given in column A.

Column A	Column B
$CH_3–CH_2–CH_2–CH_2–OH$	_____
$CH_3–CH_2–CH_2–CH_2–CH_2–CH_2–OH$	_____

2.Halo Group

IUPAC Name : Haloalkane

Activity 24

Write the IUPAC names of the following compounds.

(a) $CH_3–CH_2–CH_2–Cl$

(b) $CH_3–\underset{\displaystyle Br}{\underset{|}{CH}}–CH_3$

(c) $CH_3–CH_2–CH_2–CH_2–Cl$

(d) $CH_3–\underset{\displaystyle Cl}{\underset{|}{CH}}–CH_2–CH_3$

(e) $CH_3–\overset{\displaystyle Cl}{\overset{|}{CH}}–\underset{\displaystyle Cl}{\underset{|}{CH}}–CH_3$

(f) $CH_3–CH_2–\overset{\displaystyle Cl}{\overset{|}{\underset{\displaystyle Cl}{\underset{|}{C}}}}–CH_3$

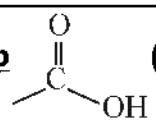
(g) $CH_3–CH_2–CH_2–CH_2–Br$

Activity 25

Write the structural formula of the following compounds

(a) 2,2,3,3-Tetra chloro butane

(b) 2,2,3 -Tri bromo pentane

3.Carboxylic Group  **(–COOH)**

IUPAC Name : Alkane-e+oic acid → Alkanoic acid

Activity 26

Complete (a),(b),(c),(d),(e) suitably

H - COOH	(a)
(b)	Propanoic acid
$CH_3–CH_2–CH_2–COOH$	(c)

4. Alkoxy Group (O-R)

Ether IUPAC Name : Alkoxy alkane

Activity 27

35. Complete (a),(b),(c),(d),(e) suitably

$CH_3–O–CH_3$	**(a)**
(b)	Ethoxy ethane
$CH_3–O–CH_2–CH_3$	**(c)**
$CH_3–CH_2–O–CH_3$	Methoxy ethane
(d)	Ethoxy butane
$CH_3–CH_2–CH_2–CH_2–O–CH_2–CH_3$	**(e)**

Cydic or Ring Compounds

Cydic or ring compounds are classified into two

1. Alicyclic compounds
2. Aromatic compounds

Alicyclic Hydrocarbons

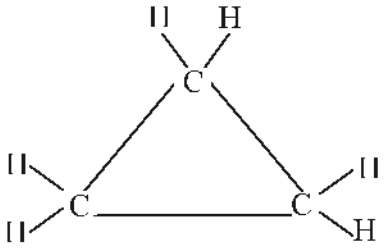
They are cyclic hydrocarbons similar to open chain hydrocarbons like alkanes, alkenes and alkynes

Arometic Compounds

Cyclic compounds having their own aroma. Benzene is an aromatic compounds having industrial importance.

Activity 28

28. The structure of cydropopane is given below



Based on this given the structure of the following

a) Cydobulane

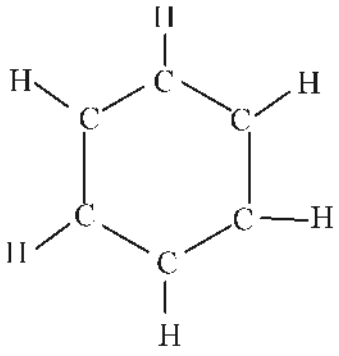
b) Cydonexane

c) Cydobutene

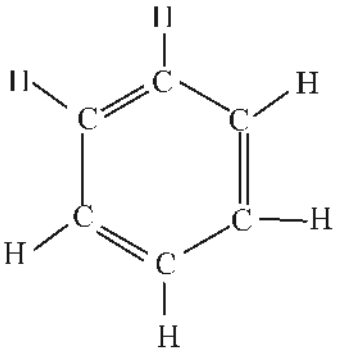
d) What are the molecular formula of these compounds?

Activity 29

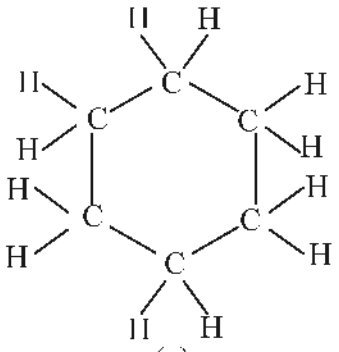
(a). Identify the correct the structure of benzene from the following.



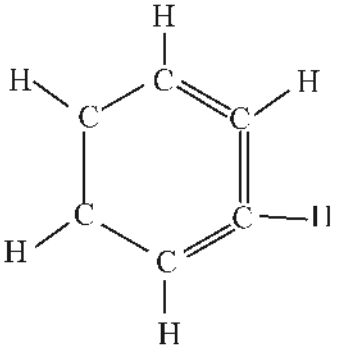
(a)



(b)



(c)



(d)

(b) Write the molecular formula of benzene.

ISOMERISM

Compounds having same molecular formula but different chemical and physical properties are called Isomers. The phenomenon is called Isomerism.

Activity 30

(i) $CH_3 - CH_2 - O - CH_3$

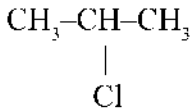
(ii) $CH_3 - CH_2 - CH_2 - OH$

(a) Write the molecular formulae of the compounds given .

(b) Write their IUPAC names

(c) Which type of isomerism is shown by these compounds?

Activity 31



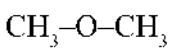
(a) Write the molecular formula of the compound given.

(b)What is the functional group present ?

(c) Write the IUPAC name .

(d) Write the structural formula of any one isomer of the compound.

Activity 32



(a) Write the IUPAC name of the compound

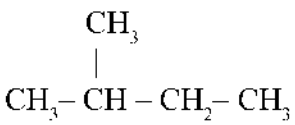
(b) Write the structural formula of any one isomer of the compound

(c) Write the IUPAC name of the newly written isomer.

(d) What type of isomerism is shown by these compounds ?

Activity 33

The molecular formula of hydrocarbon is C_5H_{12} . Its structural formula is given below



(a) Write the IUPAC name of the compound

(b) Write the structural formula and IUPAC name of any two structural isomers of it.

Activity 34

Identify the pairs of isomers from the following table . Write the type of isomerism shown by each pair

(a) $CH_3–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–CH_2–CH_3$
(b) $CH_3–CH_2–CH_2–Cl$
(c) $CH_3–CH_2–CH_2–CH_2–CH_3$
(d) $CH_3–\underset{\displaystyle Cl}{\underset{\vert}{CH}}–CH_3$
(e) $CH_3–O–CH_3$
(f) $CH_3–CH_2–OH$

Activity 35

The IUPAC names of two organic compounds are given below

- Ethoxy ethane
- Butan-1-ol

(a) Which type of isomerism is shown by these compounds?

(b) Write the structure of any position isomer of Butan -1-ol

Activity 36

Cyclohexane is an alicyclic hydrocarbon

(a) Write the structure of Cyclohexane

(b) Write the structural formula of any one alkene having the same molecluar formula of cyclohexane

ANSWER KEY

1.

Structural formula	**Molecular formula**
CH_3-CH_2-CH_3	C_3H_8
CH_3-CH_2-CH_2-CH_2-CH_3	C_5H_{12}
CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3	C_8H_{18}
CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3	C_9H_{20}

2. Alkane

3. (a) CH_3-CH_2-CH_2-CH_2-CH_2-CH_3

   (b) C_6H_{14}

   (c) Hexane

4. CH_3-CH_2-CH_2 -CH_3

5.

Structure	**IUPAC Name**
$CH_3 - CH_3$	Ethane
$CH_3 - CH_2 - CH_3$	Propane
$CH_3 - CH_2 - CH_2 - CH_3$	Butane
$CH_3 - CH_2 - CH_2 - CH_2 - CH_3$	Pentane
$CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$	Octane

6. (a) 4

   (b) 2

   (c) Methyl

   (d) 2- Methyl butane

7. (a) 5

   (b) 3

   (c) Methyl

   (d) 3- Methyl Pentane

8. (a) Student 2 is right . Longest carbon chain

   (b) Correct structures of 2 – Ethyl butane and 2- Methyl butane

9. (a) 8

   (b) 4

   (c) Ethyl

   (d) 4- Ethyl octane

10. Correct structure

11. (a) 5

    (b) 3,3

    (c) Methyl, Methyl

    (d) 3,3-Dimethyl pentane

12. (a) 2,4-Dimethyl pentane
    (b) 2,2-Dimethyl pentane
    (c) 2, 3 - Dimethyl hexane
    (d) 2,3,4,5-Tetra methyl heptane
    (e) 3,3,5,5- Tetra methyl heptane
13. (a) CH_3-CH=CH_2
    (b) But-2-ene
    (c) CH_2=CH-CH_2-CH_2-CH_3 / CH_3-CH_2-CH_2-CH=CH_2
    (d)Pent-2-ene
14. (a) But-1-ene
    (b) But-2-ene
15. (a) C_4H_6
    (b) Alkyne
    (c) But-2-yne
16. (a) Ethyne
    (b) CH_3– C≡CH
    (c) But-1-yne
    (d) But-2-yne
    (e) CH≡C–CH_2–CH_2–CH_3 / CH_3–CH_2–CH_2–C≡CH
    (f) Pent-2-yne

Functional Groups

17. Hydroxyl group
18. (a) Hydroxyl group
    (b) Alcohols
    (c) Propan-2-ol

19. $CH_3–CH_2–OH$: Ethanol

20. (a) Propan-1-ol
    (b) Propan-2-ol
    (c) Butan-1-ol
    (d) Butan-2-ol
    (e) Butan-2-ol

21. $CH_3–CH(OH)–CH_2–CH_2–CH_3$

$CH_3–CH_2–CH(OH)–CH_2–CH_3$

22. Pentan-2-ol

23.

Column A	Column B
$CH_3–CH_2–CH_2–CH_2–OH$	Butan-1-ol
$CH_3–CH_2–CH_2–CH_2–CH_2–CH_2–OH$	Hexan-1-ol

24. (a) 1- Chloro propane
    (b) 2- Bromo propane
    (c) 1- Chloro butane
    (d) 2- Chloro butane
    (e) 2,3 – Dichloro butane
    (f) 2,2 - Dichloro butane
    (g) Bromo butane

25.

(a) $CH_3–C(Cl)(Cl)–C(Cl)(Cl)–CH_3$

(b) $CH_3–C(Br)(Br)–CH(Br)–CH_2–CH_3$

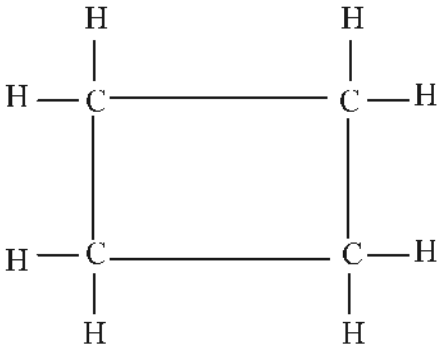
26.

HCOOH	Methanoic acid
$CH_3–CH_2–COOH$	Propanoic acid
$CH_3–CH_2–CH_2–COOH$	Butanoic acid

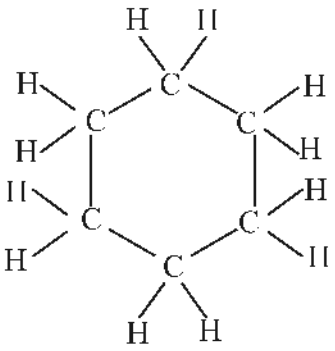
27.

$CH_3–O–CH_3$	Methoxy methane
$CH_3–CH_2–O–CH_2–CH_3$	Ethoxy ethane
$CH_3–O–CH_2–CH_3$	Methoxy ethane
$CH_3–CH_2–O–CH_2–CH_2–CH_2–CH_3$ Or $CH_3–CH_2–CH_2–CH_2–O–CH_2–CH_3$	Ethoxy butane
$CH_3–CH_2–CH_2–CH_2–O–CH_2–CH_3$	Ethoxy butane

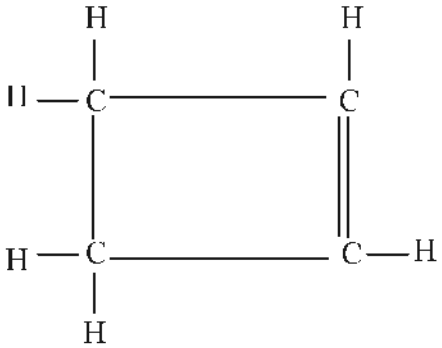
28. a) Cyclobutane



b) Cyclohexane



c) Cyclobutene



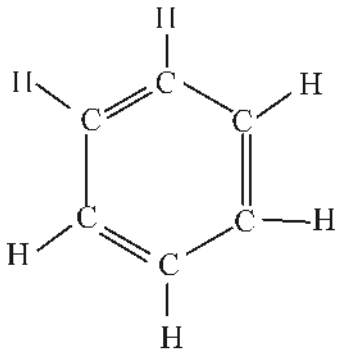
Molecular formula

a) Cyclobutane C_4H_8

b) Cyclohexane C_6H_{12}

c) Cyclobutene C_4H_6

29. a)



b) C_6H_6

ISOMERISM

30. (a) C_3H_8O

(b) (i) Methoxy ethane (ii) Propan - 1 - ol

(c) Functional isomerism

31. (a)C_3H_7Cl

(b) Cl - (Chloro)

(c) 2- Chloro propane

(d) CH_3-CH_2-CH_2-Cl

32. (a) Methoxy methane

(b) CH_3-CH_2-OH

(c) Ethanol

(d) Functional isomerism

33. (a) 2-Methyl butane

(b) Correct structure and IUPAC name

34.

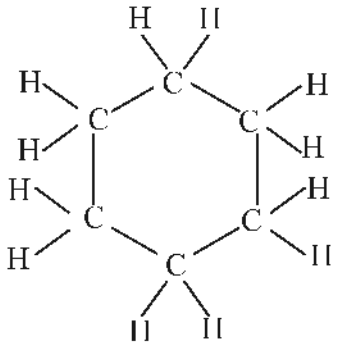
Chain isomers
(a) $CH_3–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_2–CH_3$
(c) $CH_3–CH_2–CH_2–CH_2–CH_3$
Position isomers
(d) $CH_3–\underset{\displaystyle Cl}{\underset{|}{CH}}–CH_3$
(b) $CH_3–CH_2–CH_2–Cl$

Functional isomers
(f) $CH_3–CH_2–OH$
(e) $CH_3–O–CH_3$

35. (a) Functional isomerism

(b) $CH_3–CH_2–\underset{\displaystyle OH}{\underset{|}{CH}}–CH_3$

36. (a)



(b) $CH_3–CH_2–CH_2–CH_2–CH=CH_2$

(Or any other position isomer of hexene)

UNIT TEST

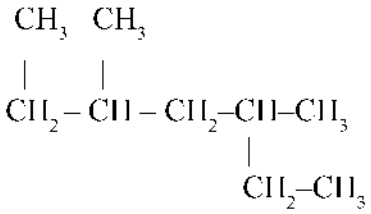
Time : 40 minutes
Score : 20

(Questions 1 and 2 are compulsory. One score each)

1. Which of the following can be the molecular formula of an alkene

(C_3H_4, C_3H_6, C_3H_8)

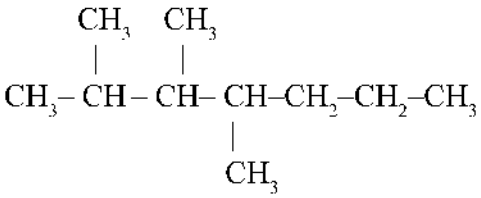
2. The structure of a hydrocarbon is given below



How many carbon atoms are present in the longest carbon chain of this compound?

(Write any two answers for questions three to five. Two scores each)

3.



(a) Which is the branch of the compound?

(b) Write the IUPAC name of the compound.

4. (CH_3-CH_2-O-CH_3, CH_3-CH_2-CHO, CH_3-CH_2-CH_2-OH)
Write the IUPAC names of the isomer pairs from the compounds given above.

5. Complete the following table.

C_2H_6O	.....(a).....	Ethanol
C_3H_7Cl	CH_3–CH_2–CH_2–Cl	.....(b).....

(Write any two answers for questions six to eight . Three scores each)

6. Fill in the blanks.

C_2H_6O	CH_3-CH_2-OH	.....
$C_2H_4O_2$	.....	Ethanoic acid
.....	.....	Ethoxy ethane

7. Write the structures of the position isomers of the compound CH_3-CH_2-CH_2-CH_2-CH_2-OH
8. Write any two similarities and one difference between CH_3–CH_2–CH_2–OH and CH_3–O–CH_2–CH_3

(Answer any two for the questions from nine to eleven . Four scores each)

9. Write the structures of the all isomers having molecular formula C_4H_{10}
10. The structural formulae of some organic compounds are given below.

(a) CH_3–CH_2–CH_2–CH_3 (b) CH_3–CH_2–O – CH_2–CH_3

(c) CH_3–CH_2–CH_2–CH_2–OH (d) CH_3–$\underset{\displaystyle CH_3}{\underset{|}{CH}}$– CH_3

(i) Identify the isomer pairs

(ii) Write the type of isomerism shown by them.

11. The structure of an organic compound is given

$$CH_3–CH_2–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_2–CH_3$$

(a) How many carbon atoms are present in the main chain of it ?

(b) What is the position number of the carbon atom to which the branch is attached ?

(c) What is the name of the branch?

(d) Write the IUPAC name of the compound.

Answer Key

1. C_3H_6

2. 6

3 (a) Methyl

(b) 2, 3, 4 Trimethyl heptane

4. CH_3-CH_2-O-CH_3 - Methoxy ethane

CH_3-CH_2-CH_2-OH - Propan-1-ol

(Functional isomers)

5. C_2H_6O CH_3-CH_2-OH Ethanol

C_3H_7Cl CH_3-CH_2-CH_2-Cl 1- Chloro propane

6.

C_2H_6O	$CH_3 - CH_2 - OH$	Ethanol
$C_2H_4O_2$	$CH_3 - COOH$	Ethanoic acid
$C_4H_{10}O$	$CH_3 - CH_2 - O - CH_2 - CH_3$	Ethoxy ethane

7. **Pentan-2-ol**

$$CH_3 - CH_2 - CH_2 - CH - CH_3$$
$$\quad\quad\quad\quad\quad\quad OH$$

$$CH_3 - CH_2 - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_2 - CH_3$$

8. **Similarities**

3 Carbon atoms

8 Hydrogen atoms

One Oxygen atom

Difference

Difference functional groups

9. C_4H_{10}

$CH_3 - CH_2 - CH_2 - CH_3$

$$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$$

10. Isomer pairs

a) i. a, d

ii. b, c

b) a, d - Chain Isomers

b, c - Functional Isomers

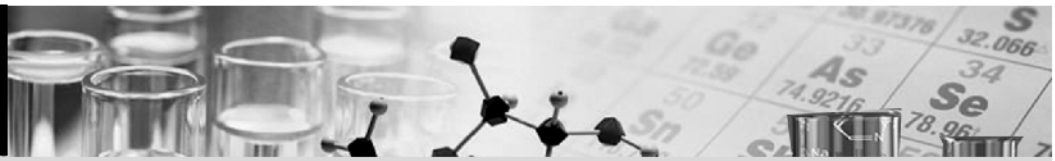
11. (a) 4

(b) 3

(c) Methyl

(d) 3-Methyl pentane

Unit 7



CHEMICAL REACTIONS OF ORGANIC COMPOUNDS

There are a lot of organic compounds found around us such as medicines plastics, perfumes, soaps, detergents etc. New organic compounds are also produced day by day. These are obtained by different chemical reactions. Let us familiarise with some of the basic chemical reactions in this unit.

Diiferent Chemical Reactions of Organic Compounds

At a Glance

Different Chemical Reactions of Organic Compounds

① Substitution Reaction	② Addition Reaction	③ Polymerisation	④ Thermal Cracking	⑤ Combustion
An atom is replaced from the compound by another atom or group of atoms.	It takes place mostly in to form polymers compounds. By the effect of this reaction triple bonded Compounds change in to double bonded and forms Saturated compounds. (Single bonded)	Monomers combine mass is heated The products formed are depending on temperature, pressure, catalyst and the nature of hydrocarbon. Products formed are saturated and unsaturated compounds.	Hydrocarbons with high molecular in the absence of air undergo decomposition to form hydrocarbons with lower molecular mass.	Hydrocarbons combine with oxygen forming CO_2 and H_2O. It is an exothermic reaction. So hydrocarbons are used as fuels.

Activity 1

Write the substitution reaction products obtained when ethane (C_2H_6) react with chlorine.

i) $C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$

ii) $C_2H_5 - Cl + Cl_2 \rightarrow$ _____ + HCl

iii) _____ + $Cl_2 \rightarrow C_2H_3Cl_3 + HCl$

iv) $C_2H_3Cl_2 + Cl_2 \rightarrow$ _____ + _____

v) _____ + $Cl_2 \rightarrow C_2HCl_5 + HCl$

vi) _____ + $Cl_2 \rightarrow$ _____ + _____

Activity 2

Fill up the following.

a) $C_3H_8 + Cl_2 \rightarrow$ _____ + _____

b) $C_3H_7 - Cl + Cl_2 \rightarrow$ _____ + _____

c) _____ + $Cl_2 \rightarrow C_3H_5Cl_3 + HCl$

d) $C_3H_5Cl_3 + Cl_2 \rightarrow$ _____ + _____

e) _____ + $Cl_2 \rightarrow C_3H_3Cl_5 + HCl$

f) $C_3H_3Cl_5 + Cl_2 \rightarrow$ _____ + _____

g) _____ + _____ $\rightarrow C_3HCl_7 + HCl$

h) _____ + _____ $\rightarrow$ _____ + HCl

Activity 3

Write the products.

a) $CH_3 - CH = CH_2 + H_2 \rightarrow$ _____

b) $CH_3 - CH = CH_2 + Cl_2 \rightarrow$ _____

c) $CH \equiv CH + Cl_2 \rightarrow$ _____

d) $CH \equiv CH + HCl \rightarrow$ _____

Activity 4

Complete the table.

Monomer	Polymer
$CH_2 = CH_2$	_____
_____	$\left[CH_2 - \underset{CH_3}{CH} \right]_n$
$CH_2 = CH - Cl$	_____
$CF_2 = CF_2$	_____

Activity 5

Complete the equation.

i) $CH_3 - CH_2 - CH_3 \xrightarrow{\text{Heat}} CH_4 + \_\_\_\_\_$

ii) $CH_3 - CH_2 - CH_2 - CH_3 \xrightarrow{\text{Heat}} CH_2 = CH_2 + \_\_\_\_\_$

iii) $C_8H_{18} \xrightarrow{\text{Heat}} C_3H_6 + \_\_\_\_\_$

iv) $CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3 \xrightarrow{\text{Heat}} \_\_\_\_\_ + CH_3 - CH = CH_2$

Activity 6

Fill up the blanks.

$C_2H_4 + 3O_2 \rightarrow \_\_\_\_\_ + \_\_\_\_\_$

$C_3H_8 + 5O_2 \rightarrow \_\_\_\_\_ + \_\_\_\_\_$

Activity 7

Complete the table.

Chemical reaction	Product	IUPAC name of product
$CH_2 = CH_2 + Cl_2$ $CH_2 = CH_2 + HCl$ $CH_2 = CH - CH_3 + H_2$ $CH \equiv CH + H_2$		

Activity 8

Fill in the blanks.

Monomer	Polymer	Use
Vinylchloride	_____	_____
Ethene	Polythene	_____
Isoprene	Natural Rubber (poly isoprene)	_____
_____	Teflon	_____

Activity 9

Match the following appropriately.

Reactants	Products	Name of the reaction
$CH \equiv CH + H_2$	$CH_3 - CH_2 - Cl$	Combustion
$nCH_2 = CH_2$	$CH_3 - CH_3 + CH_2 = CH_2$	Polymerisation
$CH_3 - CH_3 + Cl_2$	$+CH_2 - CH_2+_n$	Addition
$CH_3 - CH_2 - CH_2 - CH_3$	$CH_2 = CH_2$	Substitution Reaction
$C_2H_4 + O_2$	$2CO_2 + 2H_2O$	Thermal Cracking

Activity 10

Complete the table.

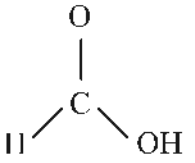
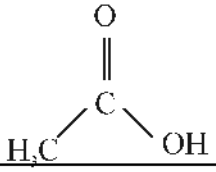
Reactants	Products
$CH_4 +$ _____	$CO_2 + 2H_2O$
$CH \equiv CH + H_2$	_____
$CH_3Cl + Cl_2$	___ $+ HCl$
_____ $+ H_2$	$CH_3 - CH_3$
$CH_2 = CH - CH_3 + H_2$	_____

Activity 11

The important component in LPG is butane. Write the balanced chemical equation for the complete combustion of butane.

Activity 12

Complete the table

Condensed formula	Structural formula	IUPAC Name	Common Name
$H-COOH$		_____	_____
_____		Ethanic acid	_____
CH_3-CH_2-COOH	_____	Propanoic acid	_____

Some Important Organic Compounds
Alcohols (Functional group - OH)

Industrial preparation of methanol (CH_3-OH)

$$CO + 2H_2 \xrightarrow[\text{High Temperature}\\ \text{High pressure}]{\text{Catalyst}} CH_3-OH$$

Industrial preparation of ethanol (C_2H_5- OH)

Ethanol is manufactured by fermenting diluted molasses by adding yeast.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Invertase}} C_6H_{12}O_6 + C_6H_{12}O_6$$

Sucrose (Sugar) Glucose Fructose

$$C_6H_{12}O_6 \xrightarrow{\text{Zymase}} 2C_2H_5-OH + 2CO_2$$

Ethanol

(1) → Wash (8 - 10% alcohol)

(2) → Rectified spirit (95.6%)

(3) → Absolute alcohol (99% or above)

(4) → Power alcohol (Absolute alcohol+petrol)

(5) → Denatured spirit (Ethanol mixed with poisonous substances)

Carboxylic Acids (Functional group – COOH)

Ethanoic acid (CH_3-COOH)

Industrial preparation of ethanoic acid.

$$CH_3-OH+CO \xrightarrow{\text{Catalyst}} CH_3-COOH$$

Methanol Ethanoic acid

5 - 8 % ethanoic acid - Vinegar

Esters (- COOR)

Carboxylic acid + Alcohol $\xrightarrow{Conc.H_2SO_4}$ Ester + H_2O

Activity 13

The chemical reaction of the industrial production of ethanol is given. Complete the reaction.

i) $C_{12}H_{22}O_{11}+H_2O \xrightarrow{Invertase} C_6H_{12}O_6+.....$

ii) $C_6H_{12}O_6 \xrightarrow{Zymase} 2\ \_\_\_\_\_ +2CO_2$

Activity 14

Two balanced chemical equations in related to the manufacture of ethanol are given.

$$C_{12}H_{22}O_{11}+H_2O \xrightarrow{(A)} C_6H_{12}O_6+C_6H_{12}O_6 \xrightarrow{(B)} 2C_2H_5-OH+2CO_2$$

a) Write the names of (A) and (B)

b) Name the isomer of Glucose ?

c) What is the name of the ethanol produced by this method ?

d) How is rectified spirit obtained from 8 to 10% solution of alcohol ?

Activity 15

Match the following.

Wash	Ethanol mixed with poisonous Substance
Rectified spirit	8 - 10% ethanol
Absolute alcohol	95.6% ethanol
Denatured spirit	99% ethanol
Power alcohol	Motor fuel

Activity 16

Complete the chemical equations.

a) $CH_3-COOH + HO-H_2C-CH_3 \xrightarrow{H_2SO_4}$ _____ + _____

b) _____ + _____ $\xrightarrow{H_2SO_4} CH_3-CH_2-CH_2-COO-CH_2-CH_3+H_2O$

Activity 17

$CH_3-CH_2-COOH+CH_3-CH_2-OH \rightarrow CH_3CH_2-COO-CH_2-CH_3+H_2O$

a) Write the names of the products formed by the above reaction.

b) What is the importance of this substance in our daily life. ?

Activity 18

Write the products.

i) $CH_3-OH+CO \xrightarrow{\text{Catalyst}}$ _____

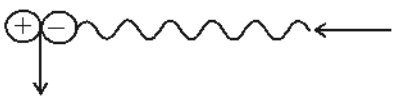
ii) $CO+2H_2 \xrightarrow[\text{High Temperature}\\ \text{High pressure}]{\text{Catalyst}}$ _____

Cleansing Action of Soap

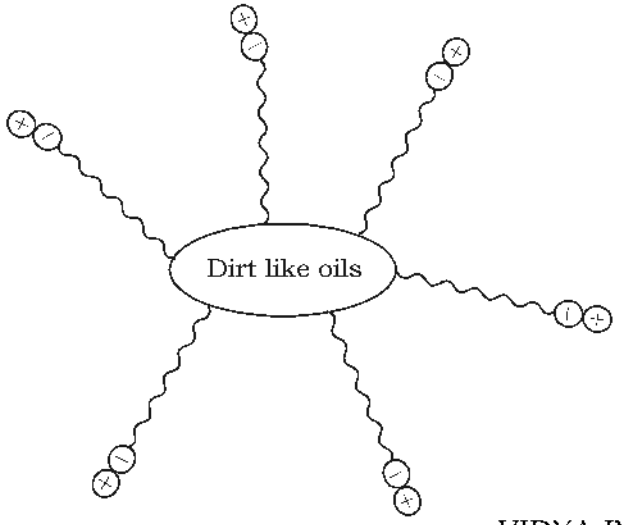
At a glance

* Oils and fats are esters formed by the combination of glycerol and some fatty acids. Soap is the salt formed when oils and fats react with alkalies like Sodium hydroxide and Potasium hydroxide.

* **Soap**



Polar End (Ionic Part)



* Detergents are made from hydrocarbons obtained from coal and petroleum. Most detergents are salts of Sulphonic acids.

Activity 19

Which end of soap dissolves in water when it romoves dirt?

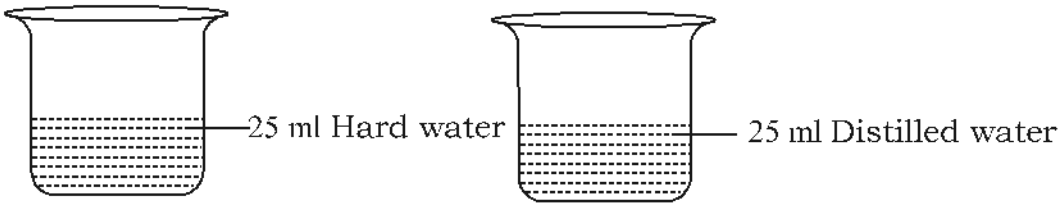
Activity 20

Which salt doesn't cause hardness of water.

(NaCl, $MgCl_2$, $CaCl_2$, $Mg(HCO_3)_2$

Activity 21

Analyse the given picture



Add same quantity of soap solution to both beakers and shake well. Which beaker will have more foam and why ?

Activity- 22

Detergents are more effective than soaps in hard water. why?

Activity- 23

List out the merits and demeritsof detergents

Answer key

1. *ii*) $C_2H_4 - Cl_2$

   iii) $C_2H_4 - Cl_2$

   iv) $C_2H_2 - Cl_4, HCl$

   v) $C_2H_2 - Cl_4$

   vi) C_2HCl_5, C_2Cl_6, HCl

2. *a*) $C_3H_7 - Cl, HCl$

   b) $C_3H_6 - Cl_2, HCl$

   c) $C_3H_6 - Cl_2$

d) HCl , $C_3H_4 - Cl_4$

e) $C_3H_4 - Cl_4$

f) $C_3H_2 - Cl_6, HCl$

g) $C_3H_2 - Cl_6, Cl_2$

h) C_3HCl_7, Cl_2, C_3Cl_8

3. a) $CH_3 - CH_2 - CH_3$

b) $CH_3 - \underset{Cl}{CH} - \underset{Cl}{CH_2}$

c) $\underset{Cl}{CH} = \underset{Cl}{CH}$

d) $CH_2 = CH - Cl$

4. $\left[CH_2 - CH_2\right]_n$

$CH_2 = CH - CH_3$

$\left[CH_2 - \underset{Cl}{CH}\right]_n$

$\left[CF_2 - CF_2\right]_n$

5. (i) $CH_2 = CH_2$

(ii) $CH_3 - CH_3$

(iii) C_5H_{12}

(iv) $CH_3CH_2CH_2CH_3$

6. $2CO_2, 2H_2O$

$3CO_2, 4H_2O$

7. $\underset{Cl}{CH_2} - \underset{Cl}{CH_2}$ (1, 2 - dichloro ethane)

$CH_3 - CH_2 - Cl$ (Chloro ethane)

$CH_3 - CH_2 - CH_3$ (Propane)

$CH_2 = CH_2$ (Ethene)

8. Polyvinyl chloride, Manufacture of pipes and taps .
Polythene, manufacture of covers and bags.
For the manufacturing of tubes, tyres, belt, hoses, ...
Tetra Fluroethene, Coating on the inner surface of non - stick cook ware .

9.

$CH \equiv CH + H_2$	$CH_2 = CH_2$	Addition
$nCH_2 = CH_2$	$\{CH_2 - CH_2\}_n$	Polymerisation
$CH_3 - CH_3 + Cl_2$	$CH_3 - CH_2 - Cl$	Substitution reaction
$CH_3 - CH_2 - CH_2 - CH_3$	$CH_3 - CH_3 +$ $CH_2 = CH_2$	Thermal cracking
$C_2H_4 + O_2$	$2CO_2 + 2H_2O$	Combustion

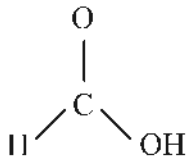
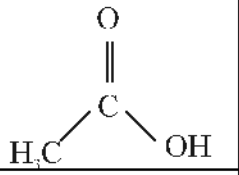
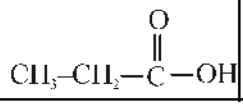
10. $2O_2$, $CH_2 = CH_2$

$CH_2 - Cl_2, CH_2 = CH_2$

$CH_3 - CH_2 - CH_3$

11. $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

12.

Condensed formula	Structural formula	IUPAC Name	Common Name
$H - COOH$		Methanoic acid	Formic acid
$CH_3 - COOH$		Ethanic acid	Acetic acid
$CH_3 - CH_2 - COOH$		Propanoic acid	propionic acid

13. 1)$C_6H_{12}O_6$

2)$2C_2H_5 - OH$

14. a) A - Invertase B - Zymase

b) Fructose

c) Wash

d) Fractional distillation

15. Wash - 8-10% ethanol
Rectified spirit - 95.6% ethanol
Absolute alcohol - 99% ethanol
Denatured spirit - Ethanol mixed with poisonous substance
Power alcohol - Motor Fuel

16. *a*) $CH_3-COO-CH_2-CH_3, H_2O$

b) $CH_3-CH_2-CH_2-COOH, CH_3-CH_2-OH$

17. a) Ethyl propanoate

b) Esters have a pleasant fruity and floral smell. So they are used for making synthetic flavours.

18. *i*) CH_3-COOH

ii) CH_3-OH

19. Polar End (ionic end)

20. NaC*l*

21. Second beaker

Soap, doesn't lather well in hard water. Hardness of water is due to the dissolved calcium and magnesium salts in it. These salts react with soap to form insoluble compounds.

22. Detergents do not give insoluble compounds on reaction with calcium and magnesium salts dissolved in hard water.

23.

Merits	**Demerits**
Effective in hard water too	Micro organisms can not decompose the components of detergents.
Do not forms insoluble Compounds.	The detergents which contain phosphates increses the growth of algae and hence limits the quantity of oxygen. This leads to the distruction of aquatic life
More convenient to use	Excessive use of detergents causes environmental problems

Unit test

Score : 20
Duration : 40 mts

Answer any four from question 1 to 6.

1. Which one among the following hydrocarbon molecules undergo polymerisation ?

   $C_2H_6, C_4H_{10}, C_2H_4, C_6H_{14}$

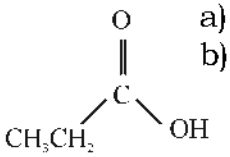
2. $C_7H_{16} + Cl_2 \rightarrow C_7H_{15} - Cl + HCl$

   To which category does the reaction belong ?
   (Addition reaction, Substitution reaction, Thermal Cracking)

3. Complete the chemical equation.

   $CH_3 - CH_2 - CH_3 \xrightarrow{\text{Heat}} CH_4 + \_\_\_\_\_$

4. Structural formula of an organic compound is given.

   a) Find the functional group from this formula
   b) Identify the compound

5. Name the monomer of the polymer teflon which is used to coat inner surface of non-stick cooking utensils ?

6. Name the carboxylic acid and alcohol required to produce the ester $CH_3 - COO - CH_3$ $(4 \times 1 = 4)$

Answer any five from questions 7 to 13

7. a) Find A, B and C from the following reactions.

   (*i*) $CH_3 - CH_2 - CH_3 \xrightarrow{\text{Thermal cracking}} CH_4 + \underline{\quad (A) \quad}$

   (*ii*) $X + H_2 \xrightarrow{\text{Addition reaction}} \underline{\quad (B) \quad} \rightarrow$

   (*iii*) $Y + Cl_2 \longrightarrow \underline{\quad (C) \quad}$

   (b) Which type of reaction is (iii)

8. Some chemical reactions are given.

   (*i*) $CH \equiv CH + HCl \rightarrow \underline{A}$

   (*ii*) $\underline{A} \xrightarrow{\text{Polymerisation}} \underline{B}$

   a) Find A and B
   b) Write any one use of B.

9. Ethanol is an industrially important compound. How is ethanol manufactured industrially ? Write any two uses of ethanol.

10. **Find A and B**

$C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Invertase}} C_6H_{12}O_6 + \underline{A}$

$A \xrightarrow{\text{Zymase}} 2\underline{B} + 2CO_2$

11. Excessive use of detergent causes environmental problems. Do yo agree with this statement? Justify.

12. a. Butane is one of the compounds usually obtained by the thermal cracking of heptane. Write the chemical equation of this reaction.

    b. Write the balanced chemical equation for the combustian of butane.

13. Write any one use of the following.

    a) Polythene b) Teflon c) Ethanoic acid d) Power alcohol

Answer any two from the questions 14 to 16

14. Analyse the following reactions and answer questions given below.

    i) $CO + 2H_2 \xrightarrow{\text{Catalyst}} \underline{A}$

    ii) $\underline{A} + CO \xrightarrow{\text{Catalyst}} \underline{B}$

    iii) $\underline{A} + \underline{B} \longrightarrow \underline{C}$

    a) Find A, B and C ?

    b) Write the IUPC name of compound C.

15. a) Select the compound from the following that undergoes addition reaction.

    C_2H_6, C_2H_4, C_3H_8

    b) Write the balanced chemical equation of the addition reaction of that compound with HCl.

    c) Write the balanced chemical equation of polymerisation of the compound C_2H_4.

16. a) Find the names of carboxylic acid and alcohol required to prepare an ester $CH_3-COO-CH_2-CH_2-CH_3$.

    b) Write the balanced chemical equation of the above reaction.

    c) What are the characteristics of these type of compounds.

$(2 \times 3 = 6)$

ANSWER KEY

1. C_2H_4
2. Substitution reaction
3. $CH_2 = CH_2$
4. a) $-COOH$ (Carboxylic acid)

   b) Propanoic acid (Propionic acid)
5. Tetra fluroethene
6. $CH_3 - COOH$

   $CH_3 - OH$
7. a) *i*) A. $CH_2 = CH_2$ b) substitution

   ii) B. $CH_3 - CH_3$

   iii) C. $CH_3 - CH_2Cl$
8. *a*) A) $CH_2 = CH - Cl$

   B) $\left[CH_2 - \underset{Cl}{CH} \right]_n$

   b) Used in the manufacture of pipes and taps
9. By the fermentation of molasses. Any two uses.
10. A) $C_6H_{12}O_6$

    B) $C_2H_5 - OH$
11. Excssive use of detergents causes environmental problems. The micro organisms in water cannot decompose the components of detergents. The detergents which contain phosphate increases the growth of algae and limits the quantity of oxygen. It causes the destruction of aquatic organisms.

12. a. $C_7H_{16} \rightarrow C_4H_{10} + C_3H_6$

OR

$CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3 \rightarrow$
$CH_3 - CH_2 - CH_2 - CH_3 + CH_3 - CH = CH_2$

b. $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

13. 1. Polythene - Covers, bags
2. Teflon - non stick utensils
3. Ethanoic acid - Vinegar
4. Power alcohol - Fuel

14. a. A. $CH_3 - OH$

B. $CH_3 - COOH$

C. $CH_3 - COO - CH_3$

b) Methyl ethanoate

15. $a) C_2H_4$

$b) CH_2 = CH_2 + HCl \rightarrow CH_3 - CH_2 - Cl$

$c) nCH_2 = CH_2 \rightarrow \left[CH_2 - CH_2\right]_n$

16. $a) CH_3 - COOH$

$CH_3 - CH_2 - CH_2 - OH$

b) $CH_3 - COOH + CH_3 - CH_2 - CH_2 - OH$

$\xrightarrow{H_2SO_4} CH_3 - COO - CH_2 - CH_2 - CH_3 + H_2O$

c) Pleasant fruity and floral smell.

SAMPLE QUESTION PAPER

1. 15 minutes is given as cool off time
2. Answer the questions as per the instructions given.

Answer any four from 1 to 5 **(1 × 4 = 4)**

1. Which of the following subshell is not possible
   4s, 6p, 2d, 5f
2. 2 moles of a solute is present in 2 litre of the solution? What is the molarity of the solution?
3. Write the product $SO_2 + Cl_2 \xrightarrow{\text{Sunlight}}$ .....
4. Which of the following metal does not displace hydrogen from dilute acids?
   Fe, Ni, Cu, Al
5. Name a compound used for imparting blue colour to glass. .....

Answer any four question from 6 - 10 **(2 × 4 = 8)**

6. Find out the carboxylic acid and the alcohol required to prepare the ester $CH_3CH_2COOCH_3$
7. Write the functional group isomer and IUPAC name of the compound CH_3-CH_2-CH_2-OH.
8. $ZnCO_3$ and ZnS are two ores of zinc.
   a) Which of these ores is converted to its oxide by calcination ?
   b) How roasting differs from calcination ?
9. The subshell electronic configuration of element X is given below. Find out the period and group of X.

   $1s^2\ 2s^2\ 2p^5$
10. Calculate the mass of the following in grams.
    a) One nitrogen atom
    b) One nitrogen molecule
    (Atomic mass of nitrogen = 14)

Answer any four from 11 - 15. **(4 × 3 = 12)**

11. Match suitably.

Cement	reduce body temperature	Anthracite
Coal	mixture of aluminates and silicates	Paracetamol
Antipyretic	Carbonisation	Gypsum

12. i) $CH_2 = CH_2 + HCl \rightarrow A$

ii) $n\,CH_2 = \underset{Cl}{\overset{CH}{|}} \xrightarrow[\text{Pressure}]{\text{Heat}} B$

a) Identify A and B

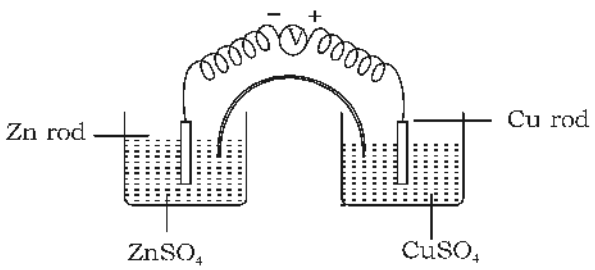
b) What type of chemical reaction is (i) ?

13. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

a) How many moles of CH_4 is necessary to form 2 mol H_2O?

b) Calculate the volume of CO_2 at STP produced by the complete combustion of 160g CH_4 ? (At.mass C=12, H=1 O=16)

14.



a) Which electrode acts as anode ?

b) From which electrode does electron flow starts ?

c) Write the equation of the cell reaction

15. The subshell electron configuration of Mn is given.

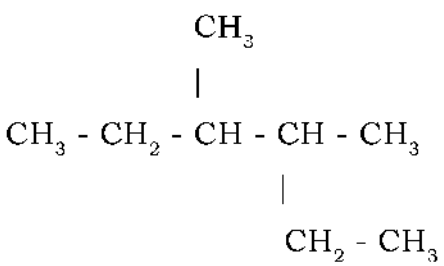
$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^2$

a) What is the atomic number of the element ?

b) What is the oxidation state of Mn in MnO_2 ?

c) Write the subshell electronic configuration of the ion formed.

Answer any four questions from 16 to 20. (4 × 4 = 16)



a) What is the number of carbon atoms in the main chain of the compound ?

b) Write the IUPAC name of the compound.

c) Write the structural formula of the compound 2 - methyl propan - 2 - ol

d) $CH_4 + Cl_2 \rightarrow ..... + HCl$

17. $N_2 + 3H_2 \rightleftharpoons 2NH_3 + Heat$

a) What happens to the speed of forward reaction if the temperature is increased ?

b) What change should be made in pressure to get more NH_3?

c) Which is the catalyst used in this reaction ? What is its function ?

18. The steps involved in the concentration of bauxite are shown in the flow chart. Fill up the missing parts.

a) Bauxite $\xrightarrow{\text{Hot NaOH Solution}}$ .....

Impurities are filtered and $Al(OH)_3$ is added

to the solution $\rightarrow$.....

$\xrightarrow{\text{Precipitate is filtered and heated}}$ Al_2O_3

b) Write the equation of the reaction taking place at the cathode in the electrolysis of alumina.

c) Why is cryolite added in the process?

19. a) Write the balanced equation of the chemical reaction between marble and hydrochloric acid

b) What will happen to the speed of chemical reaction if powdered marble is used instead of marble pieces ? Why ?

20. The decreasing order of reactivity of certain metals is given below

Mg >Fe>Cu>Ag

a) What will happen if a Mg rod is placed in cupric chloride solution? give the reason ?

b) Which are the products obtained at the anode and cathode if cupric chloride is electrolysed ?