THIRUVANANTHAPURAM
CORPORATION

PARIHARABODHANAM
(SSLC)

(2022 - 2023)

CHEMISTRY

District Institute of Education and Training (DIET)
Thiruvananthapuram

Pariharabodhanam

CHEMISTRY

First Edition
November 2022
Layout & Cover Design
Kallingal Graphics, Attingal
Concepts & Conceptualisation
Thiruvananthapuram Corporation
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Printing
Govt. Press,
Thiruvananthapuram

പ്രിയ വിദ്യാർത്ഥികളേ,

തിരുവനന്തപുരം നഗരസഭാ പരിധിയിലെ സ്കൂളുകളിൽ പഠിക്കുന്ന വിദ്യാർത്ഥികളുടെ പഠന നിലവാരം വർധിപ്പിക്കുന്നതിനായി നഗരസഭ നടപ്പിലാക്കുന്ന പദ്ധതിയാണ് 'പരിഹാരബോധനം'. മുൻ വർഷങ്ങളിൽ നടത്തിവന്നിരുന്ന പദ്ധതി ഈ വർഷവും വിപുലമായ നിലയിൽ നടപ്പിലാക്കുകയാണ്. പഠനത്തിൽ പിന്നാക്കം നിൽക്കുന്ന വിദ്യാർത്ഥികളെ കൂടുതൽ കരുതൽ നൽകി മുന്നിലേയ്ക്ക് ഉയർത്തുകയെന്നതാണ് നഗരസഭ ഈ പദ്ധതിയിലൂടെ ഉദ്ദേശിക്കുന്നത്. പൊതുവിദ്യാഭ്യാസ രംഗം കൂടുതൽ കരുത്താർജ്ജിച്ച് മുന്നേറുന്ന ഈ കാലഘട്ടത്തിൽ വിദ്യാർത്ഥികൾക്ക് ഗുണമേന്മയുള്ള വിദ്യാഭ്യാസം ഉറപ്പാക്കുന്നതിനും വിവിധ തലങ്ങളിൽ മികവ് തെളിയിക്കാനുള്ള അവസരമൊരുക്കുന്നതിനും സർക്കാരും നഗരസഭയും പ്രതിജ്ഞാബദ്ധമാണ്. അക്കാദമികവും ഭൗതികവുമായ സൗകര്യങ്ങൾ കൂടുതൽ മെച്ചപ്പെട്ട് കേരളത്തിലെ പൊതുവിദ്യാഭ്യാസ രംഗം ശ്രദ്ധേയമായ മാതൃകയായി മാറിയിരിക്കുകയാണ്. ഈ സന്ദർഭത്തിൽ നമ്മുടെ വിദ്യാർത്ഥികൾക്ക് ഉന്നത പഠനത്തിന് ഉപകരിക്കുന്ന തരത്തിൽ പഠന നിലവാരം മെച്ചപ്പെടുത്തുക എന്നതാണ് നാം ലക്ഷ്യമിടുന്നത്. മികച്ച അധ്യാപകരുടെ സഹായത്തോടെ പഠനം അസ്വാദ്യകരമാക്കി മാറ്റിക്കൊണ്ട് കുട്ടികളെ മികച്ച നിലാരത്തിലേയ്ക്ക് ഉയർത്തുകയെന്ന ലക്ഷ്യത്തിന്റെ സാധൂകരണം കൂടിയാണ് പരിഹാരബോധനം എന്ന ബൃഹത് പദ്ധതി. ഈ പദ്ധതിയുടെ ഭാഗമാകുന്ന എല്ലാ പ്രിയപ്പെട്ട വിദ്യാർത്ഥികൾക്കും അഭിനന്ദനങ്ങൾ അറിയിക്കുന്നതോടൊപ്പം മികച്ച വിജയം ആശംസിക്കുന്നു.

സ്നേഹത്തോടെ

ആര്യ രാജേന്ദ്രൻ എസ്.
മേയർ
തിരുവനന്തപുരം നഗരസഭ

പ്രിയപ്പെട്ട കുട്ടികളേ,

തിരുവനന്തപുരം നഗരസഭാ പരിധിയിൽ വരുന്ന ഹൈസ്കൂൾ, ഹയർസെക്കന്ററി വിഭാഗം കുട്ടികളുടെ പഠനനിലവാരം ഉയർത്താനും പൊതുപരീക്ഷയിൽ ഉയർന്ന ഗ്രേഡ് കരസ്ഥമാക്കാനും ലക്ഷ്യമിട്ടുകൊണ്ട് മുൻവർഷങ്ങളെപ്പോലെ പരിഹാരബോധനം പദ്ധതി ഈ വർഷവും നടപ്പിലാക്കിവരുന്നതിൽ അതിയായ സന്തോഷവും അഭിമാനവും ഉണ്ട്. ഈ വർഷത്തെ പൊതുപരീക്ഷയ്ക്ക് നേരത്തെതന്നെ തയ്യാറെടുക്കുന്നതിനും എല്ലാ വിഷയങ്ങളിലെ പാഠഭാഗങ്ങളിലൂടെ ആവർത്തിച്ചുകടന്നുപോകാനും പരിചയപ്പെടാനും സാധിക്കട്ടെ എന്ന് ആശംസിക്കുന്നു.

ഡോ.നീന കെ.എസ്.
ചെയർപേഴ്സൺ
(വിദ്യാഭ്യാസ കായിക സ്റ്റാന്റിംഗ് കമ്മിറ്റി)
തിരുവനന്തപുരം കോർപ്പറേഷൻ

Members participated in the workshop

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6. **Smt. Indulekha G. L**
   Govt. HSS, Punnamoodu
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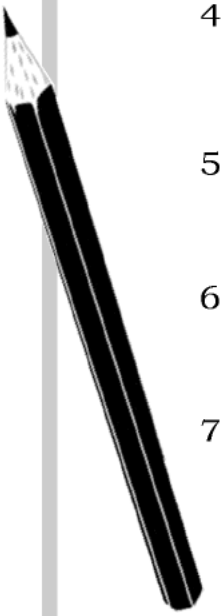

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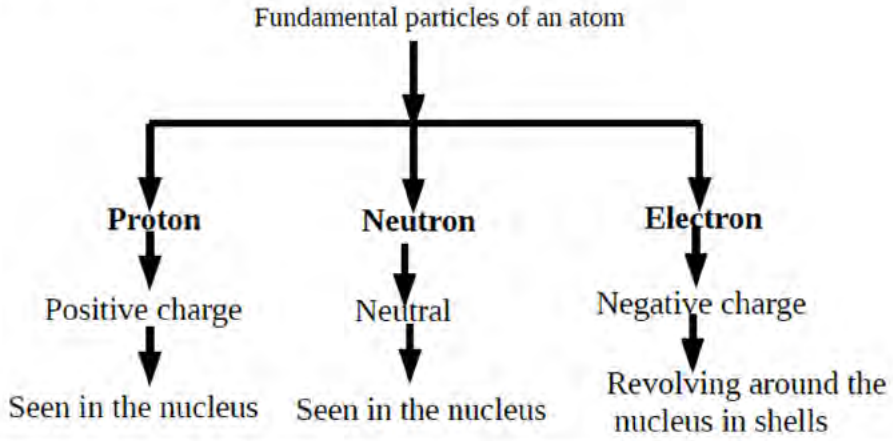
Chapter
01

PERIODIC TABLE AND ELECTRONIC CONFIGURATION

At a Glance

- 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.



Shells	Sub shells	No. of electron in subshells	Total no. of electrons in the shell
K	1s	2	2
L	2s	2	8
	2p	6	
M	3s	2	18
	3p	6	
	3d	10	
N	4s	2	32
	4p	6	
	4d	10	
	4f	14	

* Filling up of electrons in the sub shells are based on the increasing order of their energies. The arrangement of electrons in the increasing order of their energies in subshells are,

  1s <2s<2p<3s<3p<4s<3d.....

* While writing the subshell electronic configuration of elements with higher atomic numbers, the symbol of the noble gas preceding that element may be shown within 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]

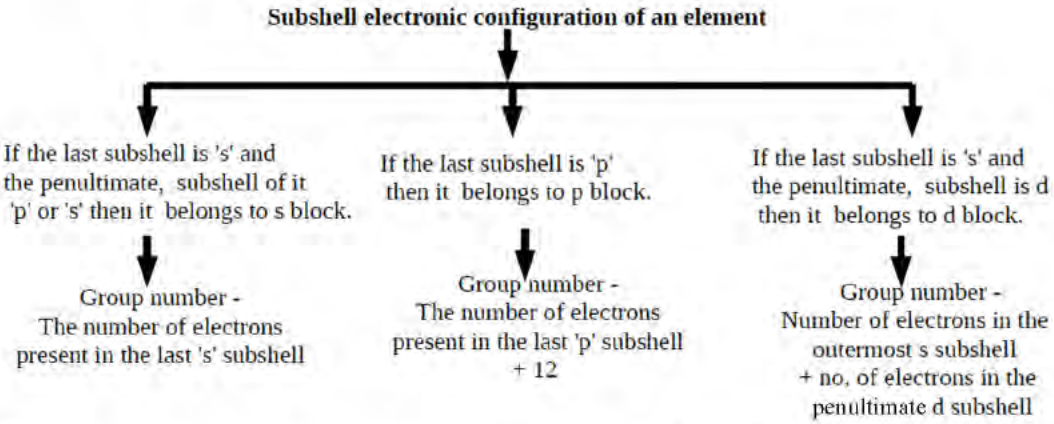
  upto $4p^6$ – use [Kr]

* **To find period, block and group of an element, when its subshell electron configuration is given**

  The highest shell number in the subshell electronic configuration is the period number.

  Eg: $1s^2\ 2s^2\ 2p^6\ 3s^2$

  Period – 3



* **Classification of elements based on their blocks**

s Block

- Group 1 and 2 elements
- Less ionisation energy and low electronegativity
- Oxides and hydroxides are basic in nature.
- Exhibit +1 or +2 oxidation state.
- Form ionic compounds.
- All are metals .

p block

- Group 13 - 18 elements.
- Elements show both positive and negative oxidation states.
- Elements found in solid liquid and gaseous states.
- Metals, nonmetals and metalloids are included.

d Block

- Group 3 - 12 elements
- Showing variable oxidation States.
- Solid metals except mercury
- Exhibit chemical similarity along the period and down the group.
- Form coloured compounds

Activity 1

Complete the table.

Shell	K	L		M			N			
Sub shell	1s	2s	2p	.....	3p	.....	4s	....	.....	.....
Maximum no. of electrons in each sub shell	2	2	.....	2	.....	10	.....	6	.....	.....
Maximum no. of electrons in each shell	2	8		18			32			

Activity 2

The subshell electronic configuration of an element X is given below. (symbol is not real)

X- $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9\ 4s^2$

(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.

Activity 3

Complete the table

Element	Atomic number	Sub shell electronic configuration	Sub shell electronic configuration using the symbol of the preceding noble gas
Na	11	$1s^2 2s^2 2p^6 3s^1$	[Ne] $3s^1$
Sc	21	.....	[.....] $3s^1 4s^2$
S	16	.....	[....] $3s^2$
Cl	.....	.....	[Ne] $3s^2 3p^5$
Ca	20	.....	.....

Activity 4

Complete the table.

Element	Subshell electronic configuration	Block	Period	Group
$_{17}Cl$	$1s^2 2s^2 2p^6 3s^2\ 3p^5$	p	3	5 + 12 = 17
$_{12}Mg$	$1s^2 2s^2 2p^6 3s^2$	s	3	2
$_{22}Ti$	$1s^2 2s^2 2p^6 3s^2\ 3p^6\ 3d^2\ 4s^2$	d	4	2 +2 = 4
$_{10}Ne$	.....	.....	.....	.....
$_{26}Fe$	.....	.....	.....	.....
$_{11}Li$	.....	.....	.....	.....

Activity 5

Characteristics of s,p, d and f block are given below. Arrange them properly based on blocks.

(a) High ionic energy.

(b) Form ionic compounds.

(c) High metallic character.

(d) Most of them are radioactive.

(e) Form coloured compounds.

(f) Used as catalyst in petroleum industry

Activity 6

Element 'X' in the 16 th group has 3 shells

- Write the subshell electronic configuration of 'X'
- Find the group, period and block

- Write the chemical formula of the compound formed when the element 'X' react with the element 'Y' which contain only one electron in the outermost shell.

Activity 7

Atomic number of Mn is 25. Its subshell electronic configuration is $1s^2\ 2s^2\ 2p^6\ 3s^2\ \ 3p^6\ \ 4S^2\ \ 3d^5$.

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		

ANSWERKEY

Activity 1

Shell	K	L		M			N			
Sub shell	1s	2s	2p	**3s**	3p	**3d**	4s	**4p**	**4d**	**4f**
Maximum no. of electrons in each sub shell	2	2	**6**	2	**6**	10	**2**	6	**10**	**14**
Maximum no. of electrons in each shell	2	8		18			32			

Activity 2

(a) 29

(b) 29

(c) No,

$1s^2\ 2s^2\ 2p^6\ 3s^2\ \ 3p^6\ \ 3d^{10}\ 4S^1$

Fully filled or half filled d subshell has more stability

Activity 3

Element	Atomic number	Sub shell electronic configuration	Sub shell electronic configuration using the symbol of the preceding noble gas
Na	11	$1s^2 2s^2 2p^6 3s^1$	[Ne] $3s^1$
Sc	21	$1s^2 2s^2 2p^6 3s^2\ 3p^6\ 3d^1\ 4s^2$	[Ar] $3d^1\ 4s^2$
S	16	$1s^2 2s^2 2p^6 3s^2\ 3p^4$	[Ne] $3s^2\ 3p^4$
Cl	17	$1s^2 2s^2 2p^6 3s^2\ 3p^5$	[Ne] $3s^2 3p^5$
Ca	20	$1s^2 2s^2 2p^6 3s^2\ 3p^6\ 4s^2$	[Ar] $4s^2$

Activity 4

Element	Subshell electronic configuration	Block	Period	Group
$_{17}Cl$	$1s^2 2s^2 2p^6 3s^2\ 3p^5$	p	3	5 + 12 = 17
$_{12}Mg$	$1s^2 2s^2 2p^6 3s^2$	s	3	2
$_{22}Ti$	$1s^2 2s^2 2p^6 3s^2\ 3p^6\ 3d^2\ 4s^2$	d	4	2 +2 = 4
$_{10}Ne$	$1s^2 2s^2 2p^6$	P	2	6 + 12 = 18
$_{26}Fe$	$1s^2 2s^2 2p^6 3s^2\ 3p^6\ 3d^6\ 4s^2$	d	4	6 +2 = 8
$_{11}Li$	$1s^2 2s^2 2p^6 3s^1$	s	3	1

Activity 5

s Block : (b) Form ionic compounds.
(c) High metallic character.

p Block : (a) High ionic energy.

d Block : (e) Form coloured compounds.

f Block : (d) Most of them are radioactive.
(f) Used as catalyst in petroleum industry

Activity :6

(a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$

(b) Period – 3
Group - 16
Block – p

(c) Y_2X

Activity 7

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	+4	$1s^2 2s^2 2p^6 3s^2\ 3p^6\ 3d^3$
Mn_2O_7	+7	$1s^2 2s^2 2p^6 3s^2\ 3p^6$
Mn_2O_3	+3	$1s^2 2s^2 2p^6 3s^2\ 3p^6\ 3d^4$

Chapter 02

GAS LAWS AND MOLE CONCEPT

At a Glance

Characteristic features of gases

- 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 random 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 are 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.

Gas laws

- **Boyle's Law**

  At a constant temperature, volume of a definite mass of gas is inversely proportional to its pressure.

- **Charles' Law**

  At constant pressure, the volume of a definite mass of gas is directly proportional to the temperature in Kelvin Scale.

- **Avagadro's Law**

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

Avagadro number:

6.022×10^{23}

GAM: Atomic mass expressed in gram

GMM: Molecular mass expressed in gram

Molar volume: Volume of 1 mole of gas molar volume of any gas at STP is 22.4L

Activity 1

Pressure and volume of a fixed amount of gas is given in the table(Temperature remains constant)

Pressure(atm)	Volume (L)
1	40
2	20
4	10
5	8

(a) Calculate P × V.

(b) Which is the gas law related to this.

Activity 2

Volume and temperature of a fixed mass of gas at constant pressure is given below.

Volume(L)	Temperature(K)	V/T
50	25	(i)
100	(ii)	2
(iii)	40	2

(a) Complete the table.

(b) Which gas law is applicable here.

Activity 3

Certain data regarding various gases kept under the same conditions of temperature and pressure are given below.

Gas	Volume (L)	Number of molecules
Hydrogen	20	x
Oxygen	10	(i)
Ammonia	40	(ii)
Carbondioxide	(iii)	x/4

(a) Complete the table.

(b) Which gas law is related to this?

Activity 4

Find the molecular mass of the following compounds.

(Given atomic mass of elements: Na-23, S-32, O-16, H-1, Ca-40, C-12, N-14)

(a) H_2SO_4 (b) NH_3 (c) $CaCO_3$ (d) NaOH

Activity 5

Complete the table.

(a)

Element	Atomic mass	GAM	Given mass (g)	Number of atoms
Hydrogen	1	(i)	1	(ii)
Carbon	(iii)	12 g	(iv)	$2\times6.022\times10^{23}$
Nitrogen	14	(v)	(vi)	$3\times6.022\times10^{23}$

(b)

Gas in STP	Molecular mass	Mass(g)	Number of moles	Volume in STP (L)
NH_3	17	34	(i)	(ii)
CO_2	44	(iii)	10	(iv)
H_2	2	(v)	(vi)	5 × 22.4

(c)

Element/ Compound	GMM	Mass(g)	Number of GMM	Number of molecules
NH_3	17	(i)	2	$2 \times N_A$
H_2O	18	90	5	(ii)
H_2	2	20	(iii)	$10 \times N_A$

ANSWER KEY

Activity 1

(a)

Pressure(atm)	Volume(L)	PxV
1	40	40
2	20	40
4	10	40
5	8	40

(b) Boyle's Law

Activity 2

(a) (i) 2 (ii) 50 (iii) 80

(b) Charle's Law

Activity 3

(a) (i) x/2 (ii) 2x (iii) 5

(b) Avagadro's Law

Activity 4

(a) H_2SO_4 molecular mass : $(2\times1)+(1\times32)+(4\times16)=98$

(b) NH_3 molecular mass : $(1\times14)+(3\times1)= 17$

(c) $CaCO_3$ molecular mass: $(1\times40)+(1\times12)+(3\times16)=100$

(d) NaOH molecular mass : $(1\times23)+(1\times16)+(1\times1)=40$

Activity 5

(a) (i) 1 g (ii) 6.022×10^{23} (iii) 12 (iv) 24 g (v) 14 g (vi) 42 g

(b) (i) 2 (ii) 2x22.4 (iii) 440 (iv) 10x22.4 (v) 10 (vi) 5

(c) (i) 34 (ii) $5xN_A$ (iii) 10

Chapter
03

REACTIVITY SERIES AND ELECTROCHEMISTRY

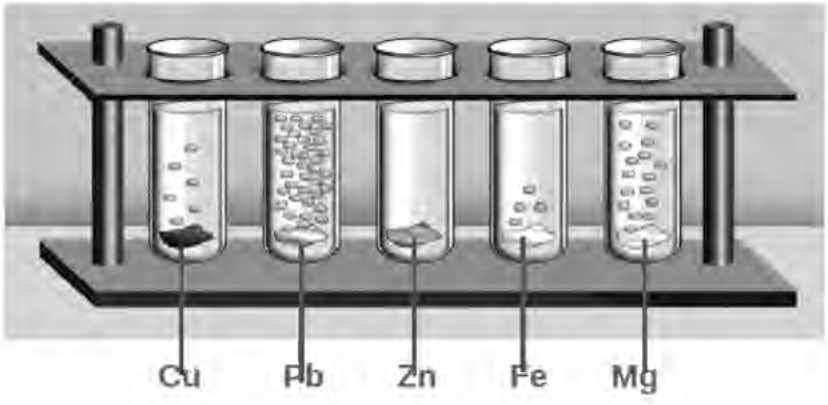
At a Glance

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.

- 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. ie, It is a redox reaction.
- Oxidation is the loss of electron
- Reduction is the gain of electron
- In Redox reaction oxidation and reduction takes place simultaneously.

Activity 1

Equal amounts of different metals are added in equal volumes of dil.HCl having same concentration. Observe the figure and answer the following.



a) Which is the highly reactive metal among these?

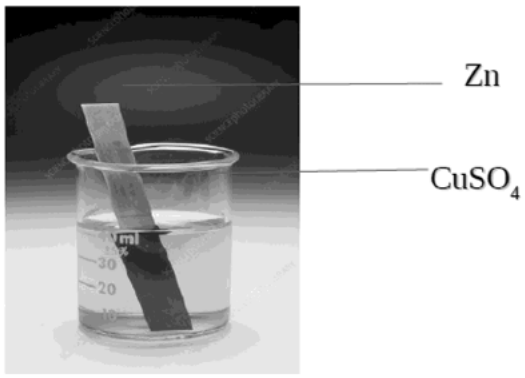
b) The metal which do not reacts with acid is .....

c) Name the gas obtained here.

d) Arrange these metals according to the increasing order of their reactivity

Activity 2

Observe the figure and answer the questions.



a) Write the changes that takes place on the surface of Zn rod and in the solution.

(b) Which chemical reaction takes place here?

(c) Write the chemical equation of this reaction?

Activity 3

Complete the table suitably.

The arrangement in which electrical energy isconverted to chemical energy	——— **A** ———-
.....**B**.....	Displacement reaction
Metals arranged in the decreasing order of their reactivity	——— **C** ———-
..... **D**	Galvanic cell

Activity 4

Some solutions and metals are given:

($CuSO_4$ Solution, $MgSO_4$ solution, Mg, Cu)

a) choose the appropriate ones to construct a galvanic cell and draw its diagram. Mark electron flow direction.

b) Which is the anode and cathode of the cell?

c) Write the chemical equation of the reaction at cathode.

d) Write the cell reaction.

Activity 5

Complete the table.

Process	Products	
	Anode	Cathode
Electrolysis of molten Sodium Chloride(NaCl)		
Electrolysis of acqueous Sodium Chloride solution(NaCl)		

ANSWER KEY

Activity 1

a) Mg

b) Cu

c) Hydrogen

d) Cu<Pb<Fe<Zn<Mg

Activity 2

a) A reddish brown substance deposited on the surface of the zinc rod and blue coloured coppersulphate solution changed to colourless .

b) Displacement reaction

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

Activity 3

A. Electrolytic cells

B. Metals having high reactivity displace the metals having less reactivity from their salt solution.

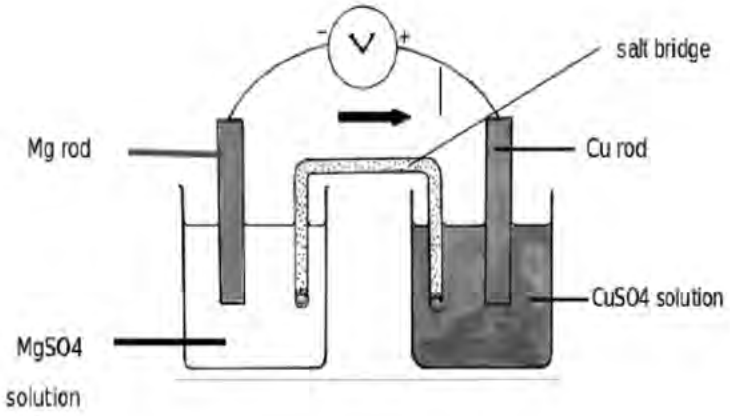
C. Reactivity series

D. An arrangement in which chemical energy is converted into electrical energy by means of a redox reaction.

Activity 4

a) $MgSO_4$ solution-Mg

$CuSO_4$ solution - Cu



b). Anode- Mg

Cathode- Cu

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

d) $Mg + Cu^{2+} \longrightarrow Mg^{2+} + Cu$

Activity 5

Process	Products	
	Anode	Cathode
Electrolysis of molten Sodium Chloride(NaCl)	Chlorine(Cl_2 gas)	Sodium(Na)
Electrolysis of acqueous Sodium Chloride solution(NaCl)	Chlorine(Cl_2 gas)	Hydrogen(H_2 gas)

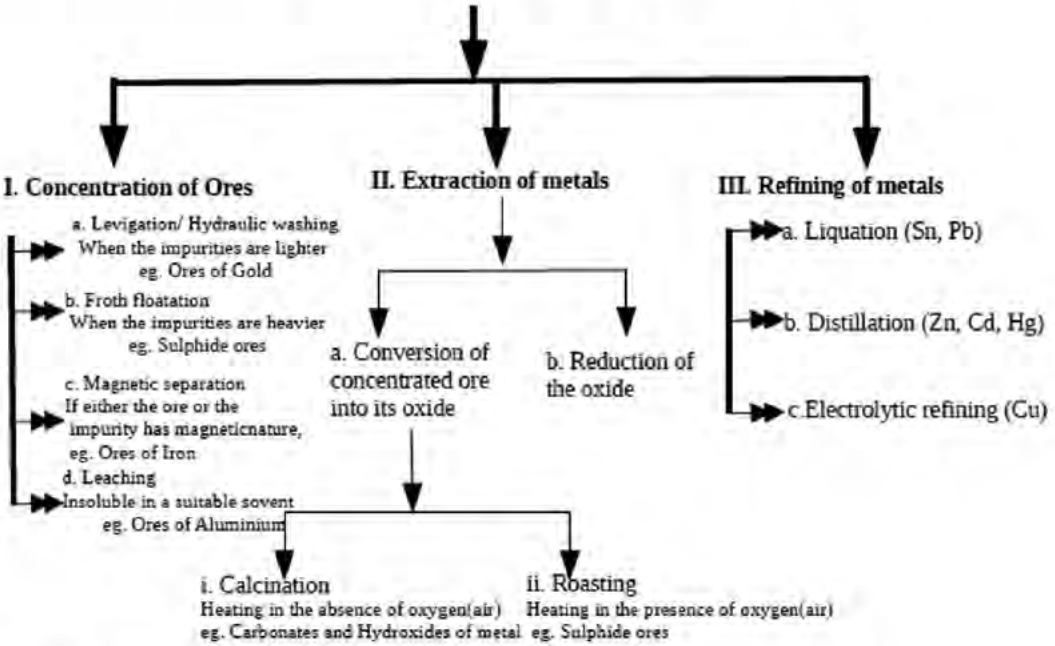
Chapter
04

PRODUCTION OF METALS

At a Glance

- Minerals - Minerals are the metallic compounds generally seen in earth crust
- Ores - A mineral from which a metal is economically, easily and quickly extracted, is called the ore of the metal.
- Metallurgy – Metallurgy involves all the processes leading to the separation of a pure metal from its ore.

The important stages in metallurgy:



- Industrial Production of Iron (Blast furnace)
- Extraction of Aluminium

	Iron	**Aluminium**
Ore	Haematite	Bauxite
Concentration method	Magnetic separation	Leaching
Reducing agent used	Carbon monoxide (CO)	Electricity

- Different types of Alloy steels

Activity 1

Fill in the blanks suitably.

Metals	Ore	Chemical formula
Aluminium	.....(a).....	$Al_2O_3.2H_2O$
.....(b).....	Haematite	Fe_2O_3
Copper	.....(c).....	$CuFeS_2$
Zinc	Calamine	.....(d).....

Activity 2

Complete the table.

Ore	Method of Concentration
Ore of Gold	.....i.....
Zinc blende	.....ii.....
.....iii.....	Leaching
Tin stone	.....iv.....

Activity 3

Pick out the statements related to calcination.

(a) Process of heating the concentrated ore in the absence of air at a temperature below its melting point

(b) Process of heating the concentrated ore in a current of air at a temperature below its melting point

(c) Sulphide ores combines with oxygen to form their oxides

(d) Carbonates and hydroxides of metals decompose to form their oxides.

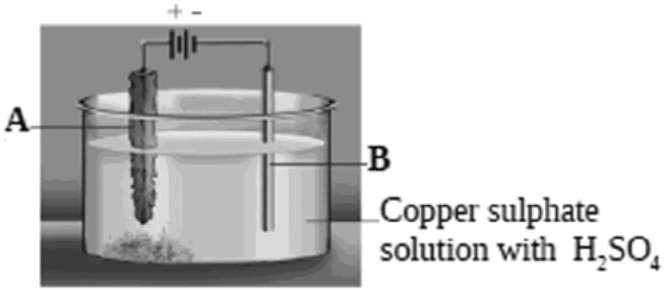
Activity 4

The given box contains some metals and their method of refining. Pair them suitably.

Mercury, Tin, Cadmium, Copper, Lead, Zinc, Liquation, Distillation, Electrolytic refining

Activity 5

Observe the given figure showing the refining of copper and answer the following questions.



(a) Identify A and B

(b) Write the equation of the chemical reaction taking place at cathode

(c) Write the equation of the chemical reaction taking place at anode

Activity 6

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

$C + O_2 \longrightarrow CO_2 + Heat$

$CO_2 + C + Heat \longrightarrow CO$

$CaCO_3$ (Limestone) $\longrightarrow CaO + CO_2$

$CaO + SiO_2 \longrightarrow CaSiO_3$ (Calcium silicate)

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

a. Write the chemical formula of iron ore

b. Write the chemical equation of slag formation

c. Identify the gangue and flux

d. Write the equation of reduction.

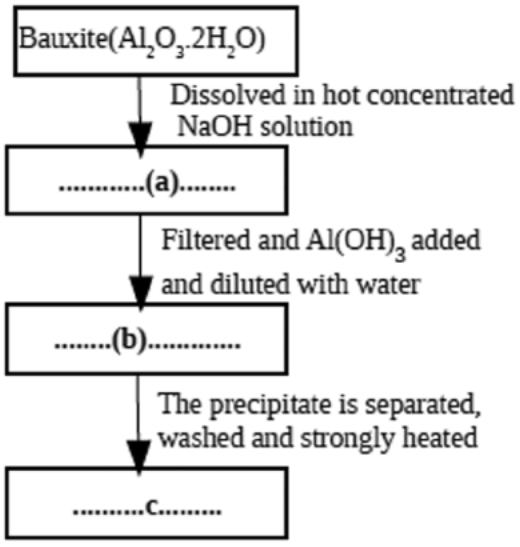
Activity 7

Match the given table suitably

Alloy steels	**Properties**	**Uses**
Stainless steel	Magnetic nature	For making heating coils
Alnico	High resistance	For the manufacture of parts of vehicles
Nichrome	Hard	For making permanent magnets

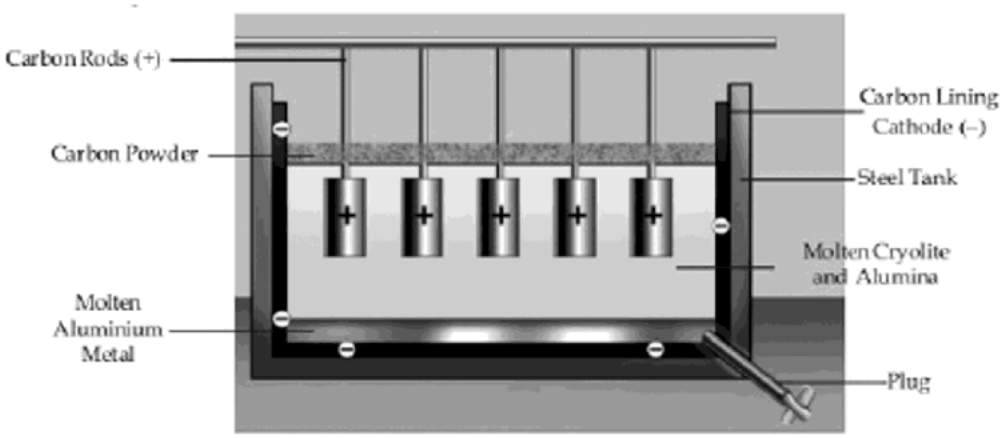
Activity 8

Complete the given flow chart related to concentration of bauxite.



Activity 9

Analyse the diagram of the electrolysis of Alumina is given below and answer the following questions.



a) Name the reducing agent used in the extraction of Aluminium.

b) Why Cryolite is added to alumina during electrolysis ?

c) Write the chemical equation of the reaction taking place at the cathode.

d) Why do we replace the carbon anodes at regular intervals ?

e) Write the equation of chemical reaction taking place at the anode.

ANSWER KEY

Activity 1

(a) Bauxite

(b) Iron

(c) Copper pyrites

(d) $ZnCO_3$

Activity 2

i . Levigation/ Hydraulic washing

ii. Froth floatation

iii. Bauxite

iv. Magnetic separation

Activity 3

(a) Process of heating the concentrated ore in the absence of air at a temperature below its melting point

(d) Carbonates and hydroxides of metals decompose to form their oxides.

Activity 4

Mercury - Distillation -
Tin - Liquation
Cadmium - Distillation
Copper - Electrolytic refining
Lead - Liquation
Zinc - Distillation

Activity 5

(a) A - Impure Copper(Anode)
B - Pure Copper (Cathode)

(b) $Cu \longrightarrow Cu^{2+} + 2e^-$

(c) $Cu^{2+} + 2e^- \longrightarrow Cu$

Activity 6

a. Fe_2O_3

b. $CaO + SiO_2 \longrightarrow CaSiO_3$ (Calcium silicate)

c. Gangue - SiO_2
Flux - CaO

d. $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

Activity 7

Alloy steels	Properties	Uses
Stainless steel	Hard	For the manufacture of parts of vehicles
Alnico	Magnetic nature	For making permanent magnets
Nichrome	High resistance	For making heating coils

Activity 8

(a) Sodium aluminate ($NaAlO_2$)

(b) Aluminium Hydroxide ($Al(OH)_3$)

(c) Alumina (Al_2O_3)

Activity 9

(a) Electricity

(b) Cryolite is used to reduce the melting point of alumina and also to increase the conductivity.

(c) $Al^{3+} + 3\ e^- \longrightarrow Al$

(d) The oxygen formed during the electrolysis react with carbon blocks and forms CO_2 gas. Hence thickness of blocks decreases and we have to replace it regularly.

(e) $2O^{2-} \longrightarrow O_2 + 4^{e-}$
$C + O_2 \longrightarrow CO_2$

Chapter
05

COMPOUNDS OF NON-METALS

At a Glance

- Ammonium chloride and calcium hydroxide are used in the laboratory preparation of ammonia.
- Physical properties of ammonia — Basic in nature
  - — Colourless
  - — Pungent smell
  - — Solubility in water is very high
  - — Density less than air
- Highly concentrated aqueous solution of ammonia — Liquor Ammonia
- Liquified ammonia by using high pressure — Liquid Ammonia
- **Chemical Reaction**

Chemical Reaction

Irreversible Reaction	Reversible Reaction
(Reactant $\longrightarrow$ Product)	Forward reaction (Reactant $\rightleftharpoons$ Product) Backward reaction
eg: $C + O_2 \longrightarrow CO_2$	$N_2 + 3H_2 \rightleftharpoons 2NH_3$

- Chemical equilibrium
- Le-Chatelier's Principle
- Influence of various factors on equilibrium in a reversible reaction

Concentration-If the concentration of the reactant increases, rate of forward reaction increases. If the concentration of the product increases rate of backward reaction increases.

Pressure - If pressure increases, reaction increases in the direction where total number of gaseous molecules decreases and vice versa. Pressure has no effect in a system having same number of molecules of gaseous reactants and products.

Temperature- If temperature increases rate of endothermic reaction increases. If temperature decreases rate of exothermic reaction increases.

Catalyst- Catalyst increases the rate of both forward and backward reaction to same extent. As a result the system reaches the equilibrium at a faster rate.

It is no beneficial to add a catalyst in a system which has already attained equilibrium.

- Industrial preparation of sulphuric acid– Contact Process
- Physical properties of sulphuric acid
  - Colourless
  - Comparatively high viscosity
  - Highly corrosive
  - Denser than water
  - Dissolves in water
- Chemical properties of H_2SO_4
  - Dehydrating nature
  - Drying nature
  - Concentrated sulphuric acid can displace volatile acid from their salts
- Identification of Sulphate Salt

Activity 1

a) Which are the chemicals required for the preparation of ammonia in the laboratory?

b) Which is the drying agent used to remove moisture from ammonia?

c) The gas jar used for collecting ammonia is kept inverted. Why?

d) If we show a red wet litmus paper over ammonia gas, what change can be observed?

e) Which property of ammonia is shown here ?

Activity 2

Observe the following chemical equation and write the forward and backward reaction in each

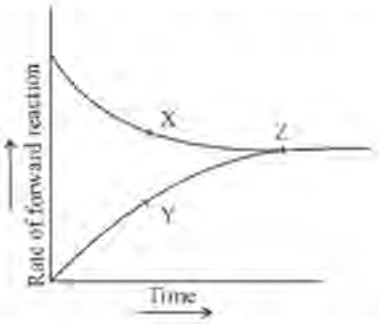
a) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$

b) $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$

c) $NH_4Cl(s) \rightleftharpoons NH_{3(g)} + HCl_{(g)}$

Activity 3

The following graph shows a reversible reaction.



a. Identify the reaction X and Y from the graph.

b) Denote the point in which both the forward and backward reactions become equal.

c) What is the name of this stage.

d) Write any two characterestics of this stage.

Activity 4

$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} + \text{Heat}$

How does the following factors influence the rate of forward reaction?

a) Ammonia is removed from the system.

b) Temperature is increased

c) Pressure is increased

d) More nitrogen is added

Activity 5

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

a) How many number of moles of reactants and products exist here?

b) What is the effect of pressure in this reversible reaction?

Activity 6

$2SO_{2\,(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} + \text{Heat.}$

It represents an important stage in the industrial preparation of sulphuric acid.

a) By what name is the industrial preparation of sulphuric acid known?

b) Which is the catalyst used in this process?

c) What will happen if the catalyst is added to this system at equilibrium?

Activity 7

A few drops of concentrated sulphuric acid is added to sugar in a watch glass.

a) What do you observe?

b) Which property of sulphuric acid is shown here?

Activity 8

When Barium chloride is added to a salt solution, a white coloured precipitate is formed. It is insoluble in dilute hydrochloric acid.

a) What is this white precipitate?

b) Which salt can be identified by this method?

ANSWER KEY

Activity 1

a) Ammonium chloride and Calcium hydroxide (NH_4Cl , $Ca(OH)_2$)

b) CaO

c) Because ammonia is less denser than air.

d) The red litmus changes to blue.

e) Ammonia is basic in nature.

Activity 2

Forward Reaction	Backward reaction
$H_{2(g)} + I_{2(g)} \rightarrow 2HI_{(g)}$	$2HI_{(g)} \rightarrow H_{2(g)} + I_{2(g)}$
$2SO_{2\,(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$	$2SO_{3(g)} \rightarrow 2SO_{2\,(g)} + O_{2(g)}$
$NH_4Cl(s) \rightarrow NH_{3(g)} + HCl_{\,(g)}$	$NH_{3(g)} + HCl_{\,(g)} \rightarrow NH_4Cl_{(s)}$

Activity 3

a. X- Forward reaction, Y- Backward reaction

b. Z

c. Equilibrium state

d i. At equilibrium both the product and reactant co exist.

ii. The rate of forward and backward reaction become equal at equilibrium.

iii. Chemical equilibrium is dynamic at the molecular level.

iv. Chemical equilibrium is attained in closed systems. (Any Two)

Activity 4

a. Increases

b. Decreases

c. Increases

d. Increases

Activity 5

a. Total number of reactants = 2 mol

Total number of products = 2 mol

b. Since total number of moles of gaseous reactants and products are equal , the pressure has no effect in the chemical equilibrium.

Activity 6

a. Contact process

b. V_2O_5, Vanadium pentoxide

c. Catalysts has no effect in a system at equilibrium.

Activity 7

a. Sugar get charred .

b. Dehydration Property

Activity 8

a. Barium Sulphate, $BaSO_4$

b. sulphate salt

Chapter 6

NOMENLCATURE OF ORGANIC COMPOUNDS AND ISOMERISM

At a Glance

Hydrocarbons

Alkanes	Alkenes	Alkynes
C_nH_{2n+2}	C_nH_{2n}	C_nH_{2n-2}
$CH_3 - CH_3$	$CH_2 = CH_2$	$CH \equiv C - CH_3$
Wordroot + ane	Wordroot + ene	Wordroot + yne

- IUPAC Name Wordroot + ane Wordroot+ene Wordroot+yne
- A series of compounds which can be represented by a general formula and having a common difference of CH_2 between successive members is called homologous series.
- The members of homologous series show similarity in chemical properties. There is a regular gradation in physical properites.
- Atom or group of atoms which can replace a hydrogen atom of a hydrocarbon are called functional group. 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 properites is called isomerism.

Activity 1

Match the following

A	B	C
Alkanes	C_nH_{2n}	$CH_3 - CH_2 - CH_3$
Alkenes	C_nH_{2n-2}	$CH \equiv C - CH_3$
Alkynes	C_nH_{2n+2}	$CH_3 - CH = CH_2$

Activity 2

The structure of organic compound is given below

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

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

b) What is the position number of carbon atoms which contain the branch?

c) What is the name of the branch?

d) Write the IUPAC name of this compound?

Activity 3

Choose the IUPAC names of the following compounds from the bracket.

(2,3 – dimethyl pentane, Pent 2yne, Pent 1ene, Butane , 2- methyl pentane)

i) $CH_3 - CH_2 - CH_2 - CH_3$

ii) $CH_3 - CH_2 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$

iii) $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH - CH_3$

iv) $CH_3 - CH_2 - CH_2 - CH = CH_2$

v) $CH_3 - CH_2 - C \equiv C - CH_3$

Activity 4

Complete the table suitably

Compound	**Functional group**	**Name of functional group**	**IUPAC Name**
$CH_3 - CH_2 - OH$	–OH	Hydroxyl	a
H - COOH	b	Carboxylic	c
d	–Cl	e	2- Chloro butane
f	g	Alkoxy	Methoxy ethane

Activity 5

Write the chemical formula of the following compounds. Find out the isomer pairs and the type of isomerism.

a) $CH_3 - CH_2 - CH_2 - CH_3$

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

c) $CH_3 - CH_2 - O - CH_2 - CH_3$

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

e) $CH_3 - CH(CH_3) - CH_3$

f) $CH_3 - O - CH_2 - CH_2 - CH_3$

Activity 6

The structural forumula of a compound with chemical formula C_6H_{14} is given below

$CH_3 - CH_2 - CH(CH_3) - CH_2 - CH_3$

a) Write the IUPAC name of the compound.

b) Write any two chain isomer of the above compound and their IUPAC names.

ANSWER KEY

Activity 1

A	B	C
Alkanes	C_nH_{2n+2}	$CH_3 - CH_2 - CH_3$
Alkenes	C_nH_{2n}	$CH_3 - CH = CH_2$
Alkynes	C_nH_{2n-2}	$CH \equiv C - CH_3$

Activity 2

a) 5 b) 2 c) Methyl d) 2- methyl pentane

Activity 3

i) butane

ii) 2 – methyl pentane

iii) 2,3 – dimethyl pentane

iv) pent – 1 – ene v) pent -2 -yne

Activity 4

a) Ethanol

b) – COOH

c) Methanoic acid

d) $CH_3 - CH_2 - CH(Cl) - CH_3$

e) Chloro

f) $CH_3 - O - CH_2 - CH_3$

g) O – R

Activity 5

a) C_4H_{10}

b) $C_5H_{12}O$

c) $C_4H_{10}O$

d) $C_5H_{12}O$

e) C_4H_{10}

f) $C_4H_{10}O$

Isomer pairs

a , e - Chain isomers

b , d – Position isomers

c, f – Functional isomers

Activity 6

a) 3 – Methyl pentane

b) $CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$ (Hexane)

$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - CH_2 - CH_3$ 2 – methyl pentane

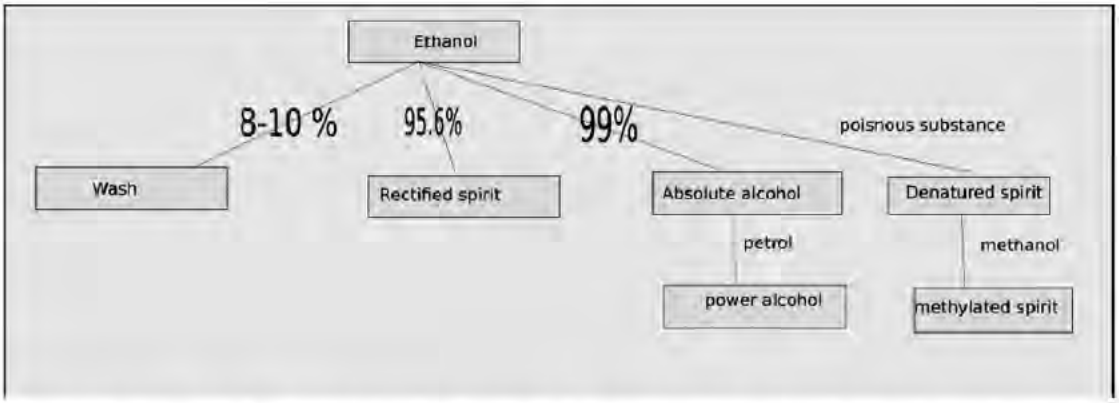
Chapter 7

CHEMICAL REACTIONS OF ORGANIC COMPOUNDS

At a Glance

Substitution reactions	Addition reactions	Polymerisation	Combustion	Thermal Cracking
A reaction in which an atom or a group in a compound is replaced by another atom or a group is called substitution reaction.	Reactions in which unsaturated organic compounds with double bond or triple bond react with other molecules to form saturated compounds are called addition reactions.	Polymerisation is the process in which a large number of simple molecules combine under suitable conditions to form complex molecules. The product molecules are called polymers.	When hydrocarbons burn they combine with the oxygen in the air to form CO_2 and H_2O along with heat and light.	Process in which hydrocarbons with high molecular masses, when heated in the absence of air undergo decomposition to form hydrocarbons with lower molecular masses.

Preparation of Methanol	Preparation of Ethanol
Industrially prepared by treating carbon monoxide with hydrogen in presence of catalyst at high temperature and pressure.	Ethanol is manufactured by fermenting dilute molasses by adding yeast. Within a few days it changes to ethanol in the presence of the enzymes invertase and zymase produced by yeast.



- Ethanoic acid is manufactured by treating methanol with carbon monoxide in the presence of catalyst.
- Esters are compounds which have the smell of fruits and flowers. Esters

are obtained by the reaction between carboxylic acids and alcohols. This reaction is esterification.

- Oils and fats are esters formed by the combination of the alcohol glycerol, and the fatty acids like palmitic acid, stearic acid, oleic acid etc. Soap is the salt formed when oils and fats react with alkalies.
- Detergents

  Most detergents are salts of sulphonic acid.
- Excessive use of the detergents causes environmental problems.

  The micro organisms in water cannot decompose the components of detergents. Hence the detergents released into water leads to the destruction of aquatic life.

  For example, the detergents which contain phosphate increases the growth of algae and limits the quantity of oxygen. Therefore, it decreases the quantity of oxygen for the breath of the organisms in water and causes their destruction.

Activity 1

A reaction in which an atom or a group in a compound is replaced by another atom or a group is called Substitution Reaction.

Fill in the blanks.

$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$

a) $CH_3Cl + Cl_2 \rightarrow$ ———— $+ HCl$

b) _____ $+ Cl_2 \rightarrow CHCl_3 + H Cl$

c) _____ $+ Cl_2 \rightarrow CCl_4 +$ _____

Activity 2

Reactions in which unsaturated organic compounds with double bond or triple bond react with other molecules to form saturated compounds are called addition reactions.

Fill in the blanks.

a) $CH_2 = CH_2 + H_2 \rightarrow$ ————

b) $CH_2 = CH_2 + HCl \rightarrow$ ————

Activity 3

Polymerisation is the process in which a large number of simple molecules combine under suitable conditions to form complex molecules.

a) What is the monomer of polyethene?

b) $n\ CH_2=CHCl \rightarrow$ ————

c) What is Teflon ? Write chemical formula? What is its use?

Activity 4

During combustion of hydrocarbons carbondioxide and water is formed.

Complete the reactions

$CH_4 + 2O_2 \rightarrow$

$2C_4H_{10} + 13O_2 \rightarrow$

Activity 5

Hydrocarbons with high molecular masses, when heated in the absence of air, undergo decomposition to form hydrocarbons with lower molecular masses; this process is called Thermal cracking.

Complete the equation.

$$CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3 \longrightarrow CH_3-CH=CH_2 + \cdots\cdots$$

Heptane (C_7H_{16}) Propene (C_3H_6)

Activity 6

Complete the reactions

Ethanol is produced by the fermentation of molasses in presence of yeast.

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

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

Activity 7

Esters are formed by the reaction of carboxylic acids with alcohols. Write the product formed when ethanoic acid reacts with ethanol.

$$CH_3-COOH + HO-CH_2-CH_3 \xrightarrow{\text{Con. sulphuric acid}}$$

ethanoic acid ethanol

Activity 8

Detergents are more effective than soap. Why?

ANSWER KEY

Activity 1

a) CH_2Cl_2

b) CH_2Cl_2

c) $CHCl_3$

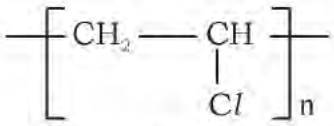
Activity 2

a) $CH_3 - CH_3$

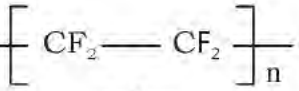
b) $CH_3 - CH_2Cl$

Activity 3

a) Ethene

b) 

Polyvinyl Chloride (PVC)

c) Teflon is the polymer of tetrafluroethene, 

Teflon

It is used for coating on inner surface of non stick cookware.

Activity 4

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + \text{Heat}$$

$$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O + \text{Heat}$$

Activity 5

$$CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_2 - CH_2 \longrightarrow$$

Heptane (C_7H_{16})

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

Propene (C_3H_6) Butane (C_4H_{10})

Activity 6

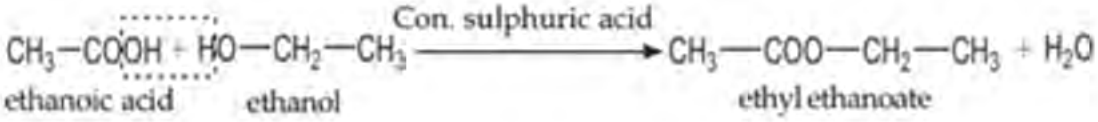
$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Invertase}} C_6H_{12}O_6 + C_6H_{12}O_6$$

Sucrose (Sugar) Glucose Fructose

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

Ethanol

Activity 7



Activity 8

Soap does not lather well in hard water. The hardness of water is due to dissolved calcium and Magnesium salt in it. These salts react with soap to form insoluble compounds resulting in the decrease of lather. But detergents do not give insoluble components on reaction with these salts. Detergents can also be used in acidic solutions.

QUESTION POOL

UNIT 1

Periodic table and electronic configuration

1. All noble gases except Helium contain ——— electrons in the outermost shell. (2, 8, 10, 14)
2. How many subshells are there in the 4^{th} shell.
3. Which block contains more radioactive elements?
4. Which subshell is common to all shells?
5. Choose the subshell which is not possible.

   (1s, 2s, 2d, 5s)
6. The outermost subshell of transition elements is.....
7. Find out the wrong subshell electronic configuration from the following and correct it.

   1. $1S^2\ 2s^2\ 2p^6\ 3s^2$
   2. $1S^2\ 2s^2\ 3p^4$
   3. $1S^2\ 2s^3$
   4. $1S^2\ 2s^2\ 2p^5\ 3s^1$
   5. $1S^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3$
8. '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 the electronic configuration.
9. Subshell electronic configuration of some elements are given below. (Symbols are not real)

   A-[HC] $2s^1$

   B-[Ar] $4s^2$

   C-[Ar] $3d^6\ 4s^2$

   D- [NC] $3s^2\ 3p^6$

   (a) Write the atomic number of C

   (b) Which element has higher electronegativity.

(c) Which elements form coloured compounds.

10. Atomic number of iron(Fe) is 26.

(a) Write the subshell electronic configuration of iron.

(b) Find the number of electrons in Fe^{2+}

(c) Write the subshell electronic configuration of Fe^{2+}

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

Elements(Symbols not real)	Atomic Number
P	11
Q	18
R	27
S	26

(a) Which is the noble gas.

(b) Find the element in first group.

(c) Which elements show different valancy.

(d) Write the subshell electronic configuration of the elements and find its group, block and period.

12. (a) Write the subshell electronic configuration of Copper(Cu-29)

(b) Write the reason for this.

UNIT 2

Gas Laws And Mole Concept

1. If an inflated balloon is kept in sunlight, it will burst. Give reason. Which gas law is applicable to this situation?
2. How many GAM is present in 71g of chlorine? (Given atomic mass of chlorine 35.5) What is the total number of atoms in it?
3. What is the temperature and pressure at a STP?
4. The molecular mass of ammonia is 17.

(a) How much is the GMM of ammonia?

(b) Find out the number of moles of molecules present in 170g of ammonia?

(c) Calculate the volume of 170g of ammonia at STP?

(d) Calculate the number of ammonia molecules present in the above sample of ammonia?

5. A balloon is being inflated. Name the gas law associated with it.

UNIT 3

Reactivity series and Electrochemistry

1. In Fe-Cu galvanic cell, which electrode acts as anode?
2. A Zinc rod is dipped in $CuSO_4$ solution.
   a) Write the changes that takes place on the surface of Zn rod and in the solution.
   b) Which chemical reaction takes place here?
3. Analyse the given figures.

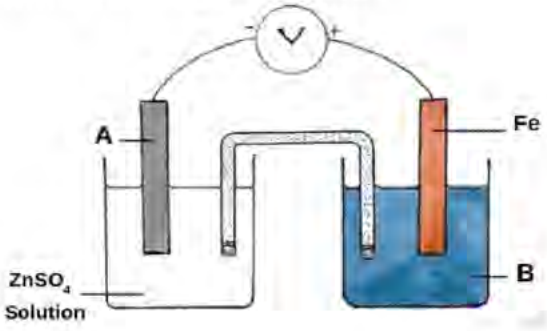
Figure A

Figure B

   a) In which of them displacement reaction will takes place?
   b) Write the equation of the oxidation reaction.
   c) Write the chemical equation of the redox reaction.
4. Some metals and solutions are given in the box

$MgSO_4$ solution, $FeSO_4$ solution, $ZnSO_4$ solution, $CuSO_4$ solution Ag rod, Mg rod, Pb rod, Cu rod

   (a) Select from the box the materials needed to construct a galvanic cell.
   (b) Which is the cathode of the cell constructed ?
   (c) Write down the equation for the chemical reaction occurs in anode?
5. The picture of a Galvanic cell is given below.



a) Identify A and B.

b) Give the direction of electron flow?

c) Write the equation of chemical reaction at cathode.

d) Which is the energy change takes place in the galvanic cell ?

6. The order of reactivity of some elements are given below. Based on this answer the following questions.

REACTIVITY SERIES
Na>Mg>Zn>Fe>Ni>H>Cu

(a) On exposure to air, which element loses its luster most easily?

(b) The element that cannot displace Hydrogen from dil.Hcl.

c) Which of these elements reacts with hot water?

d) A fresh Mg ribbon loses its luster after a few days due to the formation of ——

e) Which element reacts vigorously with cold water?

UNIT 4
Production of metals

1. Find the relation and fill in the blanks.
   a) Iron - Haematite
   b) Aluminium- _____
2. Find the relation and fill up suitably
   a) Tin stone : Magnetic separation
   b) Bauxite : _____
3. Which among the following metals is refined by liquation?
   (Zinc, Copper, Mercury, Tin)
4. Which method is not a concentration of the ore among the following?
   (Levigation, Leaching, Magnetic separation, Calcination)
5. Calamine is the Ore of .....
6. ..... is the alloy steel used for the manufacture of permanent magnet.
7. a). Which method is used to concentrate Copper Pyrites ?.
   b). What property of the ore is utilized here ?.
8. a) What is the difference between calcination and roasting?
   b) Which method is used for converting sulphide ores to their oxides?

9. Bauxite ($Al_2O_3.2H_2O$), Cryolite (Na_3AlF_6) and Clay ($Al_2O_3.2SiO_2.2H_2O$) are the minerals of Aluminium.
   (a) Which one is the main ore of Al?
   (b) Write any two characteristics of minerals that are used for the extraction of metals?
10. a) The molten iron obtained from the blast furnace contains 4% carbon and other impurities. What is this known as ?
   b) Which alloy steel is used for making heating coils?
   c) Some alloy steels contain the same component. How do they possess different properties ?
11. Blast furnace is used for the industrial preparation of Iron.
   a) Name the ore of iron used in this process?
   b) Which are the substances fed into the furnace along with the ore?
   c) Complete the following equation

   $CaO + SiO_2 \longrightarrow \_(A)\_$

   Flux + ...B..... $\longrightarrow$ Slag

   d) Write down equation of the reduction of Haematite (Fe_2O_3).
12. Industrial production of Aluminium is by the electrolysis of alumina dissolved in molten cryolite.
   a). In which name the industrial production of aluminium is known as ?
   b). Write the reason for dissolving alumina in to molten cryolite .
   c). Write the equation of the reaction taking place at anode .
   d). Write down any one use of aluminium.

Unit 5
COMPOUNDS OF NONMETALS

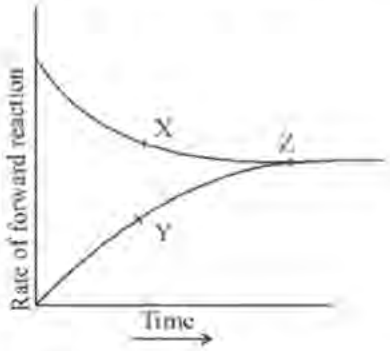
Answer to the following questions.

1. What gas evolved first when ammonium chloride is heated?
2. In which type of system equilibrium is possible?
3. Which substance is used as a drying agent in the laboratory preparation of ammonia?
4. A highly concentrated aqueous solution of ammonia is called——.
5. Complete the given chemical equation

   $NH_4Cl \longrightarrow$ ——— + HCl
6. When ammonia tanker leaks, water is sprayed to reduce its intensity. What is the reason for this?

7. $2SO_{2\,(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} + \text{Heat}$

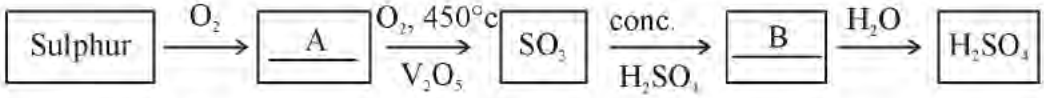
The graph of chemical reaction is given below.



a. Identify X,Y and write the chemical equation.

b. Chemical equilibrium is static in nature. Why?

8. Flow chart of industrial preparation of sulphuric acid is given. Complete it.



a. Find A,B

b. This process is known as ——

c. Which is the acid formed when concentrated sulphuric acid reacts with nitrate salt?

9. Reaction between Copper and concentrated sulphuric acid is given below.

$Cu + 2H_2SO_4 \longrightarrow CuSO_4 + 2H_2O + SO_2$

a. What happens to the copper? (Oxidation/ Reduction)

b. Which is the oxidising agent in this reaction?

10. Ammonium chloride is strongly heated in a boiling tube. A wet red litmus paper is shown at the mouth of the boiling tube.

a. What change happens to the litmus paper?

b. Which is the gas responsible for this change?

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

d. What is the white substance deposited at the inner side of boiling tube?

11. $2SO_2 + O_2 \rightleftharpoons 2SO_3 + \text{Heat}$

a. Which type of reaction is the forward reaction?
(Exothermic reaction/ Endothermic reaction)

b. What is the effect of increasing temperature at equilibrium?

c. What happens to the forward reaction when SO_3 is removed from the system in equilibrium?

d. What is the advantage of adding a catalyst, V_2O_5 in the beginning itself?

UNIT 6
Nomenclature of Organic Compounds and Isomerism

1. Which of the following is an alkane?

   (C_3H_6, C_4H_6, C_3H_8)

2. The homologue of the compound C_8H_{16} is ————————

   (C_7H_{16}, C_7H_{14}, C_7H_{12})

3. The main chain of a hydrocarbon contains 5 carbon atoms. In the third carbon atom there is a methyl group branch . Write the structural formula and IUPAC name of the compound.

4. Write all the possible isomers and IUPAC names of the compounds.

   $CH_3 - CH_2 - CH_2 - CH_2 - Cl$

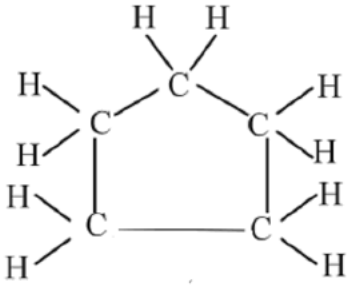
5. Write the IUPAC name

   $CH_3 - CH_2 - CH = CH - CH_3$

6. Write the IUPAC name and structure of any one functional isomer of the compound

   $CH_3 - CH_2 - OH$

7. The structure of cyclo pentane is given below. Write the structure of cyclohexane.

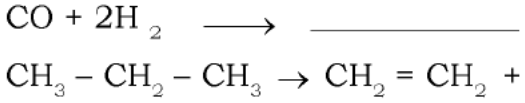


UNIT 7
Chemical reactions of organic compounds

Answer the following.

1. Detergents are salts of ————————————.
2. Name the carboxylic acid used to make ester CH_3COOCH_3
3. 5-8% Acetic acid is called ————————————.
4. ———————— is obtained as byproduct in the industrial production of soap, (Hot process)
5. What is the product obtained when methanol reacts with carbon monoxide?

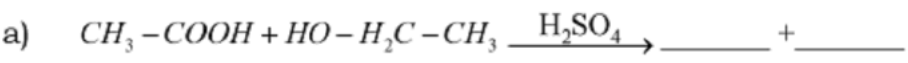
6. Write two uses of ethanol?
7. Complete the equations .



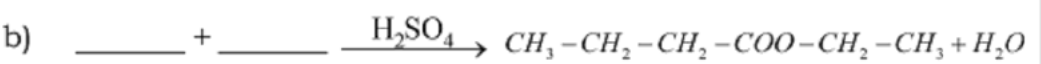
$CO + 2H_2 \longrightarrow$ _____

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

8. What is the monomer of PVC? Write any one use of PVC
9. Complete the equation.

a) 

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

b) 

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

10. **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
$CH_3 - CH_3 + Cl_2$	$\left[CH_2 - CH_2\right]_n$	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

ANSWER KEY

UNIT 1
Periodic table and electronic configuration

1. 8
2. 4
3. f
4. s
5. 2d
6. d
7. (a) $1s^2\ 2s^2\ 3p^4$ - $1s^2\ 2s^2\ 2p^4$
   (b) $1s^2\ 2s^3$ - $1s^2\ 2s^2\ 2p^1$
   (c) $1s^2\ 2s^2\ 2p^5\ 3s^1$ - $1s^2\ 2s^2\ 2p^6$
   (d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3$ - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^1$

8. (a) 22

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

9. (a) 26

   (b) D

   (c) C

10. (a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$

    (b) 24

    (c) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$

11. (a) Q

    (b) P

    (c) S

    Subshell electronic configuration - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5\ 3d^6\ 4s^2$

    Group – 8

    Period - 4

    Block - d

12. (a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$

    (b) Full or half filled d subshell has more stability.

UNIT 2
Gas Laws And Mole Concept

1. As temperature increases volume increases – Charles law
2. Number of GAM = 71/35.5 = 2

   Number of atoms = $2 \times 6.022 \times 10^{23}$
3. Temperarure – 273K Pressure – 1atm
4. a) 17 g

   b) Number of moles of molecules = 170/17 = 10

   c) Volume = 10×22.4 L

   d) $10 \times 6.022 \times 10^{23}$
5. Avogadro's law

UNIT 3
Reactivity series and Electrochemistry

1. Fe
2. a) Copper deposited on Zn rod and blue colour of Coppersulphate solution fades.

   b) Displacement reaction.

3. a) Figure A

   b) $Mg \longrightarrow Mg^{2+}+2e^-$

   c) $Mg+Zn^{2+} \longrightarrow Mg^{2+}+Zn$

4. (a) $MgSO_4$ solution, Mg rod $CuSO_4$ solution, Cu rod

   (b) Cu

   (c) $Mg \longrightarrow Mg^{2+}+2e^-$

5. a) A-Zn rod

   B-Salt solution of Fe

   b) From Zn to Fe

   c) $Fe^{2+} + 2\bar{e} \longrightarrow Fe$

   d) Chemical energy is converted into electrical energy.

6. (a) Na

   (b) Cu

   (c) Mg

   (d) magnesium Oxide (MgO)

   (e) Na

UNIT 4
Production of metals

1. Bauxite
2. Leaching
3. Tin
4. Calcination
5. Zinc
6. Alnico
7. a) Froth Floation

   b) Ore is less denser than gangue(impurity)

8. a) Calcination is the process of heating the concentrated ore in the absence of air at a temperature below its melting point

   Roasting is the process of heating the concentrated ore in a current of air at a temperature below its melting point

   b) Roasting

9. a) Bauxite ($Al_2O_3.2H_2O$)

   b) * Abundance

   * Easily and cheaply separable

   * High metal content

   (Any two)

10. a) Pig iron
    b) Nichrome
    c) The percentage composition of the component is different. So they have different properties.
11. a) Haematite
    b) Calcium carbonate ($CaCO_3$) and Coke(C)
    c) A - $CaSiO_3$
       B - Gangue
    d) $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$
12. a) Hall- Heroult process
    b) Cryolite is added to alumina to reduce its melting point and increase its electrical conductivity
    c) $2O^{2-} \longrightarrow O_2 + 4e^-$

       $C+O_2 \longrightarrow CO_2$
    d) Making cooking vessels,
       • making parts of vehicles (Any one)

Unit 5
COMPOUNDS OF NON-METALS

1. Ammonia
2. Closed system
3. CaO
4. Liquor ammonia
5. NH_3
6. Solubility of ammonia in water is very high.

7 a. X - Forward reaction, $2SO_{2\,(g)}+O_{2(g)} \longrightarrow 2SO_{3(g)}$

   Y - Backward reaction, $2SO_{3(g)} \longrightarrow 2SO_{2\,(g)}+O_{2(g)}$

   b. At equilibrium forward and backward reaction occur simultaneously at the same rate.

8. a. A-SO_2, B- $H_2S_2O_7$
   b. Contact process
   c. HNO_3 , Nitric acid
9. a. Oxidation
   b. Conc.H_2SO_4
10. a. Red litmus changes to blue.

b. Ammonia gas

c. Blue litmus changes to red, due to the frmation of HCl gas

d. Ammonium chloride

11. a. Exothermic reaction

b. Backward reaction increases (Forward reaction decreases)

c. Forward reaction increases

d. Catalyst increases the rate of both forward and backward reaction to the same extent. So the system reaches equilibrium at faster rate.

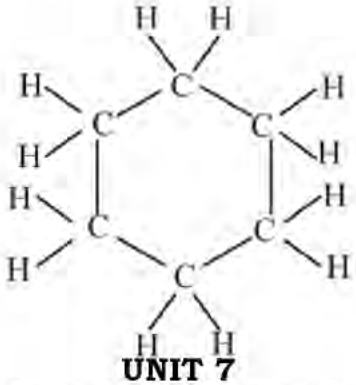
UNIT 6

Nomenclature of Organic Compounds and Isomerism

1. C_3H_8
2. C_7H_{14}
3. $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - CH_3$

   2 – methyl pentane
4. $CH_3 - \underset{\displaystyle Cl}{\underset{|}{CH}} - CH_2 - CH_3$

   2- chloro butane
5. Pent – 2 - ene
6. $CH_3 - O - CH_3$ methoxy methane.



UNIT 7

Chemical reactions of organic compounds

1. Sulphonic acids
2. Ethanoic acid CH_3COOH
3. Vinegar
4. Glycerol

5. CH_3COOH
6. In the manufacture of many organic compouns and paint .
7. a) CH_3OH
   b) CH_4
8. Vinyl chloride (Chloro ethene), used to make pipes.
9.

   a) $CH_3-COO-CH_2-CH_3, H_2O$

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

10.

$CH \equiv CH + H_2$	$CH_2 = CH_2$	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

ASSESSMENT TOOL - Set 1

CHEMISTRY

Time : 1½ hour **Maximum Score : 40**

General Instructions

- The first 15 minutes is cool - off time. You may use this time to read the question and plan your answer.
- Answer on the basis of instructions in each part.
- Consider score and time while answering.

Answer any FOUR questions from 1 to 5. Each carries 1 score. (4 × 1 = 4)

1. Which method is used for the concentration of sulphide ores?
2. 1 mole = _____L (In STP)
3. ..... is the monomer used for coating on the inner surface of non-stick cookwares?
4. Find the relation and fill up suitably.

   Liquified ammonia : Liquid ammonia

   Concentrated aqueous solution of ammonia : .....
5. Pick out the odd one.

   (C_2H_6 , C_3H_8 , C_5H_{10} , C_6H_{14})

Answer any FOUR questions from 6 to 10. Each carries 2 score.
(4 × 2 = 8)

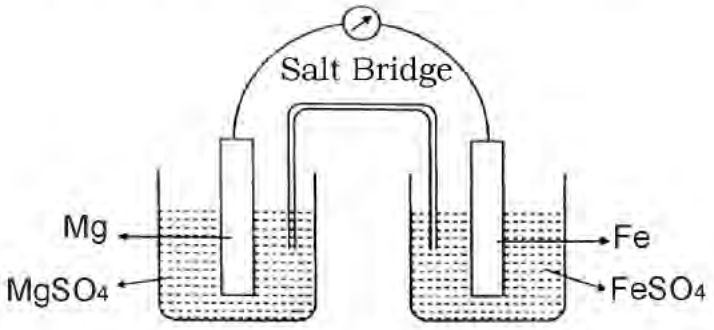
6. Choose the correct statements related to chemical equilibrium among the following.
   a. Chemical equilibrium is dynamic at the molecular level.
   b. Forward and backward reactions does not take place at equilibrium.
   c. Chemical equilibrium is attained in open systems.
   d. At the equilibrium both the reactants and the products coexist.
7. Complete the table suitably

Metals	Method of refining
Zinc	.....
Lead	.....

8. The outer subshell electronic configuration of an element is **$3d^5$ $4s^1$**.
   (a) Write the subshell electronic configuration in complete form.
   (b) Find the group and period of the element.

9. The pictorial representation of a Galvanic cell given below.

(Hint: Reactivity Ca>Mg> Zn>Fe>Cu)



(a) At which electrode does the oxidation reaction takes place?

(b) Write the chemical equation of the redox reaction taking place in the cell.

10. The structural formula of an organic compound is given.

$$CH_3 - CH_2 - CH_2 - CH_2 - CH - CH_3$$
$$\qquad\qquad\qquad\qquad\qquad\qquad\quad |$$
$$\qquad\qquad\qquad\qquad\qquad\qquad CH_2 - CH_3$$

(a) Write the position and name of the branch .

(b) Write the IUPAC name of this organic compound.

Answer any FOUR questions from 11 to 15. Each carries 3 score.

(4 × 3 = 12)

11. Analyse the given figures and answer the following questions.

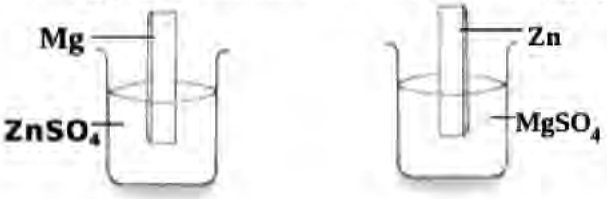


Figure A Figure B

(a) In which of the above do the displacement reaction takes place?

(b) Write the equation of the oxidation reaction.

(c) Write the chemical equation representing the redox reaction.

12. To 1 mL of Sodium Sulphate solution taken in a test tube, add two or three drops of Barium Chloride ($BaCl_2$) solution and then dilute Hydrochloric acid (HCl).

(a) What is the observation ?

(b) Which ions can be identified by this test?

(c) Write the chemical equation for this reaction

13. The relation between the volume and temperature of a fixed mass of gas at constant pressure is tabulated below.

Volume(L)	Temperature(K)
600	150
200	**A**
B	250

(a) Find out A and B.

(b) State the gas law related to this observation.

14. Copper can be coated on an iron bangle by Electroplating.

a) Which is the anode in this process ?

b) Which solution is used as electrolyte ?

c) Write the chemical equation for the reduction taking place at cathode.

15. Identify the pairs of isomers from the following compounds. Write the type of isomerism in each of these pairs.

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

(ii) $CH_3 - O - CH_3$

(iii) $CH_3 - CH_2 - CH_2 - OH$

(iv)
$$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$$

(v)
$$CH_3 - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_3$$

(vi) $CH_3 - CH_2 - OH$

Answer any FOUR questions from 16 to 20. Each carries 4 score.

(4 × 4 = 16)

16. Complete the given table suitably.

Element/ Compound	Molecular mass	Mass in grams	Number of Moles	Number of molecules
H_2	2	10	.....**A**.....	$5\times 6.022 \times 10^{23}$
CO_2	44	88	2	.....**B**.....
N_2	28	.....**C**.....	10	$10\times 6.022 \times 10^{23}$
H_2O	.....**D**.....	108	6	$6\times 6.022 \times 1023$

17. Equation showing the industrial preparation of ammonia is given below.

$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ + Heat

a) Which is the endothermic reaction?

b) What will be the effect, if the ammonia produced is removed continuously from the system?

c) What happens when the pressure of the system is increased?

d) What is the effect of catalysts in this system at equilibrium ?

18. Match the following suitably.

Reactants	**Products**	**Name of reaction**
$CH_4 + Cl_2$	$-[CH_2 - CH_2]-_n$	Thermal Cracking
$n\ CH_2=CH_2$	$CH_4 + CH_2=CH_2$	Polymerisation
$CH_3-CH=CH_2 + Cl_2$	$CH_3Cl + HCl$	Addition Reaction
$CH_3-CH_2-CH_3$	$CH_3 - CHCl - CH_2Cl$	Substitution Reaction

19. The picture of the electrolytic cell of aluminum is given below.

(a) The method used for the concentration of bauxite, an ore of aluminum, is .....

(b) Why alumina (Al_2O_3) is dissolved in cryolite (Na_3AlF_6) before electrolysis?

(c) Complete the given chemical equation related to reaction taking place at anode.

$$2O^{2-} \rightarrow O_2 + ...$$

(d) The anode is replaced periodically. What is the reason ?

20. The subshell electronic configuration of some elements are given.

(Symbols are not real)

P – $1s^2\ 2s^2\ 2p^6$

Q - $1s^2\ 2s^2\ 2p^6\ 3s^2$

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

S - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

(a) Which elements belong to same period ?

(b) Which element belongs to halogen family?

(c) Write one of the characteristic of the block in which the element R belongs.

(d) Which is the element that always show zero valency?

ASSESSMENT TOOL - Set 2

CHEMISTRY

Time : 1½ hour **Maximum Score : 40**

General Instructions

- The first 15 minutes is cool - off time. You may use this time to read the question and plan your answer.
- Answer on the basis of instructions in each part.
- Consider score and time while answering.

Answer any FOUR questions from 1 to 5. Each carries 1 score. (4 × 1 = 4)

1. Which among the following subshells have highest energy level ?

   (2p, 2s, 3d, 4s)

2. Identify the relation and complete

   Zinc : Calamine

   Aluminium : .....

3. Which gas law represents the relation between volume and temperature of a gas at constant pressure?

4. The functional group of carboxylic acid is _____

   (–OH, –COOH, –OR –COO–)

5. Name the by- product in the industrial production of soap.

Answer any FOUR questions from 6 to 10. Each carries 2 score. (4 × 2 = 8)

6. Pickout the properties of 'f' block elements from the following.
   a. Most of them shows different oxidition states.
   b. High ionisation energy
   c. Used as fuels in nuclear reactors
   d. Non metals.

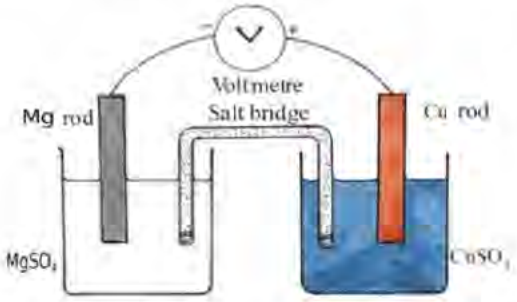
7. Equations related with the concentration of ores of Zinc are given below
   1) $ZnCO_3$ + Heat $\rightarrow$ ZnO + CO_2
   2) ZnS + O_2 + Heat $\rightarrow$ ZnO + SO_2
   a) Which of these equation represents roasting?
   b) How does roasting differs from calcination?

8. a) Find the molecular mass of Ammonia (NH_3) (Hint: Atomic mass of N=14, H=1)
   b) Calculate the number of molecules in 1 GMM of Ammonia.

9. Take some copper sulphate in a watch glass and add few drops of con. Sulphuric acid
   a. What is your observation?
   b. Which property of sulphuric acid is shown here?
10. $CH_3 - COO - CH_2 - CH_3$ is an Ester.
   a) Select the chemical formulae of chemicals used for the preparation of this ester from the following .
   (CH_3-CH_2-COOH, CH_3-COOH, CH_3-CH_2-OH, CH_3-OH)
   b) Write the chemical equation of this reaction.

Answer any FOUR questions from 11 to 15. Each carries 3 score.
(4 × 3 = 12)

11. Picture of a Galvanic cell is depicted below. (order of reactivity : Mg>Cu)



   (a) Write the chemical equation of the reaction taking place at anode
   (b) From which metal to which metal do the electron flow?
   (c) Write the energy change in a Galvanic cell.

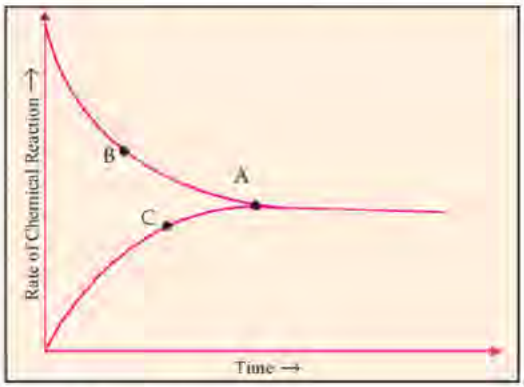
12. Balanced chemical equations related to the manufacture of ethanol are given below.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Invertase}} \mathbf{A} + C_6H_{12}O_6$$
Sucrose (Sugar) — Fructose

$$C_6H_{12}O_6 \xrightarrow{\mathbf{B}} 2C_2H_5\text{-}OH + 2CO_2$$
Ethanol

   (a) Identify A and B.
   (b) Ethanol produced by this method is known as .....
   (c) What is power alcohol ?

13. The graph given below is of a reversible reaction.



(a) Identify the forward reaction.

(b) At which point does the system attain equilibrium.

(c) Write any two characteristics of equilibrium

14. Structural formulae of two organic compounds are given.

i) $CH_3 - CH_2 - CH_2 - OH$

ii) $CH_3 - O - CH_2 - CH_3$

a) Write the molecular formulae of these two compounds.

b) Which type of isomerism is shown by them?

c) Write the structure of the position isomer of the first compound

15. Iron (Fe) is industrially produced in blast furnace.

(a) What is the function of carbon in blast furnace.

(b) Identify the flux and slag from the equation given below.

$$CaO + SiO_2 \longrightarrow CaSiO_3$$

(c) Name the iron obtained from blast furnace .

Answer any FOUR questions from 16 to 20. Each carries 4 score.
(4 × 4 = 16)

16. Electrolysis of molten sodium chloride (NaCl) is conducted.

a) Which are the ions present in the molten sodium chloride?

b) Which ion is attracted towards positive electrode ?

c) Write down the chemical equation of the reaction that takes place in cathode .

d) Which product is obtained at cathode when sodium chloride solution is electrolysed.

17. The structural formula of an organic compound is given below.

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

(a) Number of carbon atoms present in the main chain.

(b) Write the name of branch.

(c) Write the IUPAC name of this compound.

(d) What is the IUPAC name of the compound formed if the branch of the above compound is replaced by the functional group -OH.

18. The chemical formulae of two different oxides of Iron ($_{26}$ Fe) are given below.

(Oxidation state of Oxygen atom = - 2)

(i). Ferrous Oxide – FeO

(ii). Ferric Oxide – Fe_2O_3

a) In which compound Iron (Fe) shows +2 oxidation state ?

b) Write the subshell electronic configuration of Fe

c) Why does iron shows variable oxidation state.

d) Write another characteristics of the block in which 'Fe' includes.

19. Explain the effect of the following changes in the forward reaction of the given equilibrium.

$$2SO_{2(g)} + O_{2\,(g)} \rightleftharpoons 2SO_{3(g)} + \text{Heat}$$

(a) Pressure is increased.

(b) SO_3 formed is removed from the system.

(c) Temperature of the system is reduced.

(d) A suitable catalyst is used.

20. The molecular mass of CO_2 is 44.

a) What do you mean by one Gram molecular mass(1GMM)

b) Find the mass of 1GMM CO_2

c) Find the number of molecules in 1GMM CO_2

d) How many mol molecules are present in 220g CO_2.