Standard - X

CHEMISTRY

ആമുഖം

കൊല്ലം ജില്ലാ പഞ്ചായത്തും പൊതുവിദ്യാഭ്യാസ വകുപ്പും കൊല്ലം ഡയറ്റിന്റെ അക്കാദമിക പിന്തുണയോടെ പത്താം ക്ലാസ്സിലെ വിദ്യാർത്ഥികൾക്ക് വേണ്ടി തയ്യാറാക്കിയിട്ടുള്ള പഠനസാമഗ്രിയാണ് **'ഉജ്ജ്വലം'**. എസ്.എസ്.എൽ.സി. പരീക്ഷ എഴുതുന്ന കൊല്ലം ജില്ലയിലെ മുഴുവൻ വിദ്യാർത്ഥികൾക്കും പഠനനേട്ടങ്ങൾ ഉറപ്പാക്കി പരീക്ഷാഫലം മെച്ചപ്പെടുത്തുക എന്നതാണ് പദ്ധതിയുടെ ലക്ഷ്യം. കോവിഡ് കാലഘട്ടത്തിൽ സ്വാഭാവിക ക്ലാസ്സന്തരീക്ഷം സാധ്യമല്ലാതിരുന്ന സാഹചര്യത്തിലുണ്ടായ പഠനവിടവ് പരിഹരിക്കുന്നതിനും വിദ്യാഭ്യാസ പ്രവർത്തനങ്ങൾക്ക് ശക്തിപകരുന്നതിനും വേണ്ടി നൂതന സാങ്കേതികവിദ്യയുടെ കൂടി സഹായത്തോടെ തയ്യാറാക്കിയ പഠനസാമഗ്രിയാണിത്. കഴിഞ്ഞ വിദ്യാലയ വർഷം എസ്.എസ്.എൽ.സി പരീക്ഷയിൽ 'A+' കളുടെ എണ്ണം വർദ്ധിപ്പിക്കുന്നതിന് ഉജ്ജ്വലത്തിലൂടെ സാധിച്ചിട്ടുണ്ട്. ഈ പഠനസഹായി ഉപയോഗിച്ചുകൊണ്ട് 60% പരീക്ഷാചോദ്യങ്ങൾക്ക് ഉത്തരം കണ്ടെത്താൻ കുട്ടികൾക്ക് കഴിഞ്ഞു. എസ്.എസ്.എൽ.സി. പരീക്ഷയെ സ്വാഭാവിക സന്ദർഭത്തിൽ ആത്മവിശ്വാസത്തോടെ ഏറ്റെടുക്കുന്നതിന് വിദ്യാർത്ഥികളെ സഹായിക്കുന്ന വിധത്തിലാണ് ഇതിലെ ഓരോ യൂണിറ്റും ക്രമീകരിച്ചിരിക്കുന്നത്. ഒപ്പം മാതൃകാചോദ്യങ്ങളും ഉൾപ്പെടുത്തിയിട്ടുണ്ട്. കുട്ടികൾക്ക് സ്വന്തമായും അദ്ധ്യാപകരുടെ ഇടപെടലോടെയും പഠനം ഉറപ്പാക്കുന്ന രീതിയിലാണ് ഇത് രൂപകല്പന ചെയ്തിരിക്കുന്നത്. ക്ലാസ്റൂം പഠന പ്രവർത്തനങ്ങളോടൊപ്പം സ്വാഭാവിക സന്ദർഭം കൂടി ഒരുക്കി കുട്ടികളെ ആത്മവിശ്വാസത്തോടെ പരീക്ഷ എഴുതാൻ പ്രാപ്തരാക്കുന്നതിന് അദ്ധ്യാപകർ ശ്രദ്ധിക്കേണ്ടതാണ്. **'ഉജ്ജ്വലം'** പഠനസാമഗ്രി പരമാവധി പ്രയോജനപ്പെടുത്തി പ്രതിജ്ഞാബദ്ധതയോടുകൂടി അക്കാദമിക പ്രവർത്തനങ്ങളിലേർപ്പെട്ട് ജില്ലയിലെ എസ്.എസ്.എൽ.സി വിജയം 100% ഉറപ്പാക്കുന്നതിന് എല്ലാവിധ ആശംസകളും നേർന്നുകൊള്ളുന്നു.

വിജയാശംസകളോടെ...

സാം കെ. ഡാനിയേൽ
പ്രസിഡന്റ്, കൊല്ലം ജില്ലാ പഞ്ചായത്ത്

ഡോ. പി.കെ. ഗോപൻ
ചെയർപേഴ്സൺ, ആരോഗ്യ വിദ്യാഭ്യാസ സ്റ്റാന്റിംഗ് കമ്മിറ്റി,
ജില്ലാ പഞ്ചായത്ത്, കൊല്ലം.

ലാൽ കെ.ഐ
വിദ്യാഭ്യാസ ഉപഡയറക്ടർ, കൊല്ലം.

ഡോ. എസ്. ഷീജ
പ്രിൻസിപ്പാൾ - ഇൻ - ചാർജ്, ഡയറ്റ്, കൊല്ലം.

PREPARED BY

1. **Praseeda. P. N**
   GHS, Yeroor
2. **Shebi. Y**
   Gurudeva HS, Piravanthoor
3. **Indira. M**
   Govt, HSS, Vallikkeezhu
4. **Anzar M**
   GHSS, Anchalummoodu
5. **Bens Baby**
   St. John VHSS, Ummannoor
6. **Jency P. J**
   GHSS, Oachira
7. **Soorya M. S.**
   GHSS, Chavara

Accademic Supervision

Balanchandran. G
Lecturer, Diet, Kollam

CONTENTS

UNIT 1

Periodic Table and Electronic Configuration

- In modern periodic table elements are arranged in the increasing order of their atomic numbers.
- According to the Bohr Model, electrons are arranged in various shells around the nucleus.
- The shells are named as K, L, M, N etc.
- Each shell has subshells equal to the shell number.
- The subshells are named as s, p, d, f
-

Shell number	1	2		3			4			
Shells	K	L		M			N			
Maximum number of electrons in shells	2	8		18			32			
Subshells	1s	2s	2p	3s	3p	3d	4s	4p	4d	4f
Maximum number of electrons in subshells	2	2	6	2	6	10	2	6	10	14

- Shells are energy levels and each sub-energy level in a shell is called subshell.
- Electrons are arranged in subshells according to their increasing order of energy, ie.

  1s ∠ 2s ∠ 2p ∠ 3s ∠ 3p ∠ 4s ∠ 3d ∠ 4 p ∠ 5s …..
- Noble gases are including in the 18th group of periodic table. The subshell electronic configuration of elements can write with the symbols of noble gases.

  eg : $_{11}Na$ – $1s^2\ 2s^2\ 2p^6\ 3s^1$

  Short form – [Ne] $3s^1$

- The block to which the element belongs will be the same as the subshell to which the last electron is added.
- period number – Largest shell number refers to the period number. (outermost shell number)
- Group number – s block : number of electrons in the outermost 's' subshell.

  p block : number of electrons in the outermost 'p' subshell + 12

  d block : number of electrons in the outermost 's' subshell + penultimate 'd' subshell.

Characteristics of elements in different blocks

s block
- Group 1, 2 elements
- Shows metallic character
- Group 1 $\rightarrow$ +1 oxidation states

  Group 2 $\rightarrow$ +2 oxidation states
- Low ionisation energy
- Low electro negativity
- Ionic compounds forms basic oxides
- Largest elements in each period included in s- block

p block elements
- 13 – 18 group elements
- Elements in the solid, liquid, gaseous states exists in this block.
- Metals, non-metals and metalloids are included in this block.
- Elements shows +ve and –ve oxidation states.

d block elements (Transition elements)
- Metals
- 3-12 group elements
- Shows variable oxidation states
- Similar characteristics in groups as well as in periods
- Forms coloured compounds.

f block elements (Inner transition elements)

- Lanthanoids and actinoids
- They are included in 6^{th} and ^{7th} periods
- Various oxidation states
- Many of them used as catalysts in the petroleum industry.
- Used as fuels in nuclear reactors (U, Th, Pu)
- Most of the actinoids are radioactive elements.

- Subshells with half filled or completely filled electronic configurations have extra stability.

$_{24}Cr$ - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$

Or

$[Ar]\ 3d^5\ 4s^1$

$_{29}Cu$ - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2\ 3p^6\ 3d^{10}\ 4s^1$

Or

$[Ar]\ 3d^{10}\ 4s^1$

SECTION A

(Score - 1)

1. What is the basis of classification of elements in the modern periodic table?
2. As the distance from the nucleus increases, the energy of the shells …….. (increases/decreases)
3. The atomic number of Argon is 18. How many electrons are there in the outermost M shell of this element?
4. Which subshell is common to all shells?
5. 2s is the subshell of which shell?

6. The maximum number of electrons that can be accommodated in 'f' subshell is ……?
7. How many subshells are there in 'N' shell?
8. The element $^{8}_{4}Be$ includes in which block?
9. Which of the following subshell has the highest energy? (3s, 2p, 3d, 4s)
10. The outermost electronic configuration of an element X is $3s^2\ 3p^5$. Find the atomic number of this element? (symbol is not real)
11. Find the oxidation state of Mn in Mn_2O_7?
12. The outermost electronic configuration of an element is $3d^6\ 4s^2$. This element belongs to which group?
13. Which of the following is the characteristic property of 'd' block elements?
    i) used as fuels in nuclear reactors.
    ii) gives coloured compounds.
    iii) ionization energy is very low.
14 Write the subshell electronic configuration of $_{11}Na$ by using the symbol of the preceeding noble gas?
15 Which type of chemical bonding is commonly present in Compound of 's' block elements?
16. Which of the following shell has only one subshell? (K, L, M, N)

SECTION B

(Score - 2)

1. The outermost electronic configuration of an element is $3d^2\ 4s^2$.
    a) Write the complete subshell electronic configuration of this element?
    b) What is it's atomic number?
2. Examine the following subshell electronic configurations
    i) $1s^2\ 2s^2\ 2p^6\ 3s^1$ ii) $1s^2\ 2s^2\ 2p^7$ iii) $1s^2\ 2s^2\ 2p^5\ 3s^2\ 3d^1$
    a) Pick out the wrong electronic configurations.

b) Correct the wrong electronic configurations (without changing the atomic numbers)

3. Which of the following is the characteristic property of 'p' block elements?

   a) Shows similarity in groups as well as in periods.

   b) Metals, non-metals and metalloids belongs to this block.

   c) The element having highest electro negativity belongs to this block.

   d) The last electron enters to the penultimate shell.

4. Atomic number of Fe is 26.

   a) Write the oxidation state of Fe in $FeCl_3$?

   b) Write the subshell electronic configuration of Fe ion in $FeCl_3$?

5. The third shell of an element contains 1 electron.

   a) Write the subshell electronic configuration of this element?

   b) Find the valency of this element?

SECTION C

(Score - 3)

1. Two students wrote the subshell electronic configuration of Chromium as

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

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

   a) Which one is the correct electronic configuration?

   b) Justify your anwer?

2. Two chlorides of copper are CuCl and $CuCl_2$

   a) What is the oxidation state of Cu ion in both these compounds?

b) Write the subshell electronic configuration of Cu in $CuCl_2$?

c) Why Cu shows different oxidation states?

3. The outermost subshell electronic configurations of the elements P and Q are given (symbols are not real)

   P – $3s^2$ Q – $3s^2\ 3p^5$

   a) What is the valency of P?

   b) Which element shows metallic character?

   c) Write the chemical formula of the compound formed by P and Q.

4. The subshell electronic configuration of an element A is given, (symbols are not real)

   A – $1s^2\ 2s^2\ 2p^5$

   a) Write the subshell electronic configuration of an element B, which is placed just below A in the same group.

   b) Write the atomic number of the element C next to A in the same period?

   c) Which among them A, B, C is an inert gas?

5. Examine the electronic configuration given, and write the answers of the questions given below.

   X – $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$

   Y – $1s^2\ 2s^2\ 2p^5$

   Z – $1s^2\ 2s^2\ 2p^6\ 3s^2$

   a) Which element has highest electronegativity?

   b) Which element shows (-2) oxidation states?

   c) Which among these has lowest ionization energy?

SECTION D

(Score - 4)

1. Match the following.

A	B
(i) s block	(a) gives coloured compounds
(ii) p block	(b) low ionisation energy
(iii) d block	(c) used as catalyst in petroleum industry
(iv) f block	(d) high ionisation energy

2. Complete the table by finding the block group and period.

Subshell electronic configurations	Group	Period	Block
$1s^2\ 2s^2\ 2p^6\ 3s^1$	(a)	3	(b)
$1s^2\ 2s^2\ 2p^4$	(c)	2	(d)
$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$	(e)	4	(f)
$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$	14	(g)	(h)

3. Observe the table given below and write the answers of the questions given below.

A	B
X	$[Ar]\ 3d^5\ 4s^2$
Y	$[Ne]\ 3s^1$
Z	$[Ne]\ 3s^2\ 3p^5$

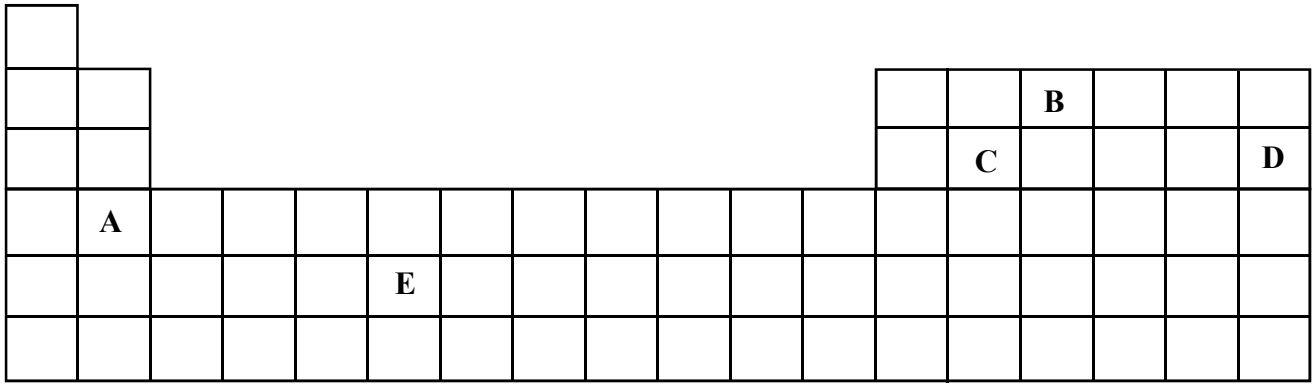
a) Which element shows similarity in properties both in groups and in periods?

b) The element Z belongs to which block?

c) What is the atomic number of the element Y?

d) How many electrons will be denated the element Y, when it undergoes a chemical reaction.

4. The part of a periodic table is given.



a) Which element belogns to 'd' block?

b) Which element's outermost electrons fill in the 3p subshell?

c) Which element shows highest metallic character?

d) Write any one characteristics of the block in which the element D belongs?

SCORING KEY

(SECTION A - Score 1)

1)	Atomic number	2)	Increase	3)	8
4)	s	5)	L (2^{nd} shell)	6)	14
7)	4	8)	s block	9)	3d
10)	17	11)	+7	12)	8
13)	(ii) gives coloured compounds	14)	[Ne] $3s^1$	15)	Ionic bonding

16) K

(SECTION B - Score 2)

1) a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2\ 4s^2$ b) 22

2) a) (ii), (iii)

b) ii) $s^2\ 2s^2\ 2p^6\ 3s^1$ iii) $1s^2\ 2s^2\ 2p^6\ 3s^2$

3) (b), (c)

4) a) +3

b) Fe^{+3} - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5$ / [Ar] $3d^5$

5) a) $1s^2\ 2s^2\ 2p^6\ 3s^1$ OR [Ne]$3s^1$ b) 1

(SECTION C - Score 3)

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

b) half filled (d^5) or completely filled (d^{10}) electronic configurations have extra stability.

2) a) +1, +2 b) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9$

c) The difference in energy between the outermost ‘s’ subshell and the penultimate ‘d’ subshell is very small. Hence under suitable conditions the elctrons in ‘d’ subshell also take part in chemical reactions.

3. a) 2 b) P c) PQ_2

4. a) B - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

b) 10 c) c

5. a) Y b) X c) Z

(SECTION D - Score 4)

1) (i) – b (ii) – d

(iii) – a (iv) – c

2) a) 1 b) s block c) 16 d) p block

e) 8 f) d block g) 3 h) p block

3. a) X b) p block c) 11 d) 1

4. a) E b) C, D c) A

- Forms coloured compounds
- Shows variable oxidation state (any one)
- They are metals
- Shows similarly in groups as well as in periods

UNIT 2

Gas Laws and Mole Concept

- 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 random motion of the gas molecules, they collide with each other and also collide with the walls of the container in which they kept. This collision with the walls account for the pressure of the gas.
- As the collision of molecules are perfectly elastic in nature, there is no loss of energy.
- There is no attractions between the gas molecules and with the walls of the container.
- Volume of a gas is the volume of the container which it occupies.
- Pressure of a gas (P): Force exerted per unit area is called pressure.
- Temperature (T) : Temperature is the average kinetic energy of molecules in a substance.
- Boyle's Law : At constant temperature, volume of a definite mass of a gas is inversely proportional to its pressure . If P is the pressure and V is the volume, then $P \times V$ = a constant.
- Charles Law : At constant pressure, the volume of a definite mass of a gas is directly proportional to the temperature in Kelvin scale.

  V/T = a constant
- Avagadro's Law : At constant temperature and pressure, the volume of a gas is directly proportional to the member of molecules.
- Relative atomic mass : The relative atomic mass of an element is the number which shows how many times an atom of the element is heavier than $\frac{1}{12}$ of the mass of an atom of C-12 isotope.

- Gram atomic mass : The mass of an element in grams equal to atomic mass is called gram atomic mass. This is also be shortened as 1 gram atom. (1 GAM)
- One gram atomic mass of any element contains 6.022×10^{23} atoms. This number is known as Avagadro's number. This is indicated as N_A.
- No. of gram atomic mass = $\frac{\text{Given mass in gram}}{\text{GAM of the element}}$
- 1 mole atoms means 6.022×10^{23} atoms.
- Gram molecular mass : The amount of a substance equal to its molecular mass is called gram molecular mass. (1 GMM)
- One gram molecular mass of any substance contains Avagadro number of molecules.

  No of gram molecular mass = $\frac{\text{Given mass in gram}}{\text{Gram molecular mass(GMM)}}$
- 6.022×10^{23} molecules are called one mole molecule.
- 273K temperature and 1 atm pressure are known as standard temperature and pressure (STP)
- At STP one mole of any gas will occupy the volume 22.4L. This is called molar volume at STP.

Calculation of Number of Moles

For atoms / molecules

No. of moles = $\frac{\text{Given mass in (gram)}}{\text{GAM / GMM}}$

For Number of perticles

No. of moles = $\frac{\text{Given number}}{6.022\times10^{23}\text{ (NA)}}$

Volume at STP

$$\text{No. of moles} = \frac{\text{Given volume in L at STP}}{22.4}$$

Mass in gram = Number of moles × GAM/GMM

Number of atoms
Number of molecules
} Number of moles × 6.022×10^{23}

Volume at STP in Litres = Number of mole × 22.4

SECTION A

(Score - 1)

1. Analyze the given situations and choose the Boyles law related situations.
   a) When an inflated balloon is kept in sunlight, it will burst.
   b) The size of air bubbles rising from the bottom of a pond increases.
   c) When a balloon is inflated, its volume increases.
2. One mole hydrogen gas contain …… number of molecules.
3. Calculate the number of GMM in 90g water.
4. Calculate the number of moles of atoms present in 24g carbon.
5. Find the volume of 28g nitrogen at STP.
6. Find the relation and complete the following.
   2g hydrogen = 1 GMM

12g carbon = …… GAM

(Atomic mass H = 1, carbon = 12)

7. Molecular mass of carbon dioxide (CO_2) is 44. Find the mass of 2GMM carbon dioxide.
8. Mass of 4 GAM of an element is 80g. Find the atomic mass of the element.
9. Find the odd one
   a) 22.4 L oxygen at STP (Atomic mass of oxygen = 16)
   b) 56g nitrogen (Atomic mass of nitrogen = 14)
   c) $2\times6.022\times10^{23}$ SO_2 molecules (Atomic mass of S = 32)
   d) 2GMM CO_2 (Atomic mass C = 12)
10. Which of the following contain 6.022×10^{23} molecules.
   a) 44.8L CO_2 at STP
   b) 14g nitrogen gas
   c) 32g oxygen gas
   d) 32g methane gas (CH_4)

   (Hint: Atomic mass C = 12, H =1, N=14, O = 16)

SECTION B

(Score - 2)

11. The following are some statements about gases. Identify wrong statements.
   a) Each gas contains numerous minute molecules.
   b) Molecules of gas are moving continuously in one direction.
   c) Gas molecules collide with each other and also with the walls of the container. Pressure exerted by gas molecule is due to collision of gas molecules with the walls of the container.
   d) There is strong attraction between the gas molecule and with the walls of the vessel.

12. Find the number of atoms in the following:

    (Atomic mass He - 4, Na – 23)

    a) 40g Helium b) 11.5g Sodium

13.

Element	H	C	O	S	Ca
Atomic Mass	1	12	16	32	40

    Find molecular mass

    a) H_2SO_4 b) $CaCO_3$

14. Atomic mass of oxygen is 16. Find number of atoms and number of molecules in 64g oxygen.

15. Which of the following contains more number of atoms?

    (Hint: Atomic mass He - 4, Ca – 40)

    a) 40g He b) 40g Ca

16. Identify the correct statements regarding the properties of gases from the following

    a) The forces of attraction between the molecules are very high.

    b) Energy of molecules are very high.

    c) Molecules have less freedom of movement.

    d) Distance between molecules are very high.

17. 50g $CaCO_3$ is given (Molecular mass $CaCO_3$ = 100)

    a) Find number of moles.

    b) Find number of molecules

18. Find the volume of 440g carbon dioxide at STP (molecular mass of CO_2 = 44)

19. Find the mass of 112L ammonia gas at STP. (Molecular mass of NH_3 = 17)

20. Find the mass of $2\times6.022\times10^{23}$ water molecules (Molecular mass of water = 18)

SECTION C

(Score - 3)

21. 8g oxygen (O_2) and 8g Ozone (O_3) are contained in cylinders A and B respectively. (Atomic mass of oxygen – 16)

    a) Find number of atoms in cylinders A and B

    b) Which cylinder contains more number of oxygen atoms.

22. a) Pressure at the surface and bottom of a lake are 1 atm and 1.5 atm respectively. An air bubble having volume 10ml rises from bottom to the surface, find volume of the bubble when it reaches the surface? (Temperature is constant)

    b) Which gas law is related to this?

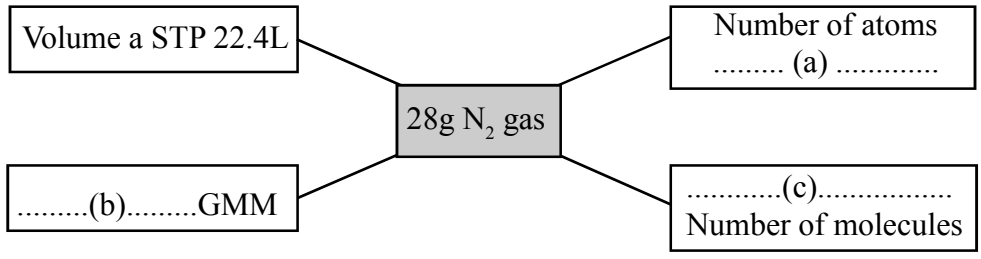
23. 11.2L chlorine gas is at STP. (Molecular mass of chlorine 71)

    a) Find the number moles of molecules in it.

    b) Find mass of gas in gram

    c) Calculate the number of molecules.

24. Complete the flow chart.



25. Molecular mass of SO_2 is 64.

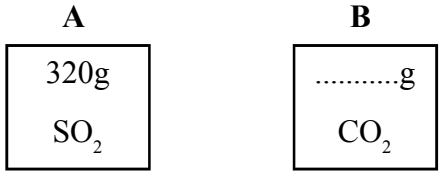
    a) Find the mass of 1GMM SO_2.

    b) Find the number of molecules in 1 GMM SO_2.

    c) How many moles of molecules are present in 320g SO_2.

26. A and B are cylinders with equal volume.

    (Atomic masses of C-12, O-16, S – 32). CO_2 and SO_2 are the gases present in cylinder at STP.



    a) Find mass of gas in the cylinder B.

    b) Find the number of molecules in the cylinder A.

    c) Which gas law relates this?

27. Find number of GAM in the following.

    a) 1200g calcium

    b) 70g nitrogen

    c) 54g silver

    (Hint: Atomic mass Ca – 40, N – 14, Ag – 108)

28. Find number of GMM

    a) 320 g Oxygen

    b) 90g glucose

    c) 11g carbon dioxide

    (Hint: molecular mass O_2 = 32, glucose – 180, CO_2 = 44)

29. Compounds and their masses are given below

    i) 85g NH_3 ii) 56g N_2 iii) 8g CH_4 iv) 12g H_2

    a) Which contains more number of molecules?

    b) Find number of atoms in 56g N_2

    c) Arrange in the increasing order of number of molecules.

30. 672L CO_2 gas is taken at STP. (Molecular mass of CO_2 = 44)

    a) Find number of moles of molecules present in it.

    b) Calculate number of molecules.

    c) Find the mass of 672L CO_2 gas at STP.

SECTION D

(Score - 4)

31. Analyze the behavior of gas in the table given below, complete the table

Sl. No	Pressure (P)	Volume (V)	P×V
1	1 atm	100L	100L atm
2	4atm	…(a)….	100L atm
3	5 atm	20L	……(b)……
4	…(c)…	10L	100L atm

    d) Which gas law relates this?

32. Molecular mass of ammonia is 17.

    a) Find GMM of ammonia

    b) How many moles of molecules are present in 170g ammonia.

    c) How many molecules are present in 85g ammonia.

    d) Find the volume of 170g ammonia at STP.

33. Atomic mass of Magnesium Mg is 24.

    a) Find GAM of Magnesium.

    b) How many atom are present in one gram atom magnesium.

c) How many electrons are present in 24g magnesium (Atomic number of Mg -12)

d) Find the mass of $2\times6.022\times10^{23}$ magnesium atoms.

34. Molecular mass of glucose is 180.

a) Find number of molecules of present in 90g glucose.

b) How many carbon atoms are present in 180g glucose.

c) Find total number of atoms in 90g glucose

d) Find mass of $2\times6.022\times10^{23}$ glucose molecules.

35. Match the following.

A	B
i) 4g H_2	a) 23g
ii) Volume 22.4L at STP	b) 90g
iii) 5×NA H_2O molecules	c) 4g He
iv) 1 gram atom Na	d) $3 \times N_A$
	e) 2 mole

(Hint: Atomic mass : Na – 23, H – 1, He – 4, O – 16)

36. Find the mass of the following samples and arrange in the increasing order.

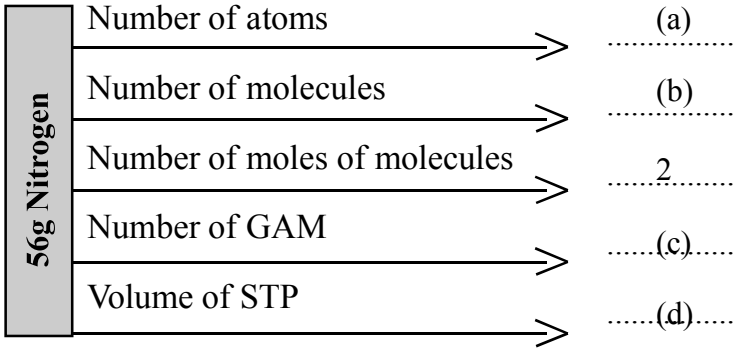
a) 112L H_2 at STP

b) 10 GMM Oxygen

c) 2 mole nitrogen

(Hint: Atomic mass H-1, O – 16, N – 14)

37. Fill in the blanks (Hint: atomic mass N – 14)



38. The properties of certain gas which are kept under same temperature and pressure are given below:

Gas	Volume	No.of Molecules
Hydrogen	10L	X
Nitrogen	20L	…(a)…..
Oxygen	….(b)….	½
Ammonia	40L	..(c)…

a) Complete the table

b) Identify the gas law which relates this data.

39. The data of an experiment on a fixed mass of a gas at constant temperature are given below. (Hint: pressure is kept constant)

Volume (V)	Temperature (T) in Kelvin Scale	$\frac{V}{T}$
546 ML	273K	2
600 ML	300 K	(p)
....(q)....	320 K	2
660 ML	....(r)K...	2

a) Complete the table

b) Which gas law relates this data.

40. Complete the table

Volume of gas at STP	Number of moles
22.4L	1
....(a)....	2
67.2 L	. ...(b)....
....(c)....	5
224 L	....(d)....

SCORING KEY

SECTION A - (Score 1)

1) (b) 2) 6.022×10^{23} or N_A 3) 5

4) 2 5) 22.4L 6) 1 GAM

7) 88g 8) 20 9) (a)

10) (c)

SECTION B - (Score 2)

11) (b) and (d) 12) a) $10\times6.022\times10^{23}$ or 10 NA b) ½ × 6.022×10^{23}

13) a) 98 b) 100

14) Number of atoms = $4 \times 6.022 \times 10^{23}$ or 4NA

Number of molecules = $2 \times 6.022 \times 10^{23}$ or 2NA

15) a) 40g He

Number of moles = $\frac{40}{4} = 10$

Number of atoms = $10 \times 6.022 \times 10^{23}$ OR $10 \times N_A$

b) 40 g Ca

Number of moles = $\frac{40}{4} = 1$

Number of atoms = $1 \times 6.022 \times 10^{23}$

$= 1 \times N_A$

40g He contains more number of atoms.

16) (b) and (d) 17) a) ½ or 0.5 b) 0.5 NA / $0.5 \times 6.022 \times 10^{23}$

18) No of moles = $\frac{440}{44} = 10$

Volume at STP = $10 \times 22.4 = 224$L

($\frac{112}{22.4} = 5$ mole $17 \times 5 = 85$g)

19) 85g 20) 36g

SECTION C - (Score 3)

21) a) $\frac{8}{16}$ = ½ mole atoms each b) Both contains equal no. of atoms.

22) a) PV = constant

At bottom = 1.5 ×10 = 15 At top = 1 × V = 15 V = **15ml**

b) Boyle's Law

23) a) 0.5 mole ($\frac{11.2}{22.4}$ = 0.5 mole) b) 35.5g c) 0.5 × 6.022 ×10^{23} molecules./ 0.5× N_A

24) a) 2×6.022 ×10^{23} b) 1 c) 6.022 ×10^{23}

25) a) 64g b) 6.022 × 10^{23} c) 5

26) a) 220g b) 5×6.022×10^{23} c) Avagadro's law

27) a) 30 b) 5 c) 0.5

28) a) 10 b) 0.5 c) 0.25

29) a) 12g H_2 b) 4×6.022×10^{23} c) iii < ii < i < iv

30) a) 30 b) 30 × 6.022 ×10^{23} c) 1320g

SECTION D - (Score 4)

31) a) 25L b) 100 L atm c) 10 atm d) Boyle's Law

32) a) 17g b) 10 c) 5 × N_A d) 224 L

33) a) 24g b) 6.022 ×10^{23} c) 12 ×6.022 ×10^{23} d) 48g

34) a) 0.5×6.022×10^{23} b) 12×6.022×10^{23} c) 24×0.5 ×6.022×10^{23} d) 360g

35) i) - e) ii) - c) iii) - b) iv) - a)

36) a < c < b

37) a) $4\times6.022\times10^{23}$ b) $2\times6.022\times10^{23}$ c) 4 d) 44.8L

38) a) 2X b) 5L c) 4X d) Avogadro's Law

39) p) 2 q) 640 r) 330 b) Charles Law

40) a) 44.8L b) 3 c) 112L d) 10

UNIT 3

Reactivity series and Electrochemistry

Reaction of metals with water, air & dilute acids

- The chemical reactivity of all the metals are not the same.
- **Reaction of metals with water** :- .
  - Sodium (Na) reacts vigorously with cold water to produce Sodium hydroxide (alkali) & hydrogen.

    $2\ Na + 2\ H_2O \rightarrow 2\ NaOH + H_2$
  - Magnesium (Mg) reacts with hot water to produce

    Magnesium hydroxide (alkali) & hydrogen. $Mg + 2\ H_2O \rightarrow Mg(OH)_2 + H_2$
  - Copper has no reaction with water.

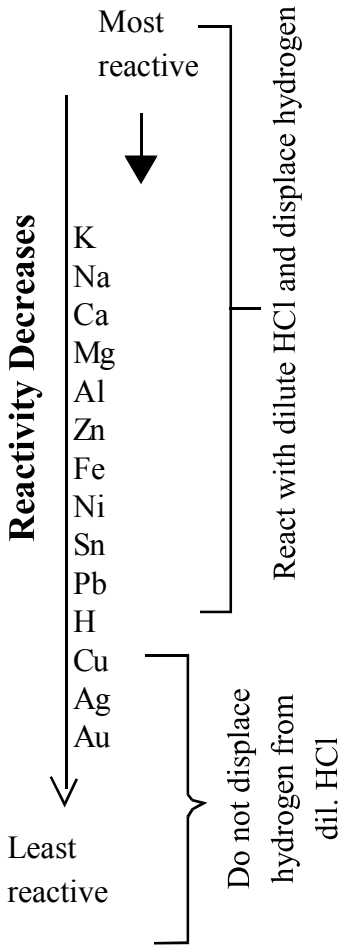
    The reactivity of metals decreases in the order **Na > Mg > Cu**
- **Reaction of metals with air:** Order of loss of metallic lustre due to its reaction with atmospheric air **Na > Mg > Al > Cu**
- **Reaction of Metals with dilute acids** :- Generally metals react with dilute acids to produce **hydrogen.** In the case of reactions of metals like Mg, Pb, Zn, Fe and Cu with dil. HCl, the reactivity decreases in the order **Mg > Zn > Fe > Pb > Cu**

Reactivity series and displacement reactions

- Reactivity Series :-

  The series obtained by arranging the metals in the decreasing order of their reactivity is known as the Reactivity series.

- Hydrogen is included in this series for the sake of comparison of chemical reactivity.



- Metal with low reactivity are displaced from their salt solution by metal of high reactivity. Such reactions are known as **Displacement reactions**
- In displacement reaction

  Metal with high reactivity - undergo oxidation

  Metal ions with low reactivity - undergo reduction
- Displacement reactions are **Redox reactions**
- Usually, those metals which are placed below hydrogen in the reactivity series do not react with dilute acids. Those metals which are placed above hydrogen in the reactivity series, react with dilute acids and liberate hydrogen.

Galvanic cell

Cell	Galvanic cell or Voltaic cell	eg. Zn- Cu Cell
Energy change energy	Chemical energy to Electrical energy	Chemical energy to Electrical
Anode	Negative, more reactive metal	**Zn**
Anode reaction	Oxidation(loss of electrons)	$\mathbf{Zn \rightarrow Zn^{2+} + 2e^-}$
Cathode	Positive (less reactive metal)	**Cu**
Cathode reaction	Reduction(Gain of electrons)	$\mathbf{Cu^{2+} + 2e^- \rightarrow Cu}$
Cell Reaction	Redox reaction	$\mathbf{Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu}$
Flow of electrons	From negative to positive/ From anode to cathode /From more reactive metal to less reactive metal	$\mathbf{Zn \rightarrow Cu}$

Electrolytic cell

- **Electrolytes** are substances which conduct electricity in molten states or in aqueous solutions and undergo chemical change.
- The process of chemical change taking place in an electrolyte by passing electricity is known as **electrolysis**.
- **Electrodes** are substances which pass electricity to electrolytes.
- In electrolytic cells anode is connected to the positive terminal of the battery and cathode is connected to the negative terminal of the battery.

Galvanic cell & electrolytic cell

Cell	Galvanic cell or Voltaic cell	Electrolytic cell
Energy change	Chemical energy to	Electrical energy to Chemical energy
	Electrical energy	
Anode	Negative	**Positive**
Anode reaction	Oxidation (loss of electrons)	Oxidation (loss of electrons)
Cathode	Positive,	**Negative**
Cathode reaction	Reduction(Gain of electrons)	Reduction(Gain of electrons)

Electrolysis of Molten sodium chloride and sodium chloride solution

Electrolyte	Reaction		Products	
	Anode (positive)	Cathode (negative)	Anode	Cathode
Molten NaCl	Oxidation $2Cl + 2e^- \rightarrow Cl_2$	Reduction $Na^+ + 1e^- \rightarrow Na$	Chlorine (Cl_2)	Sodium (Na)
NaCl solution	Oxidation $2Cl + 2e^- \rightarrow Cl_2$	Reduction $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$	Chlorine (Cl_2)	Hydrogen (H_2)
Sodium hydroxide (NaOH) is formed in the solution as a result of electrolysis of NaCl solution.				

VI. Electroplating

- The process of obtaining a coating of one metal over another metal using electrolysis is known as Electroplating
- Anode → connected to positive terminal of the battery

  → oxidation reaction takes place

Cathode → connected to negative terminal of the battery

→ reduction reaction takes place

Anode(+ve) Metal to be plated	**Cathode(-ve) Article to be coated**	**Electrolyte(Salt solution of the metal to be coated)**
Cu	Article to be coated	Copper Sulphate solution
Ag	Article to be coated	Silver nitrate solution/sodium cyanide + silver cyanide solution
Au	Article to be coated	Sodium cyanide + gold cyanide solution

- Advantages of Electroplating :- to prevent metallic corrosion, to improve the appearance of the metal.
- Examples for Electroplating : Gold plated ornaments, Chromium plated handle bars. Silver plated Utensils.

SECTION A

(Score - 1)

1. Among the following, the metal does not react with water .....

   (Sodium, Gold, Magnesium, Potassium)

2. Which element is included in the reactivity series for the sake of comparison of chemical activity?

3. From the metals given in bracket pick out one which can displace Pb from $PbSO_4$

   (Hint : Reactivity Mg > Fe > Ni > Pb > Cu > Ag > Au)

   (Ni, Cu, Ag, Au)

4. In Galvanic cells the electrode connected to the positive terminal of voltmeter is …….

5. Name the arrangement which maintains electrical neutrality of the Galvanic cell.
6. Which is the salt used in salt bridge? ($CuSO_4$, Zn SO_4, KNO_3, HCl)
7. One of the metals given below, when left exposed to the atmosphere gets coated with a green coating. Which is the metal ?(Iron, Zinc, Copper, Gold)
8. …… gets liberated at cathode during the electrolysis of Sodium chloride solution.
9. Which metal is used to electroplate iron handlebars?
10. Name the electrolyte used to coat gold on Iron rings ?
11. Who gave a scientific explanation for electrolysis for the first time?
12. …… are the substances which pass electricity to electrolytes.
13. Which one is responsible for the conduction of electricity by electrolytes?
14. During electrolysis the electrode which is connected to the negative terminal is…….
15. In the Cu - Zn cell, write down the chemical equation for the reaction taking place at the anode.
16. In a galvanic cell the direction of flow of electrons is from ,..... to ……
17. Name the electrode which undergoes oxidation reaction
18. Positively charged electrode in Electrolytic cell is …….

SECTION B

(Score - 2)

1. Classify the following metals as given below

   Copper, Calcium , Iron, Silver, Potassium

   (Hint : Reactivity Na>Ca>Mg>Al>Zn>Fe>Ni>Pb>H>Cu>Ag>Au)

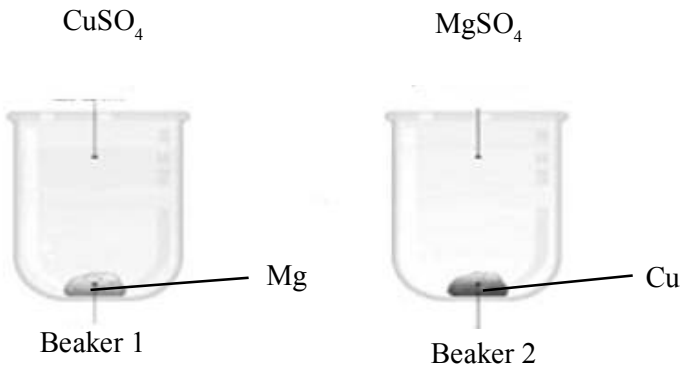
Metals displace hydrogen from dil. HCl	Metals do not displace hydrogen from dil. HCl

2. Metal X displaces metal Y from its salt solution but can not displace metal Z from its salt solution. (Symbols are not real)

   a) Which is the most reactive metal among X,Y and Z ?

   b) Justify your answer.

3. Observe the given picture



   a) In which of the beakers given a displacement reaction will take place?

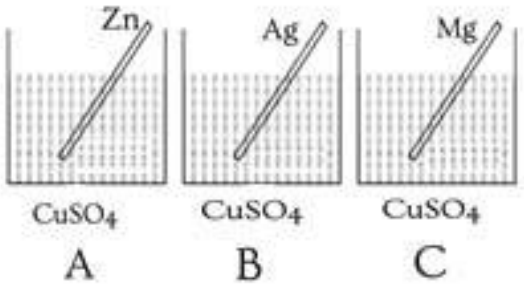
   b) Write its chemical equation.

4. Observe the given picture

   a) In which beaker/beakers colour of the solution will change after sometime?

   b) Justify your answer.

   (Hint : Reactivity Na>Ca>Mg>Al>Zn>Fe>Ni>Pb>H>Cu>Ag>Au)



5. Consider the electroplating of copper on an iron bangle
   a) Which terminal of the battery is connected to the iron bangle ?
   b) Write down the chemical reaction taking place at anode?
6. Observe the reaction given below

   $Mg + FeSO_4 \rightarrow MgSO_4 + Fe$

   a) Which metal ion undergoes reduction in the above reaction.?
   b) Write down the equation for reduction.

SECTION C

(Score - 3)

1. $Mg + CuSO_4 \rightarrow$ ……+.....
   a) Complete the above chemical equation.
   b) Is this a redox reaction? Why?
2. Observe the reaction given below

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

   a) Which metal gets displaced here?
   b) Which metal undergoes oxidation here?
   c) Write down the equation for reduction in this reaction.
3. Pick out correct sentences from the following about Galvanic cells
   a) Difference in reactivity of metals is used
   b) Electrical energy is converted into chemical energy
   c) Conversion of energy is by means of a redox reaction
   d) Anode gets a negative recharge
   e) Oxidation occurs at cathode

f) Direction of flow of current is the same as that of electrons.

4. The solutions of $ZnSO_4$, $FeSO_4$ and $CuSO_4$ are taken in three different test tubes. suppose an Iron nail is kept immersed in each one.

a) In which test tube the Iron nail undergoes a colour change?

b) Justify your answer

(Hint : Reactivity Na>Ca>Mg>Al>Zn>Fe>Ni>Pb>H>Cu>Ag>Au)

5. Cu rod is immersed in Silver nitrate solution

a) What do you observe after sometime?.

b) Write down the equation for oxidation and reduction

6. Ag, Cu, Zn , Mg

a) Write any two galvanic cells that can be made by using the metals given above.

b) When galvanic cells are constructed using these metals, which one is always placed at the cathode and which one is always placed at the anode?

SECTION D

(Score - 4)

1. Molten sodium chloride allows the passage of electricity.

a) Name the anion present in molten sodium chloride.

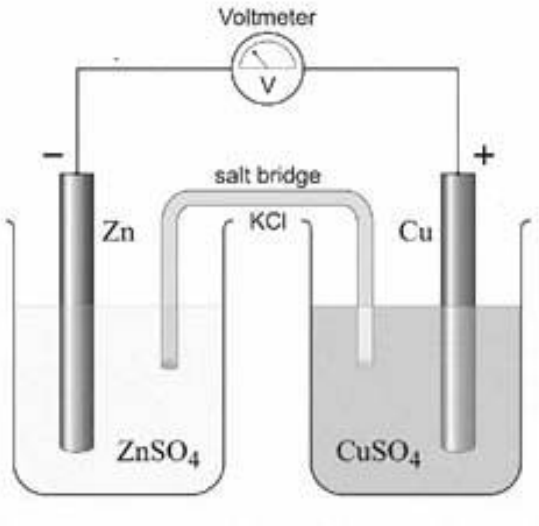
b) Which ion is attracted towards the cathode?

c) Write down the reaction at anode?

2. Complete the table.

Galvanic Cell	Chemical Reaction	
	Anode	Cathode
Al - Cu	$Al \rightarrow Al^{3+} + 3e^-$	$Cu^{2+} + 2e^- \rightarrow Cu$
Mg - Ag	……A……..	……B……..
Mg - Al	$Mg \rightarrow Mg^{2+} + 2e^-$	……C……..
Zn - Cu	.....D.....	$Cu^{2+} + 2e^- \rightarrow Cu$

3. A galvanic cell is constructed using Zn and Cu.



a) Write down the reaction taking place at Cu electrode?

b) Which metal acts as cathode here?

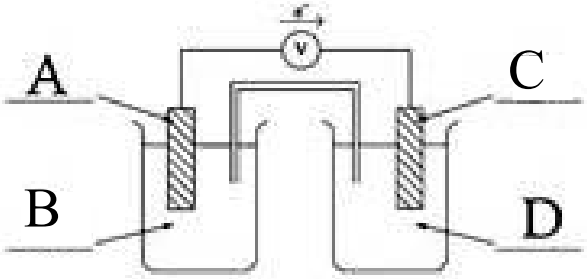
c) Find the direction of electron flow

Zn to Cu **OR** Cu to Zn

d) Write down the combined equation for the redox reaction taking place here.

4. A Galvanic cell is constructed using materials given below

   Silver wire, copper rod, two beakers, copper sulphate, silver nitrate, Salt bridge, voltmeter, copper wire, water.



   a) Find out A,B,C,D

   b) Which electrode has the ability to donate electrons?

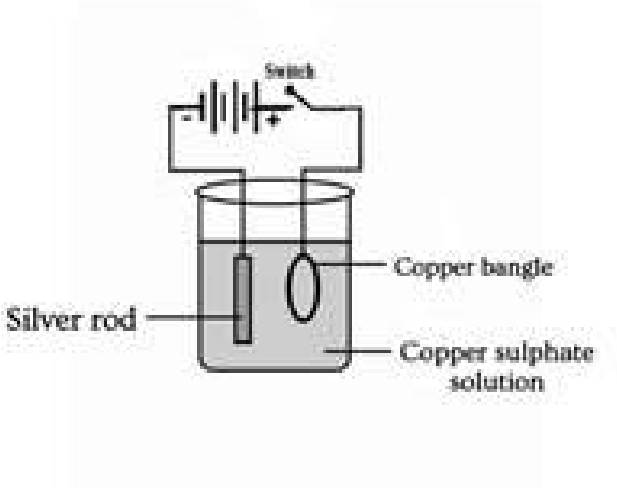
   c) Name the metal which deposited at the cathode

   d) Write down the chemical equation of the redox reaction?

5. Observe the picture given. This is the process of coating silver on a copper bangle.

   a) Name this process

   b) Point out the mistakes in the picture



6. A table related to electrolysis of NaCl solution is given below

Electrode	**Ions attracted**	**Product**
Anode	**…A….**..&...**B**...	Chlorine Gas.
Cathode	Na^+ & H_3O^+	……**C**…….

a) Find Out A, B, & C

b) Two drops of phenolphthalein are added to the electrolyte after the electrolysis. What will happen? Give reason..

7. Take three beakers having the same quantity of water. Take pieces of sodium magnesium and copper of same size and drop each one to each beaker. (reactivity series hint - Na > Mg > Cu)

a) Which metal reacts vigorously?

b) Which gas is formed as a result of this reaction?

c) Write down the chemical equation for this reaction.

SCORING KEY

SECTION A - (Score 1)

1. Gold
2. Hydrogen
3. Ni
4. Cathode
5. Salt bridge
6. KNO_3
7. Copper
8. Hydrogen
9. Chromium
10. Sodium cyanide + Gold cyanide
11. Michael Faraday
12. Electrodes
13. Freely moving ions
14. Cathode
15. $Zn \rightarrow Zn^{2+} + 2e^-$
16. Anode to cathode
17. Anode
18. Anode

SECTION B - (Score 2)

1. Metals displace hydrogen from dil HCl ,:- Iron , Potassium, Calcium

   Metals do not displace hydrogen from dil. HCl :- Copper, Silver

2. a) Z

   b) X displace Y from its salt solution ; reactivity of X>Y

   X cannot displays Z from its salt solution; reactivity Z>X

   Reactivity order of X Y and Z Z>X>Y

3. a) Beaker 1

   b) $Mg + CuSO_4$ '$\rightarrow MgSO_4 + Cu$

4. a) In beaker A&C

   b) Reactivity order Mg>Zn>Cu>Ag. . Mg and Zn can displace Cu from its solution but silver cannot displace Cu.

5. a) negative b) $Cu \rightarrow Cu^{2+} + 2\ e^-$

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

SECTION C - (Score 3)

1. a) $Mg + CuSO_4 \rightarrow \ldots MgSO_4 \ldots\ldots + .. Cu .....$

   b) Yes it is a redox reaction. Oxidation and reduction take place simultaneously. Mg undergoes oxidation and Cu^{2+} undergoes reduction.

2. a) Ag b) Zn c) $Ag^+ + 1e^- \rightarrow Ag$

3. a) Difference in reactivity of metals is used

   c) Conversion of energy is by means of a redox reaction

   d) Anode gets a negative recharge

4. a) Iron nail which is placed in $CuSO_4$ solution undergoes a colour change.

   b) Displacement reaction

c) Fe displaces Cu from $CuSO_4$ solution. $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

5. a) Ag gets deposited at the Cu plate. The solution turns blue

b) $Cu \rightarrow Cu^{2+} + 2e^-$ Oxidation

$2Ag+ + 2e^- \rightarrow 2Ag$ Reduction

6. a) Zn – Cu, Mg – Ag

b) one is always placed at the cathode - Ag

one is always placed at the anode- Mg

SECTION D - (Score 4)

1. a) Cl^- b) Na^+ c) $2Cl^- \rightarrow Cl^{2+}$ 2e

2. a) $Mg \rightarrow Mg^{2+}$ + 2e- b) $Ag^+ + 1e- \rightarrow Ag$ c) Al^{3+} + 3e- $\rightarrow$ Al d) $Zn \rightarrow Zn^{2+} + 2e^-$

3. a) $Cu^{2+} + 2e^- \rightarrow Cu$ b) Cu

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

4. a) A- Cu B- $CuSO_4$ C- Ag D- $AgNO_3$

b) Cu c) Ag

d) $Cu + 2Ag^+ \rightarrow Cu^{2+} + 2Ag$

5. a) Electroplating

b) 1. position of metal to be coated and article to be plated

2. Electrolyte used

6. a) A&B - Cl^- & OH^-

C - H_2 Gas

b) The solution becomes pink due to the presence alkali NaOH

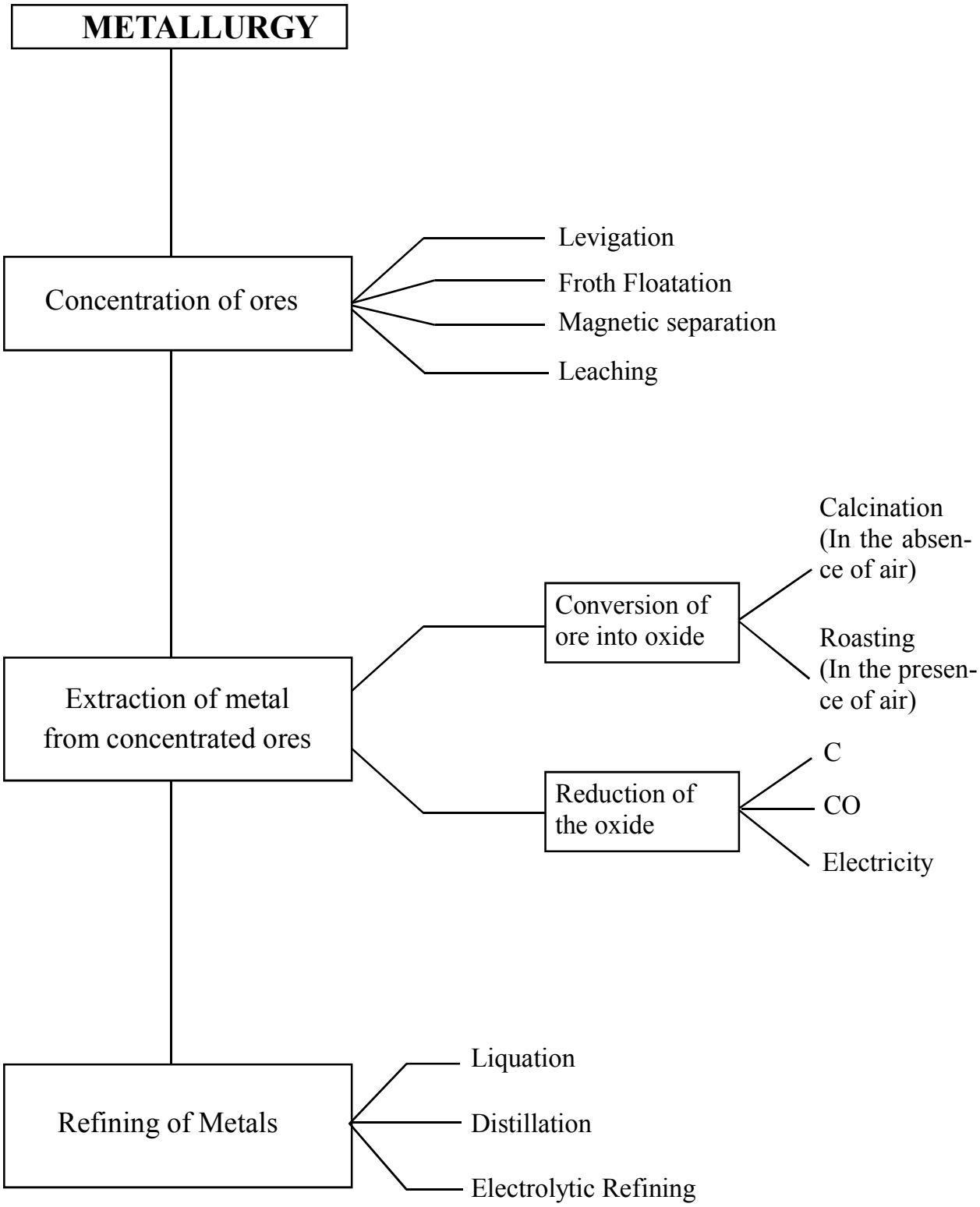
8. a) Na b) H_2

c) $2Na + H_2O \rightarrow 2NaOH + H_2$

UNIT 4

Production of Metals

- The metallic compounds generally seen in earth's crust are called minerals.
- A mineral from which a metal is economically and quickly extracted is called the ore of the metal.
- The impurities present in the ore particles are called gangue.
- Metallurgy involves all the processes leading to the separation of a pure metal from its ore.
- The chemical used to remove gangue is the flux.
- The product formed by the reaction between gangue and flux is the slag.
- Haemetite (Fe_2O_3) is the ore of iron.
- Carbon monoxide (CO) is the reducing agent in the extraction of iron.
- Gangue in iron ore is silicon dioxide (SiO_2)
- Bauxite ($Al_2O_3.2H_2O$) is the ore of aluminum.
- Bauxite, the ore of aluminum is concentrated by leaching method.
- The process of industrial production of aluminum is called Hall-Heroult process.
- Pig iron is the impure iron obtained from blast furnace.


METALLURGY
Concentration of ores
Levigation
Froth Floatation
Magnetic separation
Leaching
Extraction of metal from concentrated ores
Conversion of ore into oxide
Calcination (In the absence of air)
Roasting (In the presence of air)
Reduction of the oxide
C
CO
Electricity
Refining of Metals
Liquation
Distillation
Electrolytic Refining

SECTION A

(Score - 1)

1. The metallic compounds seen in the earth crust are called……
2. Chemical formula of bauxite is……
3. Name the concentration method of bauxite?
4. Name the concentration method of sulphide ores?
5. Which is the ore used for the industrial production of iron?
6. Name the substance added to alumina for lowering the melting point?
7. Which mineral of iron is known as fools gold?
8. Name the alloy used for the making of permanent magnet?
9. Which metal is separated by liquation? (Tin, Mercury, Gold)
10. Which alloy steel is used for making heating coils?
11. Which is the slag formed in the production of iron in blast furnace?
12. Which is the reducing agent in the blast furnace?
13. Which metal is separated by distillation. (Lead, Tin, Mercury)
14. Calamine is the ore of …….
15. Name the solvent used to dissolve Bauxite?
16. Which is the ore of Tin?
17. Write the chemical equation for the formation of slag in blast furnace.
18. The chemical formula of alumina is …….
19. In which electrode aluminium is deposited during electrolysis of alumina?
20. Name the industrial production of aluminium?
21. The mineral from which a metal is economically, easily and quickly extracted is called…..
22. During the electrolytic refining of copper, in which electrode pure copper is deposited?

23. Name the iron obtained from the blast furnace?
24. $CaO + Si\ O_2 \rightarrow$ ……..
25. If the gangue is acidic, nature of the flux will be ……
26. Which method is used to concentrate tin stone ($Sn\ O_2$), the ore of tin.
27. Find the relation and fill up suitably.
    a) Tin Stone : Magnetic separation
    b) Bauxite : ……
28. $Al\ (OH)_3 + Heat \rightarrow$ …….. + H_2O
29. Write the chemical name of calamine.
30. $Fe_2\ O_3$ + ……..→ $2Fe + 3CO_2$
31. Which method is used for the concentration of bauxite?

SECTION B

(Score - 2)

1. Analyze the table given below and match them suitably:

Metal	**Ore**
Aluminium	Haematite
Zinc	Cuprite
Iron	Bauxite
Copper	Calamine

2. Zinc blend and calamine are the ores of zinc.
    a) Write the chemical name of calamine.
    b) From this which ore is converted to oxide through roasting.

3. Complete the table:

Metal	**Purification**
Tin	…..(a)……
Copper	……(b)……

4. Choose the correct one given in the bracket and complete the table:

   (Levigation, Leaching, Magnetic separation, Froth floatation)

Ore	**Concentration Method**
Zinc blend	Froth floatation
Tin stone	…..(a)…..
Bauxite	……(b)….

5. Copper can be refined by electrolytic refining method. In this method impure copper is taken as anode and pure copper is taken as cathode.

   Write down the equation taking place at cathode and anode.

6. Iron is industrially prepared using blast furnace.

   a) Name the raw materials used in the furnace?

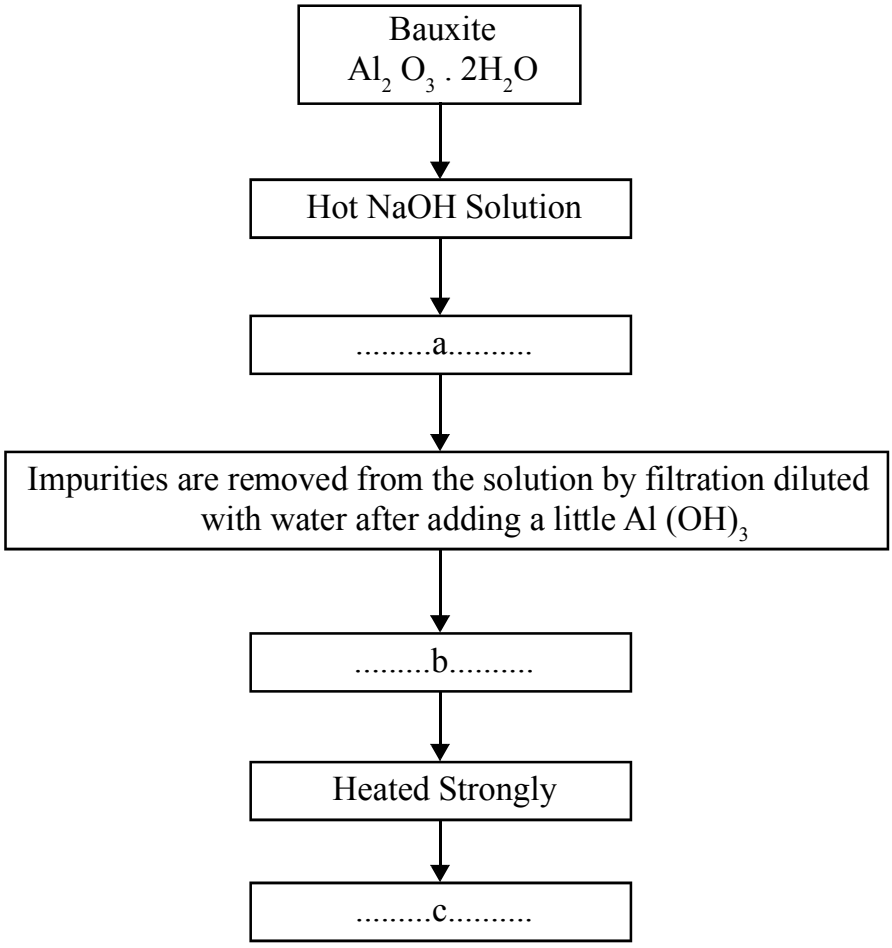
   b) What is the function of Ca CO_3

7. All minerals cannot be used for the extraction of metals. What are the characteristics possessed by minerals that are used for the extraction of metals.

SECTION C

(Score - 3)

1. The flow chart of the process of concentraton of Bauxite is given. Complete the flow chart.



2. Complete the table

Metal	**Ore**	**Chemical Formula**
Iron	Haematite	.....(a).....
.....(b).....	Bauxite	$Al_2O_3 . 2H_2O$
Zinc	.....(c).....	ZnS

3. Complete the table related to alloy steels.

Alloy steels	Constituent elements	Uses
Alnico	.....(a).....	Making permanant magnet
.....(b).....	Fe, Cr, Ni, C	For the manufacture of utensils, vehicles
Nichrome	Fe, Cr, Ni, C	.....(c).....

4. a) Molten iron obtained from the blast furnace contains 4% carbon and other impurities. What is this known as?

   b) Which property of nichrome is used in heating coils.

   c) Some alloy steels contain the same component. Then how do they possess different properties.

SECTION D

(Score - 4)

1. The equations of the production of iron in the blast furnace are given. Answer the following questions.

   $C + O_2 \longrightarrow CO_2 + heat$

   $CO_2 + C \xrightarrow{Heat} 2CO$

   $CaCO_3 \xrightarrow{Heat} CaO + CO_2$

   $CaO + SiO_2 \longrightarrow CaSiO_3$

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

   a) Write the chemical equation for the reduction of the ore.

   b) Which are gangue and flux

   c) Write the chemical equation for the formation of slag.

d) What are the bases of selecting flux in metal extraction.

2. Aluminium is obtained from the electrolysis of alumina.

a) Which are anode and cathode in this process.

b) Why Cryolite is added to alumina

c) Write the chemical equation of the electrolysis.

3. Copper is purified by electrolytic refining

a) Sketch the diagram and label anode, cathode and electrolyte.

b) Write the chemical reaction at the cathode?

4. Hematite is converted into iron by using the blast furnace.

a) Name the raw materials used in the furnace?

b) Why the furnace is it called so?

c) Name the iron obtained from the furnace.

d) What is the function of calcium carbonate?

5. Mainly two stages are used for the extraction of metals from concentrated ore

a) What are the two different stages?

b) How calcination differ from roasting?

6. Find out the suitable method of concentration and complete the table

Properties of Ore	**Properties of the impurities**	**Method of concentration**
High density	Low density	…….a……
Magnetic nature	Non-magnetic nature	…….b……
Lighter sulphide ore	High density	…….c……
Aluminium ores that get dissolved in a solution	Insoluble in the same solution	…….d……

SCORING KEY

SECTION A - (Score 1)

1) Minerals
2) $Al_2O_3 . 2H_2O$
3) Leaching
4) Froth floatation
5) Haematite
6) Molten Cryolite
7) Iron Pyrites
8) Alnico
9) Tin
10) Nichrome
11) Calcium Silicate $[CaSiO_3]$
12) CO
13) Mercury
14) Zinc
15) Hot NaOH solution
16) Tinstone
17) $CaO + SiO_2 \rightarrow CaSiO_3$
18) Al_2O_3
19) Cathode
20) Hall-Heroult process
21) Ore
22) Cathode
23) Pig iron
24) $CaSiO_3$
25) Basic
26) Magnetic separation
27) Leaching
28) Al_2O_3
29) Zinc carbonate
30) 3CO
3) Leaching

SECTION B - (Score 2)

1.

Metal	Ore
Aluminium	Bauxite
Zinc	Calamine
Iron	Haematite
Copper	Cuprite

2. a) Zinc carbonate

   b) Zinc blend

3.

Metal	Purification
Tin	Liquation
Copper	Electrolytic refining

4. a) Magnetic seperation b) Leaching

5. Anode $Cu \rightarrow Cu^{2+} + 2e^-$

   Cathode $Cu^{2+} + 2e^- \rightarrow Cu$

6. a) Haematite, limestone and coke

   b) Due to the high temperature in the furnace calcium carbonate decomposes to form calcium oxide and CO_2. This calcium oxide reacts with SiO_2 (gangue) to form calcium silicate (slag - $CaSiO_3$)

7. a) Abundance

   b) Easily and cheaply seperable

   c) High metal content

SECTION C - (Score 3)

1. a) Sodium Aluminate / Na Al O_2 b) Al $(OH)_3$ c) Al_2O_3 (Alumina)

2. a) Fe_2O_3 b) Aluminium c) Zinc blend

3. a) Fe, Al, Ni, CO b) Stainless steel c) For making heating coils

4. a) Pig iron b) High resistivity c) Ratio of the components are different

SECTION D - (Score 4)

1. a) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

   b) Gangue - SiO_2, Flux - CaO

c) $CaO + SiO_2 \rightarrow CaSiO_3$

d) If the gangue is acidic in nature, basic flux is to be used, if the gange is basic in nature, acidic flux is used.

2. a) Anode - carbon rod

Cathode – carbon lining in steel tank

b) To lower the melting point of alumina and increase the electrical conductivity

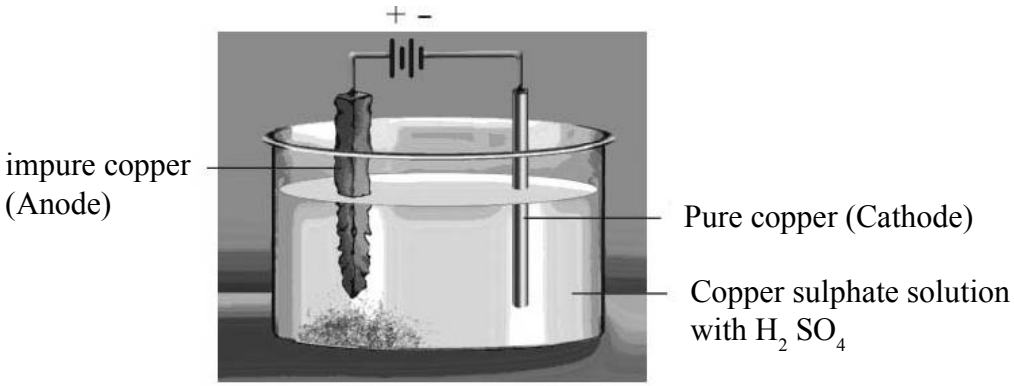
c) $Al_2O_3 \rightarrow 2Al^{3+} + 3O^{2-}$

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

$2O_2^- \rightarrow O_2 + 4e^-$

$C + O_2 \rightarrow CO_2$

3. a) Correct diagram



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

4. a) Haematite, limestone and coke

b) Blast of hot air is passed through the bottom of the furnace.

c) Pig iron

d) Due to the high temperature in the furnace calcium carbonate decomposes to form CaO and CO_2 CaO act as flux.

5. a)
   - Conversion of the concentrated ore into its oxide.
   - Reduction of the oxide

   b)
   - Calcination is the process in which the concentrated ore is heated below its melting point in the absence of air.
   - Roasting is the process in which the concentrated ore is heated below its melting point in the presence of air.

6. a) Levigation/hydraulic washing

   b) Magnetic separation

   c) Froth floatation

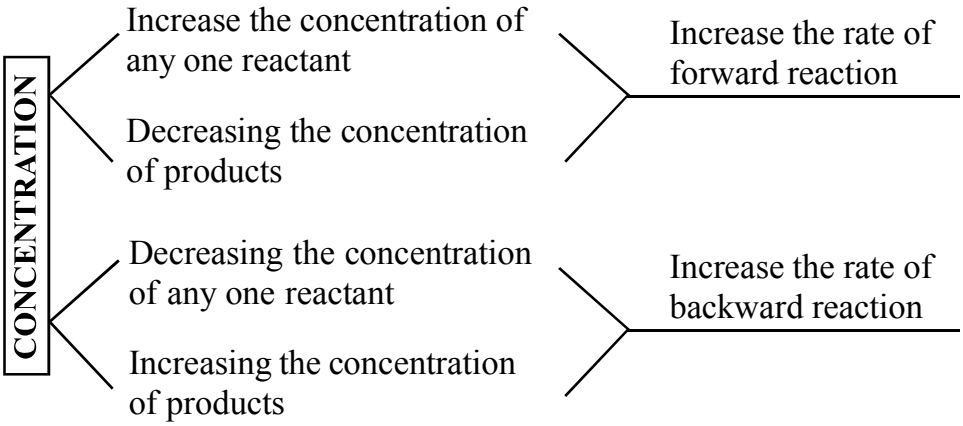
   d) Leaching

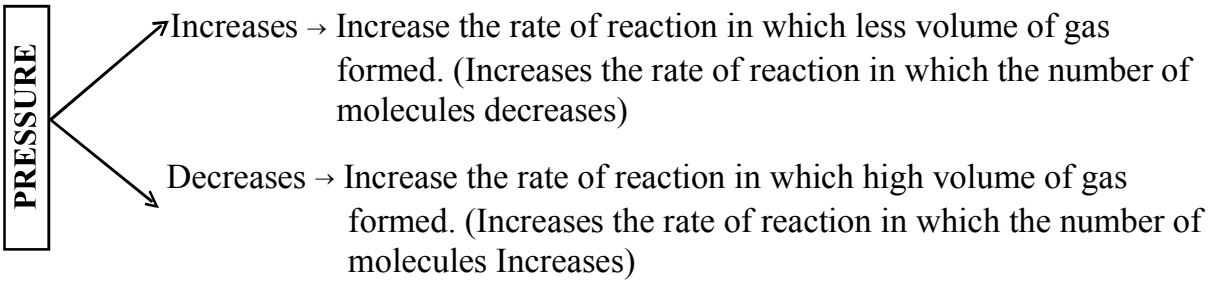
UNIT 5

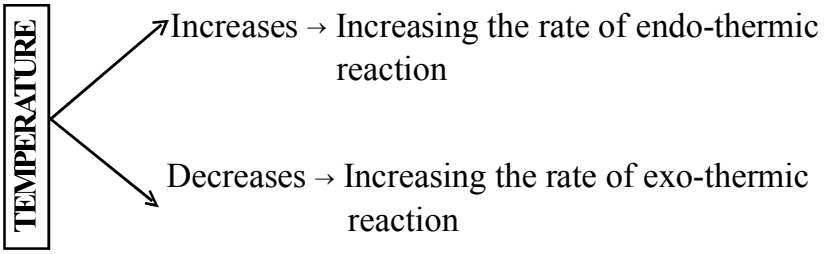
Compounds of Non-metals

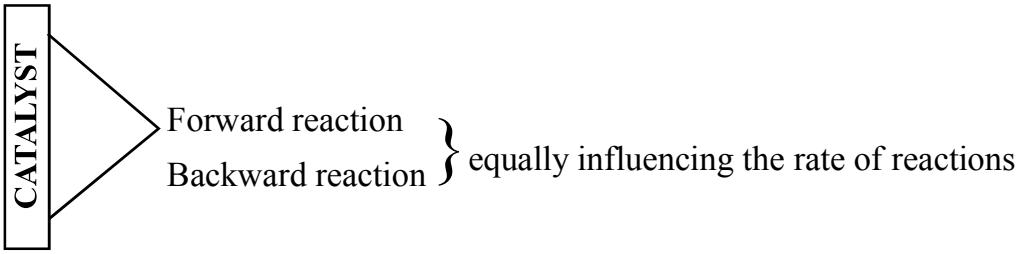
- Ammonia is an important raw material for the production of nitrogenous fertilizers.
- In the laboratory ammonia is prepared by the reaction of ammonium chloride and calcium hydroxide.
- Quick lime (CaO) is used for drying ammonia gas.
- Ammonia is a colourless gas having pungent smell, highly soluble in water, less denser than air and have basic nature.
- Highly concentrated aqueous solution of ammonia is called liquor ammonia.
- Liquefied ammonia is known as liquid ammonia.
- Ammonia is used
    - For the manufacture of chemical fertilizers like ammonium sulphate, ammonium phosphate, urea etc.
    - As a refrigerant in ice plants.
    - To clean the tiles and window panes.
- Reactions taking place in both directions are called reversible reactions
- Eg: $N_2 + 3H_2 \underset{\text{backward reaction}}{\overset{\text{forward reaction}}{\rightleftharpoons}} 2NH_3 + \text{Heat}$
- Chemical equilibrium is the stage at which the rate of the forward reaction becomes equal to the rate of the backward reaction in a reversible reaction.

- When the concentration, pressure or temperature of a system at equilibrium is changed, the system will readjust itself to nullify the effect of that change and attain a new state of equilibrium, that is called Le Chatelier's Principle:

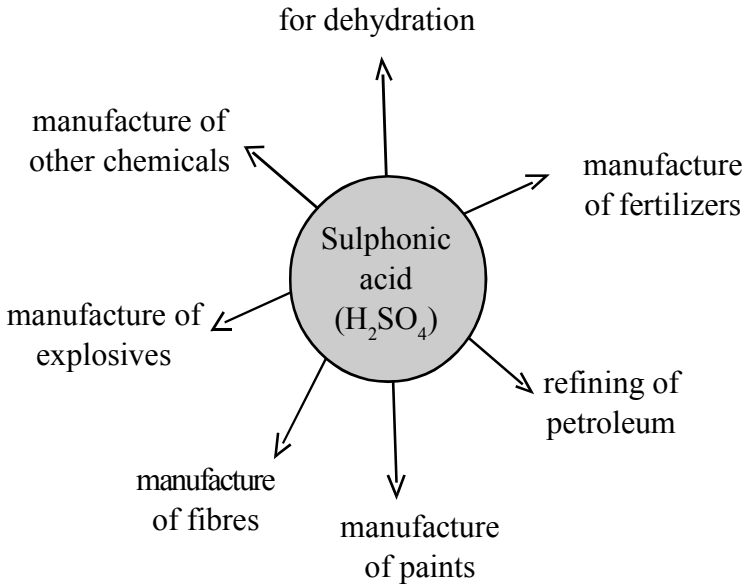








- In a reversible reaction, if the number of molecules in the reactants and products become equal, there will be no influence of pressure such reactions.



Considering the wide uses of sulphuric acid, it is known as the "King of Chemicals".

- Physical properties of sulphric acid is
- Colourless
- Comparatively high viscosity
- Highly corrosive
- Denser than water
- Dissolves in water

- The ability to absorb chemically combined water or water molecules same as in the ratio corresponding to that of water is called dehydrating agent and the process is known as dehydration.
- Con-sulphuric acid can act as a drying agent and a dehydrating agent.
- Drying agents are substances capable of absorbing the moisture present in a substance.
- Con. centrated sulphuric acid is used as a drying agent in the preparation of Cl_2, SO_2 and HCl.
- Concentrated sulphuric acid forms hydrochloric acid on reaction with chlorides and nitric acid on reaction with nitrates.

- Concentrated sulphuric acid reacts with metals and non-metals and oxides them.
- Sulphate salts react with barium chloride to form a white precipitate of barium sulphate. It is not soluble in dil. HCl. This is the identification test of sulphate salts.

SECTION A

(Score - 1)

1. An important raw material for the production of nitrogenous fertilizers is ……
2. Drying agent used for the laboratory preparation of ammonia is ……
3. Observe the relation and fill in the blanks

   Ammonia : Haber process : Sulphuric acid : ……
4. The experiment shows the solubility of ammonia in water is known as ……
5. Liquified ammonia is known as …….
6. The wet red litmus paper showing the mouth of the boiling tube on the decomposition of NH_4Cl first turns blue and then red colour the reason is …….
7. Pick out the example of a reversible reaction

   a) $C + O_2 \rightarrow CO_2$

   b) $N_2 + 3H_2 \rightleftharpoons 2NH_3 + Heat$

   c) $NaOH + HCl \rightarrow NaCl + H_2O$

   d) $NaCl + AgNO_3 \rightarrow NaNO_3 + Ag\,Cl$
8. Pressure used for the manufacture of ammonia is ……..
9. Optimum temperature used in Haber process is ……
10. Chemical formula of oleum is ……..
11. The dissolution of SO_3 in water is a ……. reaction

12. Sulphuric acid is known as …….

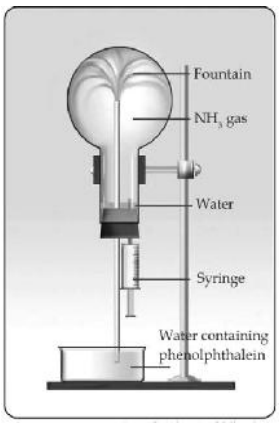
13. Name the basic substance obtained during the decomposition of NH_4 Cl.

    [N_2, H_2, NH_3, HCl]

SECTION B

(Score - 2)

1.



1. a) Which property of ammonia is proved from this experiment?

   b) Why the fountain appears pink in colour?

2. a) List out the chemicals used in the laboratory preparation of NH_3?

   b) Why the test tube is placed inverted position during the collection of ammonia gas.

3. a) Name the product obtained by the dissolution of ammonia in water?

   b) Write the balanced chemical equation for this?

4. Place a piece of cotton dipped in HCl at one end and another piece dipped in ammonia solution at the other end of the glass tube. Obtained thick white fumes in the glass tube.

   a) Which is the product obtained in this activity?

   b) What happens to the white fumes when it heated

5. $Na_2 SO_4 + BaCl_2 \rightarrow A + 2NaCl$

   a) Write A in this reaction

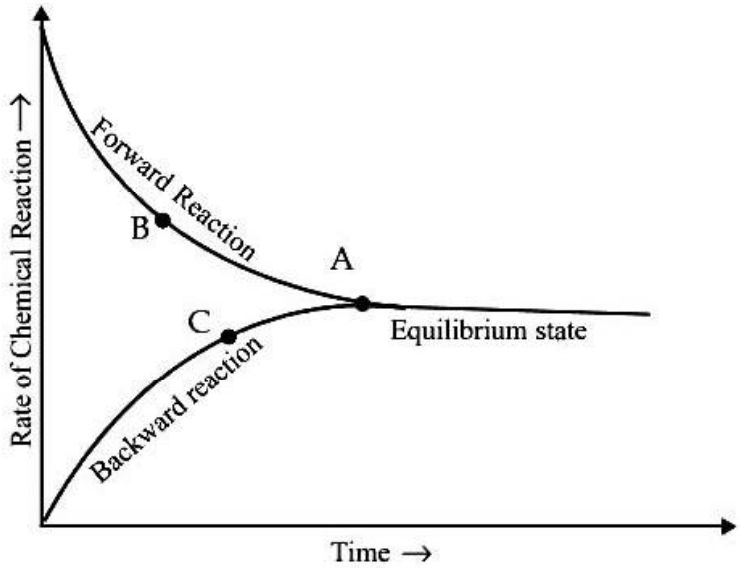
b) Write the identification test of sulphate

6. List out any two uses of ammonia?

SECTION C

(Score - 3)

1.



a) Name the point A

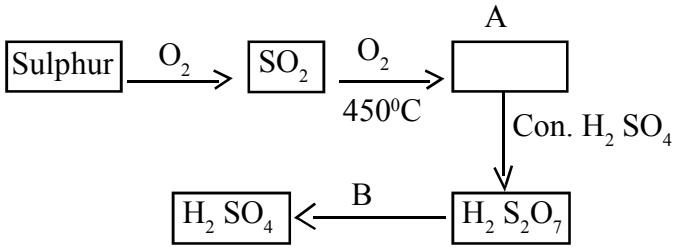
b) Write any two characteristic property of A?

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

a) How the temperature should change to obtain more ammonia.

b) An optimum temperature 450^0C is used in the industrial production of NH_3. Why?

3. Complete the flow diagram.

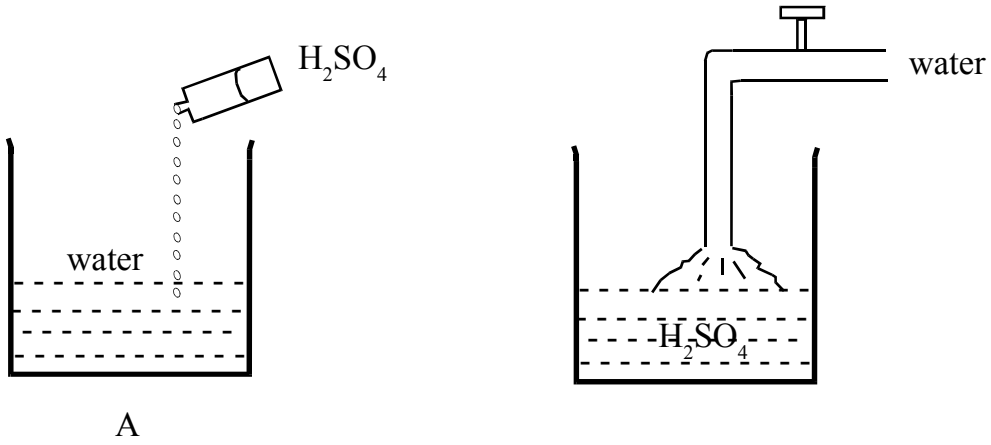


a) In which name this process is known as?

b) Name the catalyst used here?

c) Find A & B inthe diagram.

4.



a) Observe the figure and write which method is correct?

b) Justify your answer.

5. **Activity**

Adding Con. H_2SO_4 to a watch glass in which $CuSO_4$ crystals are taken.

a) Write the observation of this experiment?

b) Which property of H_2SO_4 is responsible for this?

c) Write any other activity and its obervation showing this property?

SECTION D

(Score - 4)

1. $2NO(g) + O_{2(g)} \rightleftharpoons 2NO_{2(g)} + Heat$

   How the following factors affect the rate of forward reaction.

   a) Decrease the temperature

   b) Increase the pressure

   c) Increase the amount of O_2

   d) Remove NO_2 from the system

2. Observe the chemical equation given below and answer the following questions.

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

   a) What is the oxidation state of element carbon?

   b) Write the oxidation state of carbon in CO_2.

   c) Which element get oxidized?

   d) Name the oxidizing agent in this reaction?

3. Observe the chemical equation and answer the following questions.

   $NaCl + \boxed{B} \rightarrow NaHSO_4 + HCl$

   a) write B of this reaction.

   b) Write the product formed when 'B' reacts with potassium nitrate (KNO_3)

   c) Write its balanced chemical equation?

4. Write down the observation, when 1ML $BaCl_2$ solution is added to the solutions given in the table.

No.	Solutions	By adding $BaCl_2$ solution	When dil. HCl is added
1	$MgSO_4$	a)	b) .....
2	$ZnSO_4$	c)	d) .....

SCORING KEY

SECTION A - (Score 1)

1) Ammonia (NH_3) 2) Quick lime / Calcium oxide / CaO 3) Contact process

4) Fountain Experiment 5) Liquid ammonia

6) Lighter NH_3 cames out first then the denser HCl comes later.

7) b / $N_2 + 3H_2 \rightleftharpoons 2NH_3$ + Heat

8) 150 - 300 atm 9) 450^0C

10) $H_2S_2O_7$ 11) Exothermic

12) King of chemicals 13) NH_3

SECTION B - (Score 2)

1. a) Solubility of NH_3 in water.

   b) Phenolphthalein shows pink colour in (alkalies) basic solutions. When water in the beaker combines with ammonia gas, basic ammonium hydroxide is formed.

2. a) Ammonium chloride (NH_4Cl) and Calcium hydroxide [$Ca(OH)_2$]

   b) Because ammonia is less denser than air.

3. a) Ammonium hydroxide (NH_4OH)

   b) $NH_3 + H_2O \rightarrow NH_4OH$

4. a) Ammonium chloride (NH_4Cl)

   b) It decomposes to from NH_3 and HCl

5. a) $BaSO_4$

   b) Sulphate salts react with barium chloride to form a white precipitate of $BaSO_4$. It is not soluble in dil.HCl.

6. • As a refrigerant in ice plants
   • To clean the tiles and window panes
   • For the manufacture of chemical fertilizers like ammonium sulphate, ammonium phosphate, urea etc. (write any two)

SECTION C - (Score 3)

1. a) Equilibrium point

   b) • At the equilibrium point both the reactants and the products co-exist.
   • The rates of forward and backward reactions become equal at equilibrium.
   • Chemical equilibrium is dynamic at the molecular level.
   • Chemical equilibrium is obtained in closed system (Write any two from this)

2. a) Decrease the temperature

   b) According to Le Chatelier's Principle, for the formation of a larger amount NH_3, the temperature has to be reduced. But at low temperature no. of molecules having threshold energy will be less. Therefore the rates of forward and backward reactions get very much reduced, so the system will take more time to reach equilibrium. Hence in the manufacture of NH_3 450^0C is taken as the optimum temperature.

3. a) Contact process

   b) Vanadium pentoxide (V_2O_5)

   c) A - SO_3 B - H_2O

4. a) A

   b) If water is added to acid, it will result in spurting and may cause burns to our body as the reaction is highly exo-thermic.

5. a) Blue colour of $CuSO_4$ disappears/ it turns a white powder.

   b) Dehydrating property

   c) **Activity**

   Adding Con : H_2SO_4 into sugar crystals taken in a watch glass.

   Observation

   A black substance (carbon) is obtained.

   $C_{12}H_{22}O_{11} \xrightarrow{Con.H_2SO_4} 12C + 11\ H_2O$

SECTION D - (Score 4)

1. a) Increase the rate of forward reaction b) Increase the rate of forward raction

   c) Increase the rate of forward reaction d) Increase the rate of forward reaction

2. a) O b) +4 c) carbon d) H_2SO_4 (sulphuric acid)

3. a) H_2SO_4 b) $KHSO_4$ / potassium bisulphate c) $KNO_3 + H_2SO_4 \rightarrow KHSO_4 + HNO_3$

4. a) $BaSO_4$ and $MgCl_2$ formed/Barium sulphate and magnesium chloride are formed

   b) $BaSO_4$ is not soluble in dil. HCl

   c) $BaSO_4$ and $ZnCl_2$ are formed / Barium sulphate and zine chloride are formed.

   d) $BaSO_4$ is not soluble in dil. HCl

UNIT 6

Nomenclature of Organic Compounds and Isomerism

POINTS TO REMEMBER

- The valency of carbon is four
- Ability of catenation is high for carbon
- Single, double and triple bonds are possible between carbon atoms.
- Open chain hydrocarbons having a single bond between any two carbon atoms are called alkanes.
- General formula of alkane is

  C_nH_{2n+2} (n is the number of carbon atoms)
- Hydrocarbons having double bond or triple bond between carbon atoms are commonly known as unsaturated hydrocarbons.
- Hydrocarbons having double bond between any two carbon atoms are called alkenes.
- The general formula of alkene is C_nH_{2n}.
- Hydrocarbons having a triple bond between any two carbon atoms are called alkynes.
- General formula of alkyne is C_nH_{2n-2}
- The difference between the molecular formula of any two successive alkane is CH_2 and can be represented by a general formula. Such series of compounds are called homologous series.
- The presence of certain atoms or groups imparts certain characteristic properties to organic compounds. They are called functional groups

FUNCTIONAL GROUP

Name of function group	Structure	Name of compound
Hydroxyl group	- OH	Alcohols
Carboxylic group	- COOH	carboxylic acid
Halo group	-F, -Cl, -Br, -I	Halo compounds
Alkoxy group	-OR	Ethers

- Compounds having same molecular formula but different chemical and physical properties are called isomers. The phenomenon is called isomerism.
- Compounds with the same molecular formula but possess a difference in the chain structure are called chain isomers.
- Compounds having same molecular formula, but having a difference in their functional groups, are known as functional isomers.
- If the position of the functional group is different in two compounds having the same molecular formula and same functional group, then they are position isomers.

PART - A

1. Find the odd one

   (CH_4, C_4H_{10}, C_5H_8, C_6H_{14})

2. The functional group present in organic acid is ……

3. What is the structure of pent-2-ene?

   a) $CH_2 = CH - CH_2 - CH_2 - CH_3$

   b) $CH_3 - CH = CH - CH_2 - CH_3$

   c) $CH_3 - CH_2 - CH_2 - CH = CH_3$

   d) $CH_3 - CH_2 - CH_2 - CH_2 - CH_3$

4. Which functional group present in ethers?

   (-OH, -COOH, -O-R, -Cl)

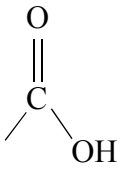
5. $CH_3 - CH_2 - O - CH_3$ write the IUPAC name of this compound.

6. Find out an example of aromatic hydrocarbon from the given organic compounds?

   (C_6H_{14}, C_6H_{12}, C_6H_6, C_6H_{10})

7. Hydrocarbons having a double bond between any two carbon atoms are considered as

8. Name the functional group

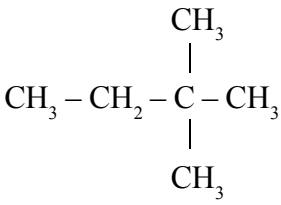


9. Complete the following homologous series.

   CH_4 ….(a)…., C_3H_8, ……(b)……, C_5H_{12}

10. Which is the general formula of a alkanes?

11. Write down the IUPAC name of the hydrocarbon compound with the structural formula.



12. Which is the functional isomer of propanol ?

13. The compound containing alkoxy group are called …….

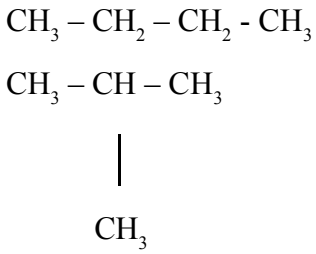
14. In an alkene there are four carbon atoms. How many hydrogen atoms are in it?

15. Which is the smallest alicyclic hydrocarbon?

PART - B

1. Compound – I

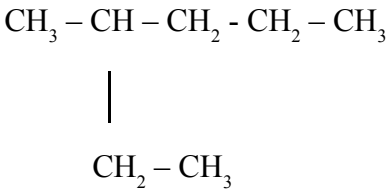
   Compound – II



   a) Find out the type of isomerism exist in these compound?

   b) Write the IUPAC name of compound – II ?

2. The structural formula of a hydrocarbon is given



   a) How many carbon atoms are there in the main chain?

   b) Write the IUPAC name of this compound.

3. $CH_3 – CH_2 – CH_2 – CH_2 – CH_2 – OH$

   a) Write the structure of possible position isomers from the given compound?

   b) Write the IUPAC name of this compound?

4. Select the structural formula of the given compound from the box.

   a) Propene b) But – 1 – yne

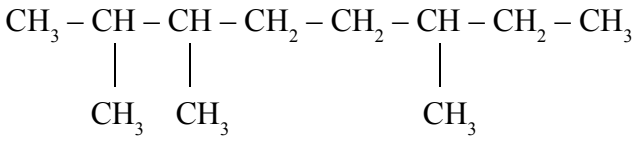
- $CH_2 = CH_2$
- $CH_3 – CH = CH_2$
- $CH_3 – CH_2 – C \equiv CH$
- $CH_3 – C = C – CH_3$

5. Some information about an organic compound are given below.
   - Four carbon atom in the main chain
   - It has carboxylic functional group

   a) Write the structural formulae of the compound?

   b) Write its IUPAC name?

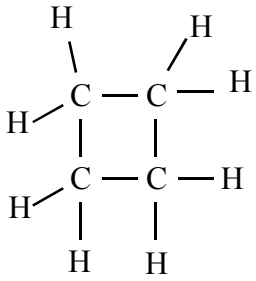
6. Analyze the given structural formula.



   a) How many branches are there in this compound?

   b) Give the position number of branches?

7. The structure of a cyclic compound is given



   a) Write the molecular formula of the compound?

   b) Write its IUPAC name?

8. Some molecular formulae are given

   i) C_5H_{12}

   ii) C_5H_{10}

   iii) C_5H_8

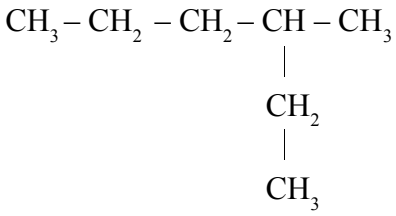
   iv) $C_5H_{12}O$

a) Which of the above is the molecular formula of pent – 2 – ene?

b) Draw the structure of pent – 2 – ene?

PART - C

1. Given below is the structural formula of a hydrocarbon

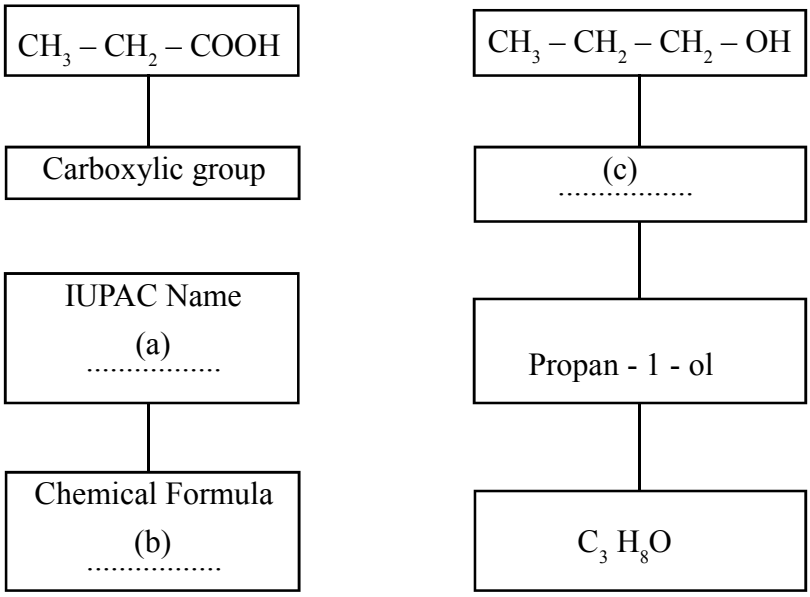


a) What is the molecular formula of this hydrocarbon?

b) Name the branch present?

c) Write down the IUPAC name of this hydrocarbon?

2. Some details about the organic compounds are given below, find a, b, c?



3. Structure of some hydrocarbons are given

1) $CH_3 - CH_2 - O - CH_3$

2) $CH_3 - CH_2 - CH_2 - OH$

3) $CH_3 - CH_2 - CH_2 - CH_3$

a) Write the position isomer of second compound?

b) Write the chain isomer of the third compound?

c) Write the IUPAC name of first compound?

4. Chemical formula of some hydrocarbons are given.

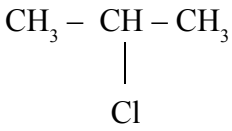
C_4H_8, C_2H_6, C_3H_4, CH_4, C_5H_{10}, C_6H_{10}

a) Which is an alkene?

b) Write the general molecular formula of alkyne?

c) Write the molecular formula of an alkyne with 5 carbon atoms from these?

5. Examine the given structural formula.



a) What is the molecular formula of the compound?

b) Identify the functional group?

c) Give the IUPAC name of the compound?

6. From the following question pick the suitable answer from the box?

a) One pair functional isomers.

b) Ethers

c) One pair position isomers.

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

PART - D

1. Write down the IUPAC names of the given compounds.

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

b) $CH_3 - CH_2 - CH_2 - C \equiv CH$

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

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

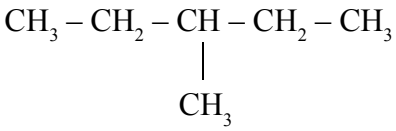
2. 2, 2- dimethyl Butane

   a) How many carbon atoms are in the longest chain?

b) Write the name of the word root?

c) Draw the structure of this compound?

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



a) Find the number of carbon atoms present in the main chain?

b) Identify the branch and write the name?

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?

4. Complete the table

Compound	**IUPAC Name**
$CH_3 - CH_2\ CH = CH_2$	.....(c).....
.....(b).....	Methoxy ethane
$CH_3 - CH(OH) - CH_2 - CH_3$	(c)
(d)	But - 2 - yne

SCORING KEY

PART - A

1) $C_5 H_8$ 2) Carboxylic group 3) (b) $CH_3 - CH = CH - CH_2 - CH_3$

4) – O – R 5) Methoxyethane 6) $C_6 H_6$

7) Alkenes 8) Carboxylic group 9) a) C_2H_6 b) C_4H_{10}

10) C_nH_{2n+2} 11) 2, 2-dimethyl butane 12) Methoxyethane

13) Ethers 14) 8 15) Cyclopropane

PART - B

1. a) Chain isomerism b) 2 - Methyl propane

2. a) 6 b) 3 - Methyl hexane

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

   b) Pentan - 1 - o*l*

4. a) $CH_3 - CH = CH_2$ b) $CH_3 - CH_2 - C \equiv CH$

5. a) $CH_3 - CH_2 - CH_2 - COOH$ b) Butanoic Acid

6. a) 3 - branches b) 2, 3, 6

7. a) C_4H_8 b) cyclobutane

8. a) C_5H_{10}

   b) $CH_3 - CH = CH - CH_2 - CH_3$

PART - C

1. a) C_7H_{16} b) 3 - Methyl hexane c) 3 - Methyl Hexane

2. a) Propanoic acid b) $C_3H_6O_2$ c) hydroxyl group

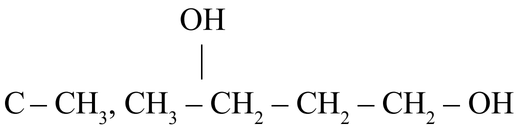
3. a) $CH_3 - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_3$ b) $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$ c) Methoxy ethane

4. a) C_5H_{10} b) C_nH_{2n-2} c) C_5H_8

5. a) C_3H_7Cl b) Chloro c) 2 - Chloro propane

6. a) $CH_3 - O - CH_2 - CH_3$, $CH_3 - CH_2 - CH_2 - OH$

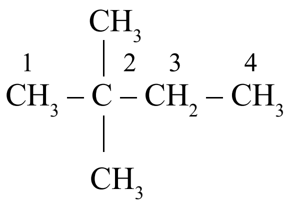
   b) $CH_3 - O - CH_2 - CH_3$

   c) 

PART - D

1. a) 3 - Ethyl pentane b) pent - 1 - yne c) 2, 2, 4 - Trimethyl pentane d) Pentan - 3 - 01

2. a) Four b) But

   c) 

3. a) 5 b) Methyl ($-CH_3$) c) 3-methyl pentane d) pentan - 3 - 0*l*

4. a) butene b) $CH_3 - O - CH_2 - CH_3$ c) Butan - 2 - 0*l* d) $CH_3 - C \equiv C - CH_3$

UNIT 7

Chemical Reactions of Organic Compounds

- Some basic chemical reactions of organic compounds are substitution reactions, addition reactions, polymerisation, combustion, Thermal cracking etc.
- A reaction in which an atom or a group in a compound is replaced by another atom or 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 (monomers) 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. This process is called combustion.
- Hydrocarbons are used as fuels, because combustion is an exothermic process.
- Butane is the main component of LPG.
- Thermal cracking is the process by which hydrocarbons with high molecular masses, when heated in the absence of air undergo decomposition to form hydrocarbons with lower molecular masses.
- Compounds with –OH functional group are called Alcohols.
- Compounds with –COOH functional group are called carboxylic acids.
- Methanol is known as wood spirit and ethanol as grape spirit.
- Methanol is used as solvent in the manufacture of paints and as a reactant in the manufacture of varnish and formalin.

- Methanol is industrially prepared by treating carbon monoxide with hydrogen in the presence of a catalyst at high temperature and pressure.
- Ethanol is manufactured by fermenting dilute molasses by adding yeast.
- 8-10% strong ethanol is known as wash.
- 95.6% strong ethanol is known as rectified spirit.
- The ethanol mixed with poisonous substance is known as denatured spirit.
- Mixture of ethanol and methanol is known as methylated spirit.
- Above 99% strong ethanol is known as absolute alcohol
- A mixture of absolute alcohol and petrol known as power alcohol is used as fuel in vehicles.
- Organic acids with more number of carbon atoms are called fatty acids.
- About 5-8% ethanoic acid (Acetic acid) is known as vinegar.
- Ethanoic acid can be manufactured by treating methanol with carbon monoxide in the presence of catalyst.
- Esters are obtained by the reaction between alcohols and carboxylic acids. This process is called esterification.
- Esters have the pleasant smell of fruits and flowers.
- Compounds with – COOR functional groups are called Esters.
- Soap is the salt formed when oils and fats react with alkalies.
- Surface tension decreases on adding soap to water.
- Most detergents are salt of sulphonic acids.
- Detergents are more effective than soaps in hard water and acidic solutions.
- The microorganisms in water cannot decompose the components of detergent, it leads to destruction of aquatic life.

SECTION - A (Score - 1)

1. Finding the relation complete this – OH : Alcohol ; -COOH : …….
2. Name the byproduct obtained in the industrial production of soap.
3. Complete the chemical equation $CO + 2H_2 \xrightarrow{\text{Catalyst}}$ …….
4. Organic compound known as wood spirit is ……
5. The 8-10% strong ethanol obtained by the fermentation of dil molasses is known as ….....
6. The ethanol which is strong more than 99% is known as ……....
7. About 5-8% ethanoic acid is known as ……....
8. Which one among these is not a fatty acid?
   a) Sulphuric acid
   b) Oleic acid
   c) Palmitic acid
   d) Stearic acid
9. The main component of LPG is ……....
10. The monomer of PVC is ……...
11. Complete the chemical equation $CH \equiv CH + H_2 \rightarrow$ ……....
12. Organic compounds having the pleasant smell of fruits and flowers are ……....
13. Ethene : Polythene; …… : Teflon
14. $CH_3\,CH_2 - OH + CH_3\,COOH \xrightarrow{H_2SO_4}$ …….. + H_2O

SECTION - B (Score - 2)

1. Examine the structures of the compounds given below and find the esters among them.

   a) $CH_3 - CH_2 - COOH$

   b) $CH_3 - COO - CH_3$

   c) $CH_3CH_2 - CH_2 - OH$

   d) $CH_3 - CH_2 - COO - CH_3$

2. Write the uses of given polymers.

Polymer	Use
PVC	(a) ……
Polyisoprene (natural rubber)	(b) ……

3. Soaps and detergents are cleansing agents write one merit and one demerit of soap compared to detergent.

4. Observe the chemical equation given below

$$n\,CF_2 = CF_2 \xrightarrow[\text{hight temp/pressure}]{\text{Catalyst}} \left[CF_2 - CF_2\right]_n$$

   a) Write the name of the product obtained

   b) Write one use of the product

5. Complete the missing part of the chemical equation

$$n\,CH_3 - CH = CH_2 \xrightarrow{\text{Polymerisation}} \underline{\quad A \quad}$$

$$CH_3 - CH_3 + Cl_2 \xrightarrow{\text{Sunlight}} \underline{\quad B \quad} + HCl$$

   Find A and B

6. Which of the given molecules can form polymers?

(Butane, Propane, Propene, Methane, Butene)

SECTION - C (Score - 3)

1. Complete the table

Reactants	Products
$CH_4 + O_2$	(a) + H_2O
$CH_2 = CH_2 + H_2$	(b)
$CH_3Cl + Cl_2$	(c) + HCl

2. $CH_3 - OH + CO \xrightarrow{\text{Catalyst}} A$

a) The industrial preparation of which organic compound is given above.

b) Write two uses of its?

3. Ethanol is prepared by fermentation of dilute molasses using yeast. The chemical equations of that reaction is given below. Complete the missing parts

$C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{(A) enzyme in yeast}} C_6H_{12}O_6 + C_6H_{12}O_6$

Sucrose — glucose — fructose

$C_6H_{12}O_6 \xrightarrow{\text{(B) enzyme in yeast}} 2\,C_2H_5OH + 2\,(C)$

4. Identify the chemicals required for the preparation of esters given below.

a) $CH_3CH_2COOCH_3$

b) CH_3COOCH_3

c) $HCOOCH_3$

5. We know that cooking gas cylinders contain LPG.

   a) Which is the main component of LPG?

   b) Which are the products obtained on combustion of that gas?

   c) Write the balanced chemical equation of the combustion reaction.

SECTION - D (Score - 4)

1. Some chemical equations are given below

   (i) $CH \equiv CH + H_2 \rightarrow$ (A)

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

   (iii) $A + HCl \rightarrow$ (C)

   a) Find A, B and C

   b) What is the name of chemical reactions (i) and (iii)

2. Complete the table

Reactants	**Products**	**Name of chemical reaction**
(i) $CH \equiv CH + H_2$	$CH_2 = CH_2$	(a)
(ii) $nCH_2 = CH_2$	(b)	Polymerization
(iii) $CH_3 - CH_2 - CH_3$	(c)	Thermal cracking
(iv) $CH_4 + Cl_2$	$CH_3Cl + HCl$	(d)

3. Match the following

(i) 8-10% ethanol	a) Rectified spirit
(ii) 95.6% ethanol	b) Wash
(iii) 99% ethanol	c) Power alcohol
(iv) Petrol + 99% ethanol	d) Absolute alcohol

4. Write the IUPAC name of the organic compounds given below

a) H – COOH

b) $CH_3 – CH_2 – COOH$

c) $CH_3 – OH$

d) $CH_3 – COO – CH_2 – CH_3$

5. $CH_3 – CH_2 – CH_3$ → i) Heating in presence of air → A + B

ii) Heating in absence of air → C + D

a) Find the products in each case

b) Write the name of each reaction

SCORING KEY

SECTION A - (Score 1)

1. Carboxylic Acid
2. Glycerol
3. $CH_3 – OH$ (methanol)
4. Methanol
5. Wash
6. Absolute Alcohol

7. Vinegar
8. (a) (Sulphuric acid)
9. Butane
10. Vinyl Chloride
11. $CH_2 = CH_2$
12. Esters
13. Terafluoro ethene
14. $CH_3\ CH_2\ COO - CH_3$

SECTION B - (Score 2)

1. (b), (d)
2. (a) Making pipes (b) Tyre manufacturing
3. The microorganisms in water cannot decompose the components of detergents. Hence detergents released into water leads to destruction of aquatic life. Soap does not form lather with hard water. But detergents are effective with hard water.
4. a) Teflon / poly-tetrafluoro ethane

   b) Used for coating on the inner surface of non-stick cookware.

5. a) $A \rightarrow \left[CH - CH_2 \right]_{CH_3} \rightarrow$ b) $CH_3 - CH_2Cl$
6. Propene, Butene

SECTION C - (Score 3)

1. a) $CO_2 + H_2O$ b) $CH_3 - CH_3$ c) CH_2Cl_2
2. a) Ethanoic acid b) Rayon manufacturing; Rubber, silk industry
3. A-invertase B- zymase C-CO_2
4. a) $CH_3–CH_2–COOH + CH_3\ OH$

   b) $CH_3–COOH + CH_3OH$

   c) $H–COOH + CH_3–OH$

5. a) Butane

   b) $CO_2 + H_2O$

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

SECTION D - (Score 4)

1. a) A – $CH_2 = CH_2$ B - $\left[CH_2 - CH_2\right]_n$ C - $CH_3 - CH_2Cl$

   b) i) & iii) are addition reactions

2. a) Addition reaction

   b) $\left[CH_2 - CH_2\right]_n$

   c) $CH_4 + CH_2 = CH_2$

   d) Substitution reaction

3. i) Wash ii) Rectified spirit

   iii) Absolute alcohol iv) Power alcohol

4. a) Methanoic acid

   b) Propanoic acid

   c) Methanol

   d) Ethyl ethanoate

5. a) A + B = $CO_2 + H_2O$

   C + D = $CH_4 + CH_2 = CH_2$

   b) i) Combustion ii) Thermal cracking

SSLC MODEL QUESTION PAPER

SET A

Time : 1½ Hours

STD: X **CHEMISTRY** Total Score : 40

General Instructions

- The first 15 minutes is the cool off time. You may use this time to read and plan your answers.
- Answer the questions only after reading the instructions and questions thoroughly.
- Answer any four questions from each section

SECTION - A

(Answer any 4 from questions 1-5 each carry 1 score)

1. Maximum number of electrons that can be accommodated in d subshell is ……

   (2, 5, 10, 14)

2. More than 99% strong ethanol is known as …….

3. Find the relation and fill up suitably.

   Iron : Haematite ; Aluminium: …….

4. I GMM water contains ……. molecules.

5. Which is the product obtained at cathode by the electrolysis of sodium chloride solution

SECTION - B

(Answer any 4 from questions 6-10. Each carry 2 score.)

6. From the statements given below find the wrong one and correct them.

   a) Energy of the shells decreases as distance from the nucleus increases.

   b) Electrons are filled in shells in the increasing order of their energy levels.

   c) As the distance from the nucleus increases force of attraction on the electron decreases.

   d) 'd' subshell is the common subshell present in all the shells.

7. Find the number of molecules and volume of 440g of CO_2. (Hint: Molecular mass of CO_2 – 44)

8. Zinc and copper are the metal rods in an electrolytic cell. The chemical reaction that happens in the cell are given below.

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

   a) Among these which one is kept as anode and which one is kept as cathode?

   b) Which one undergoes oxidation?

9. Iron is industrially prepared from Haematite.

   a) Which are the substances added to blast furnace with iron ore?

   b) Which substance act as the reducing agent here?

10. Why conc. H_2SO_4 is not used as the drying agent in laboratory preparation of NH_3? Which substance is used as the drying agent here?

SECTION - C

(Answer any 4 questions from 11-15. Each carries 3 score)

11. Structural formula of two compounds are given below.

A) $CH_3 - CH_2 - CH_2 - CH_2 - OH$

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

a) Write the molecular formula of A and B

b) What type of Isomers are they?

c) Write the structural formula of a functional isomer of compound A?

12. Subshell electronic configuration of some elements are given below. (Symbols are now real)

P – $1s^2\ 2s^2\ 2p^6$

Q – $1s^2\ 2s^2\ 2p^3$

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

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

a) Which element among this has the highest ionization energy?

b) Which one shows variable oxidation state?

c) Which are the elements in same period?

13. $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} + \text{Heat}$

In this reaction how the following changes influence the amount of product?

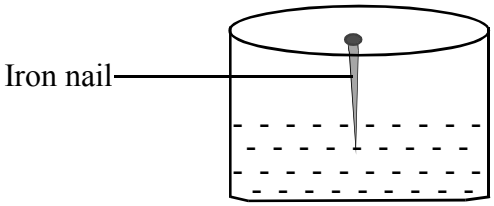
a) Decrease in temperature

b) Decrease in pressure

c) Increase in the concentration of SO_2

14. Ores of zinc are zinc blend and calamine.
    a) What is the chemical name of calamine?
    b) Which is the concentration method used for zinc blend.
    c) Which ore of zinc is converted to its oxide by the method of roasting?

15.



$CuSO_4$ Solution

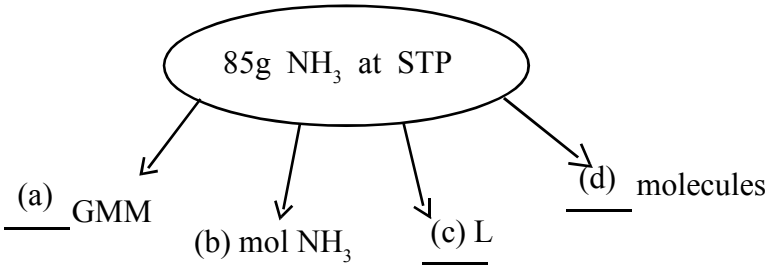
    a) Write the name of chemical reaction taking place here?
    b) What change happens on the surface of iron nail?
    c) Write the chemical equation of the reaction taking place here?

SECTION - D

(Answer any 4 questions from 16-20. Each carries 4 score)

16. Complete the flow chart related to 85 g NH_3 at STP.

    (Hint: Atomic mass N – 14, H-1)



17. Some chemical equations are given below.

i) $CH_2 = CH_2 + HBr \rightarrow$ (a)

ii) $nCF_2 = CF_2 \rightarrow$ (b)

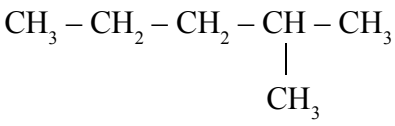
iii) $C_4H_{10} \rightarrow C_2H_6 +$ (c)

iv) $CH_4 + 2O_2 \rightarrow$ (d) $+ 2H_2O$

a) Find a, b, c, d

b) Write the name of chemical reactions in each case.

18. The structural formula of a hydrocarbon is given below.



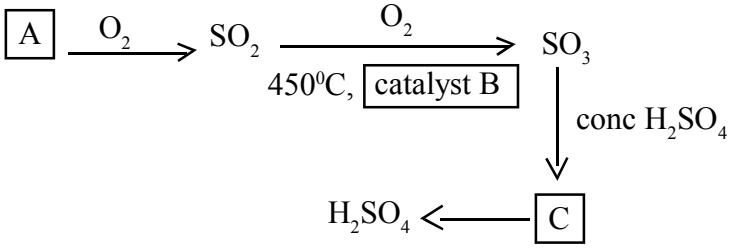
a) How many carbon atoms are in the main chain?

b) What is the name of its branch?

c) What is the position of the branch?

d) Write the IUPAC name of the compound.

19. Complete the flowchart related to the industrial preparation of sulphuric acid.



a) Find A, B, C

b) Why sulphuric acid is not prepared by dissolving SO_3 in water?

20. Subshell electronic configuration of chromium written by two children are given below:

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

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

a) Which one is correct? Why?

b) Write the oxidation state of chromium in $K_2\ Cr_2\ O_7$ ($K = {}^{+}1$, $O = {}^{-}2$)

c) Write the group and period in which this element belongs to.

d) Why does chromium shows variable oxidation state?

ANSWER KEY

SECTION - A

1. 10 2. Absolute alcohol 3. Bauxite

4. 6.022×10^{23} 5. Hydrogen

SECTION - B

6. a) As the distance from the nucleus increases energy of electron increases.

d) S subshell is the common subshell in all the shells.

7. No: of moles $= \frac{440}{44} = 10$

No: of molecules $= 10\times6.022\times10^{23}$

Volume $= 10\times22.4 = 224L$

8. a) Anode - Zinc Cathode - Copper b) Zinc

9. a) Coke, Limestone ($CaCO_3$)

   b) CO

10. As ammonia is a base it reacts with H_2SO_4. So CaO is used as the drying agent.

SECTION - C

11. a) A – $C_4H_{10}O$ B - $C_4H_{10}O$

    b) Position isomers

    c) $CH_3 – O – CH_2 – CH_2 – CH_3$ / $CH_3 – CH_2 – O – CH_2 – CH_3$

12. a - P b - R C - P & Q

13. a) Increases b) Decreases c) Increases

14. a) $ZnCO_3$ b) froth floatation c) zinc blend

15. a) Displacement reaction

    b) A reddish brown deposit of Cu is seen on the iron nail.

    c) $Fe + CuSo_4 \rightarrow FeSO_4 + Cu$

SECTION - D

16. a) $\frac{85}{17}$ = 5 GMM b) 5 mol c) 5×22.4 d) $5\times6.022\times10^{23}$

17. a) $CH_3 – CH_2Br$ b) $\left[CF_2 – CF_2\right]_n$ c) C_2H_4 d) CO_2

    b) i) Addition Reaction ii) Polymerisation

    iii) Thermal cracking iv) Combustion

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

19. a) A - Sulphur B- V_2O_5 C - $H_2S_2O_7$ (Oleum)

b) As the dissolution of SO_3 in water is an exothermic process, H_2SO_4 formed will be formed in the form of smog which hinders further dissolution.

20. a) Student 2 - $1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^6\ 3d^5\ 4s^1$, subshells with half filled arrangement is more stable than others.

b) $K_2^{+1}Cr_2O_7^{-2}$ $\quad (2\times{}^{+}1) + 2x + (7\times{}^{-}2) = 0$

$2 + 2x - 14 = 0$

$2x = {}^{+}2$

$x = {}^{+}6$

c) Group = 5 + 1 = 6, period = 4

d) There is only very small energy difference between outer s and penultimate d subshell.

SSLC MODEL QUESTION PAPER

SET B

Time : 1½ Hours

STD: X **CHEMISTRY** Total Score : 40

General Instructions

- The first 15 minutes is the cool off time. You may use this time to read and plan your answers.
- Answer the questions only after reading the instructions and questions thoroughly.
- Answer any four questions from each section

SECTION - A

(Answer any 4 from questions 1-5 each carry 1 score)

1. The maximum number of electrons that can be accommodate in a f subshell is .....
2. Which of the following metal will not react with water?

   (Sodium, Magnesium, Copper)
3. Find the relation and fill suitably

   Haemetite - Iron

   Calamine - .....
4. 95.6% ethanol is known as .....
5. 1 mol = ... number of particles

SECTION - B

(Answer any 4 from questions 6-10. Each carry 2 score.)

6. When an inflated balloon is kept in sunlight, it will burst.

   a) Which gas law is related to it.

   b) Write the mathematical expression of this law.

7. a) Which os the following is the correct electronic configuration of copper.

      i) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9\ 4s^2$

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

   b) Justify your answer.

8. Cu and Zn are the two electrods of an electrochemical cell. The chemical reactions taking place in the cell are given below.

   $Fe \rightarrow Fe^{2+} + 2e, \quad Cu^{2+} + 2\bar{e} \rightarrow Cu$

   a) Which metal acts as anode?

   b) Which metal among these is more reactive.

9. a) Which one of the following compound contains hydroxyl functional group.

      i) $CH_3 - CH_2 - OH$ ii) $CH_3 - CH_2 - COOH$

   b) Write the IUPAC name of the compound (ii)

10. Examine the following chemical reaction

$$n\ CF_2 = CF_2 \xrightarrow[\text{high temp / pressure}]{\text{Catalyst}} -[CF_2 - CF_2]_n$$

   a) Write the name of the product?

   b) Which type of chemical reaction is this?

SECTION - C

(Answer any 4 questions from 11-15. Each carries 3 score)

11. When molten NaCl undergoes electrolysis
    a) Which product obtained at cathode?
    b) Write the chemical equation of the reaction takesplace at anode?
    c) Write the chemical change taking place here?
12. Equations related to the industrial production of Iron are given below:

    $C + O_2 \rightarrow CO_2 + heat$

    $CO_2 + C + heat \rightarrow 2CO$

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

    $CaO + SiO_2 \rightarrow CaSiO_3$

    a) Write the chemical equation for the reaction between flux and gangue?
    b) Write the chemical equation for the reduction of the ore?
    c) Which are the factors to be considered by the selection of a flux?
13. At constant temperature and pressure 2L of a gas contains X molecules. Based on this complete the table given below.

Gas	Volume in litres	Number of molecules
Nitrogen	2	X
Ammonia	4	(a)
Carbon dioxide	(b)	3X
Oxygen	1	(c)

14. The chemical equation for the production of ammonia in Haber process are given below:

    $N_2 + 3H_2 \rightleftharpoons 2NH_3 + heat$

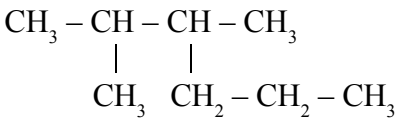
    How the following factors affect the rate of forward reaction.

a) Remove NH_3 from the system

b) Increase the pressure

c) Increase the temperature

15. Structure of a hydrocarbon is given



a) Number of carbon atoms in the straight chain?

b) Write the position numbers of the branches?

c) Write the IUPAC name of the compound?

SECTION - D

(Answer any 4 questions from 16-20. Each carries 4 score)

16. Some materials are given below:

Mg rod Cu rod Ferrous sulphate Silver rod

Magnesium Sulphate Copper sulphate

a) Choose the given materials and construct a galvanic cell, and label it?

b) Write the balanced chemical equations in cathode and anode?

17. Write the answers of the questions related to sulphuric acid?

a) Name the industrial production of sulphuric acid?

b) Which is the catalyst used here?

c) Conc: H_2SO_4 is added to copper sulphate, a white substance is formed. Which property of sulphuric acid is observed here?

d) Conc: H_2SO_4 is not used as a drying agent in the production of ammonia. Why?

18. Subshell electronic configuration of some elements are given below. Answer the following questions.

(Symbols are not real)

A – [Ne] $3s^2$ $3p^1$ B - [Ne] $3s^2$

C – [Ne] $3s^2$ $3p^5$ D – [Ar] $3d^1$ $4s^2$

a) Which element is having least ionisation energy?

b) Which one is a 'd' block element?

c) Write the group number of A?

d) Write the chemical formula of the compound formed by C and B?

19. The structural formula of a compound is given below:

$CH_3 - O - CH_2 - CH_3$

a) Write the IUPAC name of the compound?

b) Write the structure of any isomer of this compound?

c) Which type of isomerism is existing these compounds?

d) Name the functional group of the given compound.

20. Complete the table and select the correct name of the organic reactions from brackets.
(addition reaction, polymerization, substitution reaction, combustion, thermal cracking)

Chemical equations	Name of the reaction
i) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$	(a)
ii) $nCH_2 = CH_2 \rightarrow \{CH_2 - CH_2\}_n$	(b)
iii) $CH_3 - CH_3 + Cl_2 \rightarrow CH_3\ CH_2Cl + HCl$	(c)
iv) $CH_2 = CH_2 + Cl_2 \rightarrow CH_2(Cl) - CH_2(Cl)$	(d)

ANSWER KEY

SECTION - A

1. 14 2. Copper 3. Zinc

4. Rectified spirit 5. 6.022×10^{23}

SECTION - B

6. a) Charle's law b) $\frac{V}{T}$ = a constant

7. a) $1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^6\ 3d^{10}\ 4S^1$

   b) This is more stable because d^{10} electronic configuration has more stability

8. a) Fe - Anode, Cu - Cathode b) Fe

9. a) $CH_3 - CH_2 - OH$ b) Propanoic acid

10. a) Teflon b) Polymerisation

11. a) sodium b) $2Cl^- \rightarrow Cl_2 + 2e^-$ c) Electrical energy changes to chemical energy

12. a) $CaO + Si O_2 \rightarrow Ca Si O_2$ b) $Fe_2 O_3 + 3CO \rightarrow 2Fe + 3CO_2$

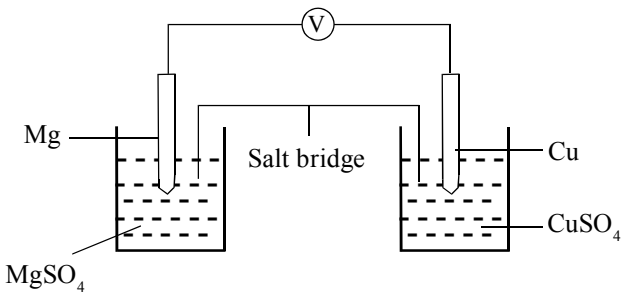
c) If gangue is acidic basic flux should be added and if gangue is basic acidic flux should be added.

13. a - 2x b - 6L c. $\frac{X}{2}$

14. a) Increases b) Increases c) Decreases

15. a) 6 b) 2 and 3 c) 2, 3 - dimethyl hexane

16. a)



b) Anode

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

Cathode

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

17. a) Contact process b) V_2O_5 c) Dehydrating nature

    d) H_2SO_4 reacts with ammonia as it is having basic nature.

18. a) B b) D c) 13 d) BC_2

19. a) Methoxy ethane b) $CH_3 - CH_2 - CH_2 - OH$

    c) Functional Isomerism d) Alkoxy (– O – R)

20. a) Combustion b) polymerisation c) substitution reaction d) addition reaction