Chemistry
Syllabus

Full marks: 100 (75T + 25 P)

Pass Marks: 27T+10P
Teaching Hours: 150T + 50P

I. INTRODUCTION

Chemistry is concerned with the physical and chemical characteristics of substances, the nature of matter and the study of chemical reactions. Chemistry, thus, is a powerful process of uncovering and extending our understanding of various chemical phenomena. The power resides in the combination of concepts and experiments involving careful observation and quantitative measurements under controlled conditions. The resulting concepts suggest further experiments and investigations as a result; there will be a modification of the existing concept leading to a creativity of thought. This creativity involves the recognition of a problem; formulation of ideas to solve the problem and ultimately refinement of the original ideas. The present curriculum aims to foster this uniqueness among students by enabling them to study both theoretical and practical aspects of chemistry.

This course is theory-cum-practical. It is intended to consolidate learning in chemistry achieved in the secondary school. Furthermore, it intends to provide a concrete knowledge and appropriate skills for those students, continuing further studies in chemistry and the students not studying the subject beyond this stage. The course seeks to maintain a balance between useful facts, concepts and theories which will facilitate understanding of the properties of substances, reactions and processes. Emphasis is enforced to stimulate, create and sustain students' interest in chemistry. Chemistry being an experimental science, laboratory is an essential component of its syllabus. The course intends to make students aware of the importance of scientific method for accurate experimental work and develop the abilities to interpret, organize and evaluate data in order to make decisions and solve problems.

II. GENERAL OBJECTIVES

The general objectives of this course are to:
1. apply appropriate chemical principles, concepts, theories, definitions, laws, models and patterns to interpret, draw conclusion, make generalization, and predictions from chemical facts, observations and experimental data;
2. select appropriate facts to illustrate a given principle, concept, theory, model and pattern;
3. present chemical ideas in a clear and logical form; and
4. select and organize data and perform calculations in which guidance on the method is not supplied.

III. SPECIFIC OBJECTIVES

After studying the course, the student shall be able to:
1. state and apply fundamental facts and principles of chemistry dealing with the
   i. Methods of preparation: general, laboratory and industrial process of the matters,
   ii. Physical and chemical properties,
   iii. Important applications.
2. perform chemical calculations
3. identify the mineral resources of Nepal
4. understand chemical patterns and principles
5. apply knowledge and understanding of chemistry in familiar and unfamiliar situations
6. make accurate observations and measurements, being aware of possible sources of error
7. record the results of experiments accurately and clearly; draw conclusion and make generalization from experiment and
8. appreciate the scientific, social, economic, environmental and technological contributions and applications of chemistry.

General & Physical Chemistry (Section A)

Unit 1: Language of Chemistry (Review Lecturers)
- 3 teaching hours
1. Chemical equations, their significances and limitations
2. Balancing chemical equations by:
   i. Hit and trail method
   ii. Partial equation method
3. Types of chemical reaction

Unit 2: Chemical Arithmetic
- 17 teaching hours

2.1 Dalton's atomic theory and Laws of Stoichiometry:
1. Postulates of Dalton's atomic theory
2. Law of conservation of mass
3. Law of constant proportions
4. Law of multiple proportions
5. Law of reciprocal proportions
6. Law of gaseous volumes
7. Chemical calculations based on stoichiometry

2.2. Atomic Mass and Molecular Mass:
Definition of atomic mass and molecular mass
1. Mole concept
2. Mole in term of mass, volume number and ions
3. Calculation based on mole concept

2.3. Empirical, Molecular Formula and Limiting Reactants:
1. Percentage compositions
2. Derivation of empirical and molecular formula from percentage composition

3. Chemical calculation based on following chemical equation
   - Limiting reactants
   - Mass-mass relationship
   - Volume-volume relationship
   - Mass volume relationship (Solving related numerical problems)

2.4. Avogadro's Hypothesis and Its Applications:
1. Development of Avogadro's hypothesis
2. Definition of Avogadro's hypothesis
3. Application of Avogadro's hypothesis
   i. Deduction of atomicity of elementary gas
   ii. Deduction of relationship between molecular mass and vapour density
   iii. Deduction of molar volume of gases
   iv. Deduction of molecular formula from its volumetric composition
   (Solving related numerical problems)

2.5. Equivalent Masses:
1. Concept of equivalent mass
2. Equivalent weight of elements, and compounds (Salt, acid , base, oxidising agents, reducing agents)
3. Gram equivalent weight (GEW)
4. Relation between equivalent weight, valency and atomic weight
5. Determination of equivalent weight of metal by
   i. Hydrogen displacement method
   ii. Oxide formation method
   (Solving related numerical problems)

Unit 3: State of Matter   - 14 teaching hours

3.1. Gaseous State:
1. Boyle's law
2. Charle's law and Kelvin scale of temperature
3. Application of Charle's law and Boyle's law
4. Combined gas law, ideal gas equation and universal gas constant
5. Dalton's law of partial pressure
6. Mathematical derivation of Dalton's law and their applications
7. Graham's law of diffusion and its applications
8. Kinetic theory of gas and its postulates
9. Ideal and real gases
10. Deviation of gas from ideal behaviour
(Solving related numerical problems)

3.2 Liquid State:
1 Physical properties of liquid
   i. Evaporation and condensation
   ii. Vapour pressure of liquid and boiling point
   iii. Surface tension
   iv. Viscosity
2 Solution and solubility:
   i. Equilibrium in saturated solution
   ii. Solubility and solubility curve and its applications.
   (Solving related numerical problems)

3.3. Solid State:
1. Crystalline and amorphous solids
2. Water of crystallization
3. Efflorescences
4. Deliquescences
5. Hygroscopic
6. Seven types of crystal system
7. Simple cubic, face centered and body centered

Unit 4: Atomic Structure   - 10 teaching hours

1. Discovery of fundamental particles of atom (electron, proton and neutron)
2. Concept of atomic number, mass number, fractional atomic mass, isotopes, isobars
3. Rutherford's α-ray scattering experiment and nuclear model of atom; limitation
4. Bohr's model of atom and explanation of hydrogen spectra
5. Limitation of Bohr's model of atom
6. Elementary idea of quantum mechanical model
   i. Dual nature of electron (de-Broglie equation)
   ii. Heisenberg's uncertainty principle
   iii. Probability concept
7. Shape of atomic orbital (s and p orbitals only)
8. Quantum numbers
9. Pauli's exclusion principle
10. Hund's rule of maximum multiplicity
11. Aufbau principle and Bohr Bury rule
12. Electronic configuration of the atoms and ions (Z = 1 to 30)

Unit 5: Nuclear Chemistry
- 3 teaching hours
1. Concept radioactivity
2. Radioactive rays (alpha ray, beta ray and gamma ray)
3. Meaning of natural and artificial radioactivity
4. Nuclear reactions, Nuclear energy (fission and fusion)
5. Nuclear isotopes and uses

Unit 6: Electronic Theory of Valency and Bonding
- 8 teaching hours
1. Basic assumption of electronic theory of valency
2. Octet rule
3. Ionic bonds, ionic compounds and characteristics of ionic compounds. Lewis symbol to represent the formation of ionic compounds
4. Covalent bonds, covalent compounds and characteristics of covalent compounds - Lewis structure of some typical covalent compounds
5. Co-ordinate covalent bonds. Lewis structures of some typical co-ordinate covalent compounds
6. Exception of the octet rule
7. Partial ionic characters of covalent compounds. Non-polar and polar covalent molecules
8. Dipole moments and its application
9. Some special types of bonds: hydrogen bond and its types, metallic bond, Vander Waal's bond, Resonance and resonance hybrid structures of O_3, SO_3, SO_2, CO_3^{-2}, SO_4^{-2}, PO_4^{-3}, NO_3^{-}
10. Classification of crystalline solids
    - i. Ionic solid
    - ii. Covalent solid
    - iii. Molecular solid
    - iv. Metallic solid

Unit 7: Periodic Classification of Elements
- 6 teaching hours
1. Introduction
2. Mendeleev's periodic law and periodic table
3. Anamolies of Mendeleev's periodic table
4. Modern periodic law and modern periodic table
5. Advantages of modern Periodic table
6. Division of elements into s,p, d and f-blocks
7. Periodicity of physical properties: valency, atomic radii, ionic radii ionisation energy, electron affinity and electronegativity (general trends only)

Unit 8: Oxidation and Reduction
- 6 teaching hours
1. Classical concept of oxidation and reduction
2. Electronic interpretation of oxidation and reduction
3. Oxidation number and rules for the assignment of oxidation number
4. Differentiate between oxidation number and valency
5. Oxidising and reducing agent
6. Redox reaction
7. Balancing redox reactions by
    - i. oxidation number method
    - ii. ion-electron method

Unit 9: Equilibria
- 5 teaching hours
1. Introduction
2. Equilibrium involving in physical change
3. Chemical equilibrium
    - Reversible and irreversible reactions
    - Dynamic nature of chemical equilibrium and its characteristics
    - Law of mass action
    - Equilibrium constant (Kc) and its characteristics
    - Homogenous and heterogeneous equilibrium
    - Relation between Kp and Kc (derivation)
    - Le-Chatelier's principle and its application
    (No numerical is required)

Inorganic Chemistry (Section B)

Unit 10: Non - Metals I
- 12 teaching hours

10.1. Hydrogen:
1. Position in periodic table
2. Atomic hydrogen , Nascent hydrogen
3. Isotopes of hydrogen
4. Ortho and Para hydrogen
5. Applications

10.2. Oxygen:
1. Position in periodic table
2. Types of oxides
3. Uses of oxygen

10.3. **Ozone:**
1. Occurrence
2. Preparation from oxygen
3. Structure of ozone
4. Important properties of ozone
5. Ozone layer and ozone hole
6. Uses of ozone

10.4. **Water:**
1. Structure
2. Solvent property of water
3. Heavy water and uses
4. Uses

10.5. **Nitrogen and Its Compounds:**
1. Position of nitrogen in Periodic table
2. Uses of nitrogen
3. Types of nitrogen oxides (name and Lewis structure)
4. Ammonia
   - Manufacture by Haber's synthesis method
   - Physical properties, chemical properties and uses
5. Oxyacids of nitrogen (type)
6. Technical production of nitric acid by Ostwald's method
   - Properties of nitric acid and uses.
   - Test of nitrate ion

Unit 11: Non-Metals II   - 23 teaching hours

11.1. **Halogens: (Chlorine, Bromine and Iodine)**
1. Position in periodic table
2. Comparative study on: preparation, properties and uses
3. Manufacture of bromine from Carnallite process and manufacture of iodine form
   i. Sea weeds (principle only)   ii. Caliche (Principle only)
4. Uses of halogens
5. Comparative study on; preparation, properties and uses of haloacids (HCl, HBr and HI)

11.2. **Carbon:**
1. Position in periodic table
2. Allotropes of carbon including fullerenes
3. Laboratory preparation, properties and uses of carbon monoxide

11.3. **Phosphorous:**
1. Occurrence, position in periodic table
2. Allotropes of phosphorous and uses of phosphorus
3. Preparation, properties and uses of phosphine
4. Oxides and oxyacids of phosphorous (structure and uses)
5. Preparation, properties and uses of orthophosphoric acid

11.4. **Sulphur:**
Position in periodic table and allotropes
1. Hydrogen Sulphide: (Laboratory methods and Kipp's apparatus), properties and uses of
2. Sulphurdioxide : Laboratory preparation, preparation and uses
3. Sulphuric acid: Manufacture by Contact process, properties and uses
4. Sodiumthiosulphate (hypo): formula and uses

11.5. **Boron and Silicon:**
1. Occurrences, position in periodic table
2. Properties and uses
3. Formula and uses of borax, boric acid, Silicate and Silica

11.6. **Noble gas:** Position in periodic table, occurrence and uses

11.7. **Environmental Pollution:**
- Air pollution, photochemical smog
- Acid rain, water pollution
- Green house effect

Unit 12: Metal and Metallurgical Principles   - 6 teaching hours

1. Characteristics of metals, non-metals and metalloids
2. Minerals and ores
3. Important minerals deposit in Nepal
4. Different process involved in metalurgical process
5. Concentration
6. Calcination and roasting
7. Smelting
8. Carbon reduction process
9. Thermite process
10. Electrochemical reduction
11. Refining of metals: poling, electro-refinement etc

Unit 13: Alkali and Alkaline Earth Metals
- 10 teaching hours

13.1 Alkali Metals:
1. Periodic discussion and general characteristics.
2. Sodium: Occurrence, Extraction from Down's process; properties and uses.
3. Sodium hydroxide: Manufacture, properties and uses.
4. Sodium carbonate: Manufacture, properties and uses.

13.2 Alkaline Earth Metals:
1. Periodic discussion and general characteristics
2. Preparation, properties and uses of
   i. Quick lime, ii. Plaster of Paris iii. Bleaching powder, iv. Magnesia v. Epsom salt

Organic Chemistry (Section C)

Unit 14: Introduction to Organic Chemistry

14.1 Fundamental Principles:
- 6 teaching hours
1. Definition of organic chemistry and organic compounds
2. Origin of organic compounds (Vital force theory)
3. Reasons for the separate study of organic compounds
4. Tetra covalency and catenation property of carbon
5. Classification of organic compounds
6. Functional groups and homologous series
7. Meaning of empirical formula, molecular formula, structural formula and contracted formula
8. Qualitative analysis of organic compounds. (Detection of N,S and halogens by Lassaigne's test)

14.2. Nomenclature of Organic Compounds:
- 6 teaching hours
1. Common names
2. IUPAC system and IUPAC rules of naming hydrocarbons, alcohols, ethers, aldehydes, ketones carboxylic acid, amines, ester, acid derivatives, halogen derivatives, nitriles etc.)

14.3. Structure Isomerism in Organic Compounds:
- 2 teaching hours
1. Definition of structure isomerism
2. Types of structure isomerism: chain isomerism, position isomerism, functional isomerism and metamerism

14.4 Preliminary Idea of Reaction Mechanism
- 2 teaching hours
1. Concept of homolytic and heterolytic fission
2. Electrophile, nucleophiles and free-radicals
3. Inductive effect, +I and -I effect

Unit 15: Hydrocarbons

15.1 Sources:
- 4 teaching hours
Origin of coal and petroleum, hydrocarbon from petroleum cracking and reforming, aliphatic and aromatic hydrocarbon from coal, quality of gasoline, octane member and gasoline additive

15.2 Alkanes (Saturated Hydrocarbons):
1. General methods of preparations:
   - Decarboxylation
   - Catalytic hydrogenation
   - Reduction of haloalkane
   - Kolbe's electrolysis method
   - Using Grigrand's reagent
   - Wurtz reaction
   - From aldelydes and ketones
2. Physical properties
3. Chemical properties: Substitutions reaction, oxidation, pyrolysis or cracking, aromatization

15.3. Alkenes:
1. General methods of preparation
- 4 teaching hours
   - Dehydration of alcohol
   - Dehydrohalogenation
   - Catalytic hydrogenation of alkyne
   - Kolbe's electrolysis
2. Laboratory preparation of ethene
3. Chemical properties of alkene: Addition reaction (H_2, X_2, HX, H_2O, O_3, H_2SO_4)
4. Oxidation with alkaline $KMnO_4$ (Baeyer's reaction)
5. Polymerisation
6. Test of ethene and uses

15.4. Alkynes:
Ethyne
- 3 teaching hours
1. Preparation from
   - Carbon and hydrogen
   - Kolbe's electrolysis

1. 1,2 dibromoethane
2. Laboratory preparation of ethyne
3. Physical properties
4. Chemical properties: Addition (H_2, X_2, HX, H_2O, O_3), Acidic nature (action with ammoniacal $AgNO_3$ and ammoniacal Cu_2Cl_2), Oxidation with alkaline $KMnO_4$, Polymerization and uses of ethyne

Practical

Full Marks: 25   **Pass Marks: 10**

Students are required to secure the pass marks in the practical paper separately. The following is the list of experiments. The students are required to perform in the practical classes in Grade XI.

A. Experiments based on laboratory techniques:
1. To separate the insoluble component in pure and dry state from the given mixture of soluble and insoluble solids. (NaCl and sand)
2. To separate volatile component form the given mixture of volatile and non volatile (demonstration of sublimation process)
3. To separate a mixture of two soluble solids by fractional crystallization (KNO_3 + NaCl)
4. To prepare a saturated solution of impure salt and obtain the pure crystal of the same salt by crystallization
5. To separate the component of a mixture of two insoluble solids (The being soluble in dil acids)
6. To obtain pure water from given sample of water (Distillation).

B. Experiment to study the different reactions (Neutralization, Precipitation, Redox reaction, electrolysis):
7. To perform precipitation reaction of $BaCl_2$ and H_2SO_4 and obtain solid $BaSO_4$;
8. To neutralize sodium hydroxide with hydrochloric acid solution and recover the crystal of sodium chloride
9. To test the ferrous ions in the given aqueous solution and oxidise it to ferric ion (Ferrous → Ferric system) Redox Reaction
10. To study the process of electrolysis and electroplating.

C. Experiments on quantitative analysis:
11. To determine the equivalent weight or weight of metal by hydrogen displacement method;
12. To determine the solubility of the given soluble solid at laboratory temperature;
13. To determine the relative surface tension of unknown liquid by drop count method; and
14. To study the rate of flow of liquid through Ostwald's viscometer and determine the relative viscosity of unknown liquid.

D. Experiments on preparation of gas and study of properties:
15. To prepare and collect hydrogen gas and study the following properties;
    a. Solubility with water, colour, odour
    b. Litmus test
    c. Burning match stick test and
    d. Reducing properties of nascent hydrogen.
16. To prepare and collect ammonia gas and investigate the following properties:
    a. Solubility with water / colour / odour
    b. Litmus test
    c. Action with copper sulphate solution and
    d. Action with mercurous nitrate paper.
17. To prepare carbondioxide gas and investigate the following properties:
    a. Solubility, colour, odour
    b. Litmus paper test
    c. Lime water test and
    d. Action with burning magnesium ribbon
18. To study the properties of hydrogen sulphide (Physical, analytical and reducing);
19. To study the following properties of sulphuric acid:
    a. Solubility with water;
    b. Litmus paper test;
    c. Precipitating reaction and
    d. Dehydrating reaction.

E. Experiments on qualitative analysis:
20. To detect the basic radical of the given salt by dry way and the acid radical by dry and wet ways. Basic radicals: Zn^{++}, Al^{+++}, NH_4^+, Ca^{++}, Na^+ Acid radicals: CO_3^{--}, SO_4^{--}, NO_3^-, Br^-, I^-, Cl^-

Note: Experiment from no 1 to 19 requires one practical period of each experiment and the experiment no 20 requires four practical periods. (Two theory periods will be equivalent to one practical period)

Evaluation Scheme

The chemistry theory paper (XI) will consist of three types of questions:
a. Very short-answer questions (weightage of 2 marks of each)
b. Short-answer questions (weightage of 5 marks of each) and
c. Long-answer questions (weightage of 10 marks of each).

According to manner of questions groups are divided into group 'A', group 'B' and group 'C'.
1. Group 'A' will consist of twenty two (22) very short questions, out of which, examinees are required to answer only fifteen (15) questions.
2. Group 'B' will consist of seven (7) short questions, out of which examinees are required to answer five (5) questions.
3. Group 'C' will consist of four (4) questions, out of which examinees are required to answer 2 questions.

The weightage of content distribution for the three types of questions from different sections of the curriculum will be as follows:

Units	Teaching hours	V.S.Q.	S.Q.	L.Q.
1	3	X		
2	17	2		
3	14	2		
4	10	2		
5	3	1		
6	8	2		
7	6	1		
8	6	1		
9	5	1		
10	12	2		
11	23	2		
12	6	1		
13	10	1		
14	16	2		
15	11	2		
Total 15	**150**	**22**	**7**	**4**

New Model Questions- 2068

Time : 3 hrs

F.M. : 75
P.M. : 27

Group A

Attempt any fifteen questions. [15×2=30]

1. Calculate mass in gram of
   i. one molecule of nitrogen [1]
   ii. one atom of carbon [1]

   Ans: (i) 4.64×10^{-23} (ii) 1.99×10^{-23} g

2. State law of equivalent proportions. [2]
3. Why does boiling point of liquid remain constant even though the heating is continued? [2]
4. Distinguish between crystalline and amorphous solids. [1+1]
5. An atom of an element has 19 electrons. What is the total number of p-electrons? [2]

   Ans: 12

6. Give the limitation of Rutherford atomic model. [2]
7. What is meant by nuclear fusion? Give an example of it. [1+1]
8. Write down the Lewis structure of: [1+1]
   a. SO_3 b. HPO_4^{--}
9. What are the necessary conditions for the formation of hydrogen bond? [2]
10. Mention two important application of dipole moment. [1+1]
11. Calculate the oxidation number of Fe in $Na_4[Fe(CN)_6]$. [2]

    Ans: +2

12. What is the relationship between Kp and Kc for the following reaction? [2]
    $$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$
13. Write a reaction to show nascent hydrogen is more powerful reducing agent than molecular hydrogen. [2]
14. How would you convert Oxygen into Ozone and vice-versa? [1+1]
15. What are the most harmful pollutants present in photochemical smog? [2]
16. What is allotropy? Name the latest allotropie of carbon. [1+1]
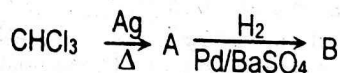
17. What is hydrometallurgy? [2]
18. Write down the balanced chemical reaction for the preparation of:
    i. Plaster of paris [1]
    ii. Bleaching powder [1]
19. Give two possible isomers of $C_2H_4O_2$ and write their IUPAC name. [1+1]
20. What are electrophiles? Give two examples. [1+1]
21. Identify A and B in the following reaction and give their IUPAC name. [1+1]

    $$CHCl_3 \xrightarrow[\Delta]{Ag} A \xrightarrow[Pd/BaSO_4]{H_2} B$$

    Ans: A = Ethyne, B = Ethane

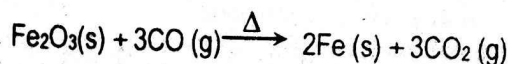22. What is gasoline additive? [2]

Group B

Attempt any five questions. [5×5=25]

23. What is the cause of Periodicity of elements in the periodic table? How do the following properties vary in a group? [1]
    i. Atomic size [2]
    ii. Ionization energy [2]
24. Consider a reaction. [1.5+1.5+2]

    $$Fe_2O_3(s) + 3CO(g) \xrightarrow{\Delta} 2Fe(s) + 3CO_2(g)$$

    If the reaction is carried out by mixing 30 g of Fe_2O_3 and 10 g of CO
    i. Find the limiting reactant.
    ii. Calculate the weight of iron produced.
    iii. What volume of CO_2 is produced at 30^0C and 730 mm pressure? [Atomic weight of Fe = 56]

    Ans: (i) CO is limiting reagent (ii) 21 g (iii) 14.511

25. Give the essential postulates of Bohr's atomic model. How is Balmer spectral line originated? [4+1]
26. How is bromine manufactured from Carnallite? Give a chemical reaction for the test of bromide ion in the aqueous solution. [4+1]
27. What happens when: [5×1=5]
    i. Iron wire is dipped in conc. nitric acid?
    ii. Magnesium is treated with dilute nitric acid?
    iii. Ammonia is passed through copper sulphate solution in excess?
    iv. Carbon is boiled with conc. nitric acid?
    v. Freshly-prepared ferrous sulphate solution is added to a mixture of dil. nitric acid and conc. sulphuric acid?
28. Describe in brief the smelting process in the extraction of metal. [5]
29. How is ethene prepared in the laboratory? Give a chemical test to detect the double bond in hydrocarbon. [4+1]

Group C
Attempt *any two* questions [2×10=20]
30. State Charles law. How did this law give the concept of absolute scale of temperature? A perfectly elastic balloon of radius 20 cm was filled with hydrogen gas at sea level. Find the diameter of the balloon when it is raised to a height where the pressure is 0.5 atmosphere. (Assuming no change of temperature and pressure at sea level) [6+4]

Ans: 758.84 cm

31. Give the principle for the manufacture of sulphuric acid by Contact process and sketch a self-explanatory diagram. Mention any two important uses of sulphuric acid. [8+2]
32. Sketch a well labelled diagram for the extraction of sodium by Down's process and explain the principle involved in the process. Explain why? [6]
    i. Sodium fire in laboratory should not be extinguished by water. [2]
    ii. Alkali metals impart characteristics colour to the flame. [2]
33. Write short notes on (any two): [2×5=10]
    i. Electronic interpretation of oxidation and reduction.
    ii. Le-Chatelier's principle
    iii. Homologous Series
    iv. Detection of nitrogen in organic compound

Chapter Based Questions

Section A: General and Physical Chemistry

Unit 1: Language of Chemistry (Review Lecturers)

VERY SHORT ANSWER QUESTIONS

1. 2075 Set B Q.No. 2 What is meant by the term basicity? Predict the basicity of H_2SO_4 in the following reaction. [1+1]
   $NaOH + H_2SO_4 \longrightarrow NaHSO_4 + H_2O$
2. 2059 Q.No. 10 How many electrons and neutrons are present in the symbol $^{27}_{13}Al^{3+}$? [2]

Ans: Electron = 10 and Neutron = 14

3. 2056 Q.No. 2 Define a chemical change and point out its two important characters. [2]
4. 2056 Q.No. 6 What information can you obtain from the symbol $^{39}_{19}K$? [2]

Ans: Atomic No. = 19, Atomic mass = 39, No. of electron = No. of proton = 19, No. of neuton = 20

Unit 2: Chemical Arithmetic

2.1 Dalton's Atomic Theory and Laws of Stoichiometry

VERY SHORT ANSWER QUESTIONS

1. 2076 Set B Q.No. 1 Nitrogen reacts with oxygen to give N_2O_3 and N_2O_5 respectively. Which law of stoichiometry do this data illustrate? State the law. [1+1]
2. 2076 Set C Q.No. 1 Why is the law of reciprocal proportion called the law of equivalent proportion? [2]

3. 2075 Set A Q.No. 2 State law of definite proportion and give an example to support this law. [1+1]
4. 2074 Supp Q.No. 2 2073 Set C Q. No. 2 How does Dalton's atomic theory explain the law of conservation of mass? [2]
5. 2074 Set A Q.No. 2 State Gay-Lussac's Law of gaseous volume. [2]
6. 2074 Set B Q.No. 2 2073 Supp Q.No. 2 2072 Set D Q. No. 2 2069 (Set B) Q. No. 7 or State law of equivalent proportion. [2]
7. 2073 Set D Q. No. 2 2056 Q.No. 1 State law of constant composition giving a suitable example. [2]
8. 2071 Supp. Q.No. 2 2069 (Set A) Q. No. 1 2055 Q.No. 7 State Law of Multiple proportions. [2]
9. 2071 (Set D) Q.No. 1 12 g of carbon react with 4 g of hydrogen to produce 16 g of methane. Which chemical law do these data illustrate? State the law. [1+1]

Ans: Conservation of mass

10. 2068 Q.No. 2 12 g of Carbon react with 32 g of Oxygen to produce 44 g of Carbondioxide. Which Chemical Law do these data illustrate? State the Law. [1+1]

Ans: Conservation of mass

11. 2067 Q.No. 5 State Law of conservation of mass. Why is this law known as Law of indestructibility of matter? [1+1]
12. 2066 Q.No. 4 Phosphorous reacts with Oxygen to Produce P_2O_3 and P_2O_5 respectively. Which Chemical law does the data illustrate? State the Law. [1+1]

Ans: Multiple proportion

13. 2065 Q. No. 13 2063 Q.No. 2 2057 Q.No. 1 2058 Q.No. 3 State the law of reciprocal proportion. [2]
14. 2064 Q.No. 12 One-volume of hydrogen reacts with one-volume of chlorine to give two-volume hydrogen chloride gas. Which law of stoichiometry is illustrated? State the law. [2]

Ans: Gay Lussac's Law

15. 2062 Q.No. 5 H and O reacts separately to give H_2O_2 and H_2O respectively. What law of stoichiometry is illustrated? State the law. [2]

Ans: Multiple proportion

16. 2060 Q.No. 3 How did the law of multiple proportions encourage Dalton to introduce an atomic theory? [2]

NUMERICAL PROBLEMS

17. 2066 Q.No. 13 What volume of CO_2 gas is produced when 20 g of 20% pure $CaCO_3$ is completely heated? [2]

Ans: 896 mL

18. 2060 Q.No. 25 State the law of Reciprocal proportions.
    a. 0.46 g of a metal produced 0.77 g of metal oxide.
    b. 0.805 g of the same metal displaced 760 cc of H_2 gas at NTP from HCl.
    c. 1.26 g of water was formed by the union of 1.12 g of oxygen with hydrogen.

Show that these data illustrate the law of reciprocal proportions. [5]

Ans: (a) 0.67 g (b) 1:8 (c) 1:8

19. 2054 Q.No. 28 State and explain law of multiple proportion. A certain element X_1 forms three different binary compounds with chlorine, containing 50.68%, 68.95% and 74.75% chlorine, respectively. Show how these data illustrate the law of multiple proportions. [10]

Ans: 1:2:3

20. 2052 Q.No. 1 Group C A metal X, forms two oxides A and B, 3.00 g of A and B contain 0.720 g and 1.160 g of oxygen respectively. Calculate the masses of metal in gram which combine with one gram of oxygen in each case. What chemical law do these masses of metal illustrate? State the chemical law. [10]

Ans: 2 : 1

2.2. Atomic Mass and Molecular Mass

FORMULAE
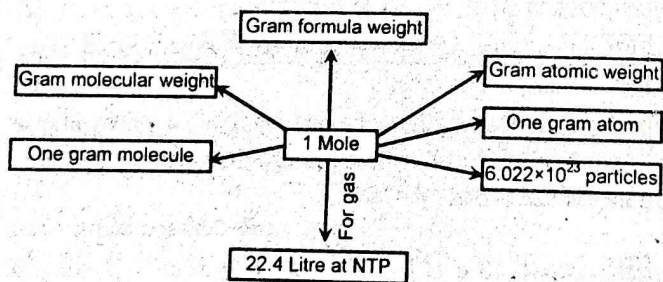
1. Mole in terms of number:
   1 mole of atom = 6.022×10^{23} atoms
   1 mole of molecule = 6.022×10^{23} molecule
   1 mole of ion = 6.022×10^{23} ion
   1 mole of electron = 6.022×10^{23} electron
2. Mole in terms of mass:
   1 mole of atom = gram atomic mass of element
   1 mole of molecule = gram molecular mass
   1 mole of ion = gram ionic weight
3. Mole in terms of volume:
   1 mole of any gas = 22.4 Litre at NTP
4. For atom

Number of moles = $\dfrac{\text{Given weight}}{\text{Atomic weight}}$

5. For molecule

Number of moles = $\dfrac{\text{Given weight}}{\text{Molecular weight}}$

6. For ionic compound

Number of moles = $\dfrac{\text{Given weight}}{\text{Ionic weight}}$

7. For particles

8. Number of moles = $\dfrac{\text{Given no. of particles}}{\text{Avogadro's number } (N_A)}$

[Avogadro's number $(N_A) = 6.022 \times 10^{23}$]

9. For volume

Number of moles = $\dfrac{\text{Given volume in L at NTP}}{22.4 \text{ L(Avogadro's volume)}}$

VERY SHORT ANSWER QUESTIONS

1. 2076 Set B Q.No. 2 Mass of 2×10^{21} number of atoms of an element is 0.4g. What is the mass of 0.5 mole of the element? [1+1]

Ans: 60.22 g

2. 2076 Set C Q.No. 2 2074 Supp Q.No. 1 How many numbers of moles of CO will be left when 2×10^{21} molecules are removed from 0.28 g of CO? [1+1]

Ans: 6.68×10^{21}

3. 2075 GIE Q.No. 1 Calculate mass in gram of i) two atom of carbon ii) three molecules of hydrogen. [1+1]

Ans: (i) 3.98×10^{-23} g carbon (ii) 9.96×10^{-24} g

4. 2075 Set A Q.No. 1 How many grams of sulphur and oxygen are needed to produce 6.022×10^{24} molecules of SO_2 according to the reaction? [2]

$S + O_2 \longrightarrow SO_2$

Ans: 320 g sulphur and 320 g oxygen

5. 2075 Set B Q.No. 1 Calculate the number of hydrogen and oxygen molecules in a solution prepared by mixing 45 g of glucose in 36 g of water. [1+1]

Ans: $H_2 = 2.1077 \times 10^{24}$, $O_2 = 1.05385 \times 10^{24}$

6. 2074 Set A Q.No. 1 How many number of oxygen molecules are required to produce 220 mg of CO_2 according to the reaction? [2]

$C + O_2 \longrightarrow CO_2$

Ans: 3.011×10^{21} O_2

7. 2074 Set B Q.No. 1 What mass of nitrogen will be required to produce 6.022×10^{24} molecules of ammonia by the following reaction? [2]

$N_2 + 3H_2 \longrightarrow 2NH_3$

Ans: 1.4×10^{46}

8. 2073 Supp Q.No. 1 Calculate the mass of carbon monoxide having the same number of oxygen atoms as are present in 88 g of carbon dioxide. [2]

Ans: 56 g CO

9. 2073 Set C Q. No. 1 The cost of per mole of sugar ($C_{12}H_{22}O_{11}$) is Rs. 20. How much a pocket of sugar containing 2 kg would cost? [2]

Ans: Rs. 116.95

10. 2073 Set D Q. No. 1 Calculate the mass of following: [1+1]
    i. 4 atom of carbon
    ii. 3 molecule of hydrogen

Ans: (i) 7.97×10^{-23} g (ii) 9.96×10^{-24} g

1. **2072 Set C   Q.No. 1** Calculate the number of molecules of hydrogen and carbon present in 4 g of methane. [1+1]
Ans: $H_2 = 3.011 \times 10^{23}$; $C = 1.5 \times 10^{23}$

2. **2072 Set D Q.No. 1** Why one has higher mass and why? [1+1]
a. 0.5 mole of CO_2 or 16 g of SO_2.
b. 2 g of hydrogen or 6.023×10^{21} number of oxygen molecules.
Ans: (a) 0.5 mol of CO_2 (b) 2 g of H_2

3. **2072 Set E Q.No. 1** A vessel containing 32 g of pure CH_4 gas was partially evacuated to remove 6.023×10^{23} molecules of CH_4. How many grams of hydrogen and carbon are left in the vessel? [2]
Ans: H = 4g, C = 12 g

4. **2071 Supp. Q.No. 1** Calculate the mass in g of:
a. 1×10^{23} molecule of methane
b. 2.5 moles of Cl_2. [1+1]
Ans: (a) 2.65 g (b) 177.5 g

5. **2071 (Set C) Q.No. 1** Calculate the mass of water having the same number of hydrogen atoms as are present in 32 g of methane. [2]
Ans: 36 g

6. **2071 (Set D) Q.No. 2** How many number of gold atoms are present in 0.6 g of 18 carat gold. The 24 carat gold is taken as 100% pure gold. (Atomic mass of gold = 197). [2]
Ans: 1.37×10^{21} atoms

7. **2070 Supp. Q.No. 2** **2070 Set C Q.No. 2** 6 g of an element x combine with 16 g of another element y to give 0.5 mole of a compound xy. What is the molecular mass of xy? [2]
Ans: 44 amu

8. **2070 Supp. Q.No. 1** How many numbers of oxygen molecules are present in 3 liters of CO_2 at STP? [2]
Ans: 8.065×10^{22}

9. **2070 Set C Q.No. 1** **2067 Q.No. 2** How many gram atoms of sulphur and how many grams of oxygen are needed to prepare 6.022×10^{24} molecules of SO_2? [2]
Ans: 10 gram atom of S, 320 gram of O

10. **2070 Set D Q.No. 1** Which of the following gases has greater number of hydrogen molecule?
9 g of CH_4 or 10 g of NH_3 [2]
Ans: 9 g CH_4

11. **2070 Set D Q.No. 2** What mass of H_2 gas will react with 22.4 litres of O_2 at STP to produce 36 gram of water? [2]
Ans: 4g

12. **2069 (Set A) Q. No. 2** Calculate the mass of: i. one molecule of Nitrogen is gram ii. a mole of carbondioxide [1+1]
Ans: (I) 4.64×10^{-23} g (II) 44 gram

13. **2067 Q.No. 1** What weight of Na will contain the same number of atoms as are present in 1.2 g of Carbon (C^{12})? [2]
Ans: 2.3g

14. **2066 Q.No. 1** Which of the followings has larger number of molecules and how? 7 g of nitrogen or 1 g of hydrogen? [2]
Ans: 1 g of H_2

15. **2065 Q. No. 1** **2061 Q.No. 2** One atom of an element 'A' weights 6.644×110^{-23}g. Calculate the number of gram atom in 80 kg of its. [2]
Ans: 2000 g atom

26. **2065 Q. No. 2** Calculate the mass of 120 cc of nitrogen at NTP. How many numbers of molecules are present in it? [2]
Ans: 3.23×10^{21} molecules

27. **2064 Q.No. 1** What weight of 60% pure sulphuric acid is required to decompose 25 gram of chalk ($CaCO_3$)? [2]
Ans: 40.83 g

28. **2064 Q.No. 2(a)** Calculate the mass of two atom of Nitrogen. [2]
Ans: 4.64×10^{-23} g

29. **2064 Q.No. 2(b)** Calculate the mass of one molecule of Hydrogen. [2]
Ans: 3.35×10^{-24} g

30. **2064 Q.No. 3** An oxide of trivalent metal contains 32% of oxygen. Calculate the atomic mass of the metal. [2]
Ans: 51 amu

31. **2063 Q.No. 1(a)** How heavy is one atom of hydrogen? [2]
Ans: 1.674×10^{-24} g

32. **2058 Q.No. 4** **2055 Q. No. 2** **2051 Q.No. 7** Explain why atomic weights of elements are not whole numbers. [2]

33. **2058 Q.No. 5** How many mole of Fe^{2+} can be oxidized to Fe^{3+} by 0.75 mole of Cl_2, according to the following equation? [2]
$Fe^{2+} + Cl_2 \longrightarrow Fe^{3+} + Cl^-$
Ans: 1.5 mole of Fe^{2+}

NUMERICAL PROBLEMS

34. **2072 Supp Q. No. 1** 6.3 g of concentrated nitric acid is diluted by adding 68 g of pure water. How many oxygen molecules are present in the solution? [2]
Ans: 1.225×10^{24} oxygen molecules

35. **2068 Q.No. 1** 34.2 gram of Sucrose $C_{12}H_{22}O_{11}$ are dissolved in 180 gram of water. Calculate the number of oxygen atoms in the solution. [2]
Ans: 6.684×10^{24} atoms

36. **2063 Q.No. 1(b)** How may moles of CO_2 are there in 4.4 g of carbon dioxide? [2]
Ans: 0.1 mol

37. **2063 Q.No. 3** Calculate the volume of 11 g of CO_2 at NTP. [2]
Ans: 5.6 L

38. **2062 Q.No. 2** How many moles of hydrogen are left when 3×10^{21} molecules of hydrogen are removed from a vessel containing 40 g of hydrogen? [2]
Ans: 0.015 mol of H_2 left

39. **2061 Q.No. 1** How many molecules are contained in 0.35 mole of N_2? [2]
Ans: 2.17×10^{23} N_2

40. **2059 Q.No. 11** What volume would 5.5 g CO_2 occupy at STP? [2]
Ans: 2.8 L

41. **2058 Q.No. 1** Make the following conversions. [2]
a. 2.62 moles of C to grams of C
b. 28.0 grams of N_2 to moles of N_2
Ans: (a) 31.44 g (b) 1 mol

42. **2058 Q.No. 2** Calculate the weight, in grams, of 5.60 litres of chlorine gas (Cl_2) at NTP? [2]
Ans: 17.75 g

43. **2057 Q.No. 2** Calculate the number of atoms of carbon present in 25g $CaCO_3$. [2]
Ans: 1.505×10^{23} atoms

44. **2057 Q.No. 5** 16 g of a gas at STP occupies 5.6 litre. What is the molecular mass of the gas? [2]
Ans: 64 amu

45. **2056 Q.No. 3** How many moles of oxygen molecules are present in 112 mL of O_2 gas at NTP? [2]

Ans: 0.005 mol

46. **2055 Q.No. 5** If 32 g of O_2 contains 6.022×10^{23} molecules at NTP, how many molecules under the same condition 32 g of S will contain? [2]

Ans: 6.022×10^{23} molecules

47. **2055 Q.No. 6** 1 mole of a compound contains 1 mole of C and 1 mole of O. What is the molecular weight of the compound? [2]

Ans: 44 g

48. **2055 Q.No. 13** What will be molecular weight of a gas, 11.2 litre of which at NTP weights 14 g? [2]

Ans: 28 g

49. **2054 Q.No. 2** The cost of table sugar ($C_{12}H_{22}O_{11}$) is Rs. 24 per kg. Calculate its cost per mole. [2]

Ans: 8.20 per mole

50. **2053 Q.No. 1 Group C** A jar containing 0.400 mole of H_2S. Calculate the following: [10]
    a. How many grams of H_2S?
    b. How many mole of H and S?
    c. How many grams of H and S?
    d. How many molecules of H_2S?
    e. How many atoms of H and S?

Ans: (a) 13.6 g (b) 0.8 mol H and 0.4 mol S (c) 0.8 g H and 12.8 g S
(d) 2.40×10^{23} molecules
(e) 4.81×10^{23} atom H and 2.40×10^{23} atom S

51. **2053 Q.No. 7 Group A** Calculate the weight of 11.2 litres of CO_2 gas at STP. (Molecular Weight of CO_2=44). [1.5]

Ans: 22 g

52. **2052 Q.No. 4 Group A** Copper has a density of 8.92 g / mL. If 1 mole of copper were shaped into a cube, what would be the length of the side of the cube (atomic weight of copper = 63.5)? [1.5]

Ans: 1.92 cm

53. **2052 Q.No. 10 Group A** How many moles of atoms is contained in 15 g of Zn. [1.5]

Ans: 0.23 mol

54. **2052 Q.No.20 Group A** What is the weight (in g) of 0.5 atom of oxygen? [1.5]

Ans: 1.33×10^{-23} g

55. **2052 Q.No. 3 Group B** Define atomic mass of an element Chlorine naturally is made up of 75%, Cl-35 and 25% Cl-37. Calculate the atomic mass of element chlorine. [5]

Ans: 35.5

56. **2051 Q.No. 6 Group A** How many molecules are contained in 0.35 mole of N_2? [2]

Ans: 2.10×10^{23} molecules

57. **2051 Q.No. 1 Group C**
    a. How many grams of H_2S are contained in 0.400 mole of H_2S? [2]
    b. How many gram-atoms of H and of S re contained in 0.400 mole of H_2S? [2]
    c. How many grams of H and of S are contained in 0.400 mole of H_2S? [2]
    d. How many molecules of H_2S are contained in 0.400 mole of H_2S? [2]
    e. How many atoms of H and of S of are contained in 0.400 mole of H_2S? [2]

Ans: (a) 13.6 g (b) 0.8 gram atom of H and 0.4 gram atom of S
(c) 0.80 g of H and 12.8 g of S (d) 2.40×10^{23} molecules
(e) 4.80×10^{23} atoms of H, 2.40×10^{23} atoms of S

2.3. Empirical, Molecular Formula and Limiting Reactants

FORMULAE

1. % composition = $\dfrac{\text{Total weight of individual atom}}{\text{Weight of compound}} \times 100$

2. Molecular formula = n × (empirical formula)

   Where, n = $\dfrac{\text{Molecular formula weight}}{\text{Empirical formula weight}}$ = 1,2,3,4.........

VERY SHORT ANSWER QUESTIONS

1. **2060 Q.No. 2** What is a limiting reactant? Why is it essential in stoichiometric calculations? [2]

SHORT ANSWER QUESTIONS

2. **2076 Set B Q.No. 29b** **2076 Set C Q.No. 29b** 16.8 g of $NaHCO_3$ when heated produces 9 g of Na_2CO_3 according to the following reaction: [3]

   $$2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + H_2O + CO_2$$

   i. Find the percentage purity of the $NaHCO_3$
   ii. How much volume of CO_2 will be produced at 1 atmospheric pressure and 27°C temperatures?

Ans: (i) 84.88% (ii) 2.09 Litre

3. **2075 GIE Q.No. 24** You are given
   $$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$$
   The reaction is carried out by mixing 130 g of Fe_2O_3 and 50 g of CO. [1+1+1+2]
   i. Calculate the limiting reactant.
   ii. How much mass of iron is produced?
   iii. How many number of moles of unreacted reactant left over?
   iv. Calculate the volume of CO_2 produced at 25°C and 2 atmospheric pressure. (Given: Atomic weight of Fe = 56)

Ans: (i) CO (ii) 66.66 g Fe (iii) 0.65 mol (iv) 43.54 L

4. **2075 Set B Q.No. 26** **2072 Set E Q.No. 26** 2 g of magnesium is burnt in a closed vessel containing 3 g of oxygen.
   i. Which one is limiting reactant?
   ii. Calculate the mole of reactant left over.
   iii. How many gram of MgO are produced?
   iv. What is the mass of H_2SO_4 required to neutralize MgO formed in the reaction? [1+1+1+2]

Ans: (i) Mg is limiting reagent (ii) 0.052 mol (iii) 3.33 g MgO (iv) 8.15 g H_2SO_4

5. **2071 Supp. Q.No. 24** 3.00 g of H_2 react 29.00 g of O_2 to yield H_2O. [5]
   a. Which is the limiting reactant?
   b. Calculate the maximum amount of H_2O that can be formed.
   c. Calculate the amount of reactants which remains unreacted.

Ans: (a) H_2 is limiting reactant (b) 27 g H_2O (c) 2 g

6. **2068 Q.No. 25** A chemical reaction was carried out by mixing 25 g of pure Calcium Carbonate and 0.75 mole of pure hydrochloric acid to give $CaCl_2$, H_2O and CO_2. [1.5+1+1+1.5]
   i. Which one is limiting reactant and why?
   ii. Calculate the mass of $CaCl_2$ produced.
   iii. How many number of water molecules are formed?

iv. What mass of NaOH is required to absorb the whole CO_2 produced in the reaction?

Ans: (i) $CaCO_3$ (ii) 27.75 g (iii) 1.50 × 10²³ (iv) 20 g

7. **2064 Q.No. 25** 10.6 g of pure Na_2CO_3 if treated with 7.9 g of HCl to produce NaCl, H_2O and CO_2. [2+2+1]
   a. Find the limiting reagent and calculate mole of unreacted reagent left over.
   b. What volume of CO_2 gas is produced at NTP?
   c. Calculate mass of NaCl formed.

   Ans: (a) Na_2CO_3 0.016 mol (b) 2.24 liter (c) 11.7 g

NUMERICAL PROBLEMS

8. **2073 Supp. Q.No. 29** 2 g of magnesium is burnt in a closed vessel containing 1.2 g of oxygen to produce Magnesium oxide.
   i. Find the limiting reagent.
   ii. Calculate the number of molecules of unreacted reagent left over.
   iii. What mass of MgO is produced?
   iv. How many grams of pure HCl are required to neutralize whole MgO produced? [2+1+1+1]

   Ans: (i) O_2 (ii) 2.40 × 10²¹ O_2 (iii) 3 g (iv) 5.475 g

9. **2073 Set C Q. No. 29** **2073 Set D Q. No. 29** For a reaction: [2+1+2]

$$2 NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + H_2O + CO_2$$
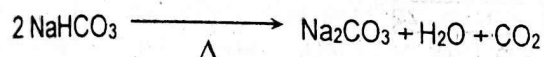
2.5 g of a sample $NaHCO_3$ when strongly heated gives 310 cc of CO_2 gas at 27°C and 760 mm Hg pressure.
   i. Calculate the percentage purity of the sample ($NaHCO_3$)
   ii. How many moles of water are produced?
   iii. What mass of pure HCl is required to neutralize Na_2CO_3 produce in the reaction?

   Ans: (i) 84.4% (ii) 0.0125 mole (iii) 0.91 g

10. **2072 Set C Q.No. 26** **2072 Set D Q. No. 26** Consider a reaction
$$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$$
10 g of Fe_2O_3 is reacted with 9 g of CO. [1+1+1+2]
   i. Find the limiting reagent.
   ii. How many mole of unreacted reactant left over?
   iii. Calculate the mole of CO consumed in the reaction.
   iv. What mass of NaOH is required to absorb whole CO_2 produced?
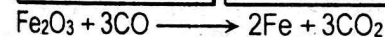
   Ans: (i) F_2O_3 is limiting reagent (ii) 0.133 mol (iii) 0.1875 mol (iv) 15 g NaOH

11. **2071 (Set C) Q.No. 24 (b)** How much sulphuric acid containing 80% H_2SO_4 by weight is needed to produce 500 kg of 80% HCl by weight
$$2 NaCl + H_2SO_4 \longrightarrow Na_2SO_4 + 2 HCl$$ [3]

   Ans: 671.23 kg

12. **2071 (Set C) Q.No. 24 (a)** What volume of oxygen will be produced by heating 245 kg of pure $KClO_3$ at STP? (atomic weight of K = 39) [2]

   Ans: 67200 liter

13. **2071 (Set D) Q.No. 24** 8 g of pure calcium is treated with 50 g of pure HCl to give $CaCl_2$ and H_2.
   a. Which is limiting reactant?
   b. Calculate the mass of unreacted left over.
   c. What mass of $CaCl_2$ will be formed?
   d. How many moles of water will be produced if the whole H_2 formed in the reaction react with O_2? [1+1+1+2]

   Ans: (a) Ca (b) 35.4 g (c) 22.2 g (d) 0.2 mol

14. **2070 Supp. Q.No. 25** 2.4 g of magnesium is treated with 0.2 mole of sulphuric acid to yield $MgSO_4$ and H_2.
   i. Which one is limiting reactant and why?
   ii. Calculate the mass of excess reactant.
   iii. How many moles of $MgSO_4$ are produced?
   iv. What mass of water will be produced if the whole H_2 gas formed in the reaction react with O_2? [1+1+1+2]

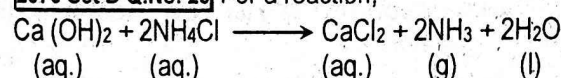   **Ans: (i) Mg (ii) 2.4 g (iii) 0.1 mol (iv) 1.8 g**

15. **2070 Set C Q.No. 28** 20 g of 40% pure $CaCO_3$ if reacted with 5g of HCl to produce $CaCl_2$, H_2O and CO_2.
   a. Find which one is limiting reactant and why?
   b. Calculate mass of $CaCl_2$ formed.
   c. How many number of water molecules are produced?
   d. Calculate the volume of CO_2 produced at 27° C and 0.5 atm pressure. [1+1+1+2]

   Ans: (a) HCl (b) 7.602g (c) 4.09 × 10²² water (d) 3.34 liter

16. **2070 Set D Q.No. 23** For a reaction,
$$Ca(OH)_2 + 2NH_4Cl \longrightarrow CaCl_2 + 2NH_3 + 2H_2O$$
$$\text{(aq.)} \quad \text{(aq.)} \quad\quad \text{(aq.)} \quad \text{(g)} \quad \text{(l)}$$
The reaction is carried out by mixing 7 g of pure $Ca(OH)_2$ and 7 g of pure NH_4Cl.
   a. Find the limiting reactant.
   b. Calculate the mole of unreacted reactant left over.
   c. How many gram of $CaCl_2$ are formed?
   d. What volumes of NH_3 gas are produced at 27°C and 1.5 atmospheric pressure? [1+1+1+2]

   Ans: (a) NH_4Cl (b) 0.029mol (c) 7.26g (d) 2.13 litre

17. **2069 (Set B) Q. No. 1** 73 g of conc. HCl was diluted by adding 144 g of water. How many gram atom of hydrogen are present in the dilute acid? [2]
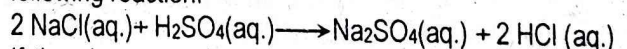
   Ans: 18 gram atom

18. **2069 (Set B) Q. No. 2** Calculate the amount of lime (CaO) that can be prepared by heating 200kg of lime stone ($CaCO_3$) that is 95% pure. [2]

   Ans: 106.4 kg

19. **2067 Q.No. 23**
   i. How much sulphuric acid containing 90% H_2SO_4 by weight is needed for the production of 1000 kg of hydrochloric acid containing 42% HCl by weight in the following reaction.
$$2 NaCl(aq.) + H_2SO_4(aq.) \longrightarrow Na_2SO_4(aq.) + 2 HCl (aq.)$$
   ii. If the above reaction is carried out by mixing 11.7 g of pure NaCl and 10 g of pure H_2SO_4, find the limiting reactant. [3+2]

   Ans: (i) 626.483kg (ii) NaCl

20. **2066 Q.No. 23** 17 g of ammonia is completely reacted with 45 g of oxygen to produce NO and H_2O. [2+1+1+1]
   i. Which is limiting reagent?
   ii. Calculate the number of moles of unreacted reactant left over.
   iii. What volume of NO are produced at NTP?
   iv. Calculate the mass of water produced.

   Ans: (i) NH_3 (ii) 0.156 mol (iii) 22.4L (iv) 27 g

21. **2065 Q. No. 23** 200 g of 90% pure $CaCO_3$ is completely reacted with excess HCl to produce $CaCl_2$, H_2O and CO_2.
   a. Which one is limiting reagent?
   b. Calculate the mass of $CaCl_2$ formed.
   c. How many moles of water are produced?

d. What volumes of CO_2 are produced if the reaction is carried out at 27°C temperature and 760mmHg pressure? [1+1+1+2]

Ans: (a) $CaCO_3$ (b) 199.8 g (c) 1.8 (d) 44.33 litre

22. **2063 Q.No. 24** 10 grams of impure zinc reacts with excess of dilute sulphuric acid to yield zinc sulphate and hydrogen. (Zn = 65, S = 32, O = 16)
   a. Calculate the number of moles of H_2SO_4 consumed.
   b. Calculate the mass of $ZnSO_4$ formed.
   c. What volume of hydrogen is evolved at NTP? [2+1.5+1.5]

Ans: (a) 0.153 mol (b) 24.76 grams (c) 3449.6 cc

23. **2062 Q.No. 23** 5 g of pure $CaCO_3$ if treated with 5 g of HCl to produce $CaCl_2$, H_2O and CO_2: [5]
   a. Find which one is limiting reactant and why?
   b. Calculate mass of $CaCl_2$ formed.
   c. How many number of water molecules are produced?
   d. Calculate the volume of CO_2 produced at NTP.

Ans: (a) $CaCO_3$ (b) 5.55 g (c) 3.011×10^{22} (d) 1.12 litre

24. **2056 Q.No. 33** Given, [10]
$CaCO_3(s) + 2HCl(aq.) \longrightarrow CaCl_2(aq.) + H_2O(l) + CO_2(g)$
If 10 grams of pure $CaCO_3$ are added in a solution containing 7.665 grams of HCl,
   a. Find the limiting reactant.
   b. Calculate the number of moles excess reactant left over unreacted.
   c. Calculate the volume of CO_2 gas produced at NTP.
   d. Calculate the number of grams of NaOH required to absorb whole of the CO_2 gas as Na_2CO_3. (atomic mass of Ca = 40, C = 12, O = 16, Cl = 35.5, Na = 23 and H = 1)

Ans: (a) $CaCO_3$ (b) 0.01 mol (c) 2,24 (d) 8 g

25. **2055 Q.No. 29** Give the equation: [10]
$4NH_3(g) + 5O_2(g) \longrightarrow 4NO(g) + 6H_2O(g)$
   a. How many moles of NH_3 must react to produce 5.0 moles of NO?
   b. How many moles of O_2 must react to produce 5.0 moles of NO?
   c. How many litres of NH_3 and O_2 must react to produce 100 litres of NO?
   d. How many litres of O_2 will react with 100 g of NH_3?
   e. How many litres of NO are formed by reacting 10 moles of NH_3 with 10 moles of O_2?

Ans: (a) 5 mol NH_3 (b) 6.25 mol O_2 (c) 100 L NH_3 (d) 164.7 L O_2 (e) 179.2 L NO

2.4. Avogadro's Hypothesis and Its Applications

FORMULAE

1. Avogadro's number (N_A) = 6.022×10^{23}
2. Vapour density (V.D.) of gas
$$= \frac{\text{Mass of certain volume of gas}}{\text{Mass of same volume of } H_2 \text{ at NTP}}$$
3. Molecular mass (M) = 2 × V.D.
4. Molar volume of gas = 22.4 L
5. Density of H_2 gas at NTP = 0.000089 g/cc

VERY SHORT ANSWER QUESTIONS

1. **2072 Set E Q.No. 2** A trivalent metal oxide contains 68.4 percentage of oxygen. What is the atomic mass of the metal? [2]

Ans: 11

2. **2069 (Set A) Q. No. 4** Calculate the wt. of 11.2 liters of CO_2 gas at STP (molecular weight of CO_2=44). [2]

Ans: 22 gram

3. **2067 Q.No. 4** In what way has Avogadro's hypothesis given support to Dalton's atomic theory? [2]

4. **2066 Q.No. 2** What volume of CO_2 will be delivered at NTP to extinguish fire from a Cylinder of 10 litres Capacity containing 5 kg of CO_2 gas? [2]

Ans: 2535.45 litre

5. **2065 Q. No. 9** **2054 Q. No. 10** State Avogadro's hypothesis. [2]

6. **2064 Q.No. 11** An oxide of nitrogen contains its half-volume of nitrogen and its vapour density is 15. Determine its molecular formula. [2]

Ans: NO

SHORT ANSWER QUESTIONS

7. **2076 Set B Q.No. 29a** A trivalent metal oxide contains 31.6% of oxygen. What is the atomic mass of the metal? [2]

Ans: 51.93 amu

8. **2076 Set C Q.No. 29a** A divalent metal oxide contains 40% of oxygen. What is the atomic weight of metal? [2]

Ans: 24 amu

9. **2075 Set A Q.No. 25** How would you apply Avogadro's hypothesis to show the molecular weight of gas is twice of its vapour density? An oxide of nitrogen contains same of its own volume of nitrogen and has vapour density equal to 22. Determine molecular formula of the nitrogen oxide. [3+2]

Ans: N_2O

10. **2074 Supp Q.No. 27** Apply Avogardo's hypothesis to derive the relationship between vapour density and molecular mass of a gas. An oxide on nitrogen contains same of its own volume of nitrogen whose vapour density is 54. Determine the molecular formula of nitrogen oxide. [3+2]

Ans: N_2O_4

11. **2074 Set A Q.No. 26** Deduce the relationship between molecular mass and vapour density of a gas using Avogadro's hypothesis. An oxide of nitrogen contains half of its own volume of nitrogen and has vapour density equal to 15. Determine molecular formula of the nitrogen oxide. [3+2]

Ans: NO

12. **2074 Set B Q.No. 25** How would you apply Avogadro's hypothesis to deduce the relationship between molecular weight and vapour density of gas. An oxide of nitrogen contains half of its own volume of nitrogen and vapour density is 23. Determine its molecular formula. [1+2+2]

Ans: NO_2

13. **2069 (Set B) Q. No. 23** Define Avogadro's hypothesis. How is this hypothesis applied to show that molecular mass of volatile substance is twice of its vapour density? An oxide of nitrogen contains same of its own volume of nitrogen and its vapour density is 54. Determine its molecular formula. [1+2+2]

Ans: N_2O_4

14. **2057 Q.No. 23; 2061 Q.No. 23** State Avogadro's hypothesis. Show that molecular wt. = 2 × vapour density. [5]

15. **2055 Q.No. 24** 1 litre of hydrogen at STP weights 0.09 g. If 2 litres of a gas at STP weights 2.880 g, calculate the vapour density and the molecular weight of the gas. [5]

Ans: VD = 16; molecular weight 32

16. **2054 Q.No. 31(a)** State and explain Avogadro's hypothesis. How this theory can be used to determine the molecular weight of a gas? [5]

17. **2069 (Set A) Q. No. 33b** Avogadro's hypothesis and its relation with molecular mass of volatile substance. [5]

2.5. Equivalent Masse

FORMULAE

1. Equivalent weight of metal $= \dfrac{\text{Weight of metal}}{\text{Weight of } H_2} \times 1.008 = \dfrac{\text{Weight of metal}}{\text{Weight of } O_2} \times 8 = \dfrac{\text{Weight of metal}}{\text{Weight of } Cl_2} \times 35.5$

2. Equivalent weight of element $= \dfrac{\text{Atomic weight}}{\text{Valency}}$

3. Equivalent weight of Acid $= \dfrac{\text{Molecular weight}}{\text{Basicity}}$

   [Basicity = no. of replaceable H^+ atom in 1 mole of acid]

4. Equivalent weight of Base $= \dfrac{\text{Molecular weight}}{\text{Acidity}}$

   [Acidity = no. of replaceable OH^- ion in 1 mole of base]

5. Equivalent weight of salt $= \dfrac{\text{Molecular weight}}{\text{Total charge on cation or anion}}$

6. Equivalent weight of oxidizing or reducing agent $= \dfrac{\text{Molecular weight}}{\text{Total change in O.N.}}$

VERY SHORT ANSWER QUESTIONS

1. **2075 GIE Q.No. 2** What is meant by equivalent weight of an acid? Calculate the equivalent weight of H_2SO_4 in the reaction given below. [1+1]
   $$NaOH + H_2SO_4 \longrightarrow NaHSO_4 + H_2O$$

2. **2072 Set C   Q.No. 2** Calculate the equivalent weight of underlined elements: [0.5×4=2]
   i. $\underline{Fe_2}O_3$ ii. $\underline{Mg}Cl_2$
   iii. $\underline{C}H_4$ iv. $\underline{N}H_3$
   (Given that Atomic weight of Fe = 56)
   Ans: (i) Fe = 18.66 (ii) Mg = 12 (iii) C = 3 (iv) N = 4.66

3. **2071 (Set C) Q.No. 2** A divalent metal oxide contains 60% of metal. What is atomic weight of metal? [2]
   Ans: Atomic weight: 24 amu

4. **2067 Q.No. 3** 4 g of a divalent metal reacts with chlorine to produce 11.1 g of its metal chloride. Calculate the atomic mass of metal. [2]
   Ans: 40 amu

5. **2065 Q. No. 3** Define equivalent weight of an element. A divalent metal has atomic weight 24. What is its equivalent weight? [2]
   Ans: 12

6. **2059 Q.No. 5** Why is hydrogen displacement method not applicable to determine the equivalent mass of copper? [2]

7. **2057 Q.No. 4** Equivalent weight of an element is 32.5. What does it mean? [2]

NUMERICAL PROBLEMS

8. **2072 Supp Q. No. 3** 24 g of divalent metal A requires 16 g of oxygen to form its oxide. What is the atomic weight of the metal A? [2]
   Ans: 24

9. **2066 Q.No. 3** Calculate the equivalent weight of following underlined elements: [1+1]
   i. $\underline{C}Cl_4$ ii. $\underline{Fe_2}O_3$
   (Atomic weight of Carbon=12, Atomic weight of iron = 56)
   Ans: (i) 3 (ii) 18.6

10. **2069 (Set A) Q. No. 9** Calculate the equivalent weight of underlined element. [1+1]
    i. $\underline{C}Cl_4$ ii. $\underline{Mg}O$
    iii. $\underline{Fe_2}O_3$ iv. $\underline{Al}Cl_3$
    Ans: (i) 3 (ii) 12 (iii) 18.6 (iv) 9

Unit 3: State of Matter
3.1. Gaseous State

FORMULAE

1. **Boyle's Law** $P_1V_1 = P_2V_2$ (at constant T)

2. **Charle's Law** $\dfrac{V_1}{T_1} = \dfrac{V_2}{T_2}$ (at constant P)

3. **Combined gas equation** $\dfrac{P_1V_1}{T_1} = \dfrac{P_2V_2}{T_2}$

4. **Ideal gas equation** $PV = nRT$
   Value of **Universal gas constant (R)** in different unit
   $R = 0.0821$ L atm K^{-1} mol^{-1}
   $R = 8.314$ J K^{-1} mol^{-1}
   $R = 8.314 \times 10^7$ L erg K^{-1} mol^{-1}
   $R = 1.987$ cal K^{-1} $mol^{-1} \cong 2$ cal K^{-1} mol^{-1}
   NTP = Normal Temperature and Pressure
   STP = Standard Temperature and Pressure
   Where, $T = 0°C = 273K$ and $P = 1$ atm $= 760$ mm Hg

5. **Dalton's Law of partial pressure** $P_T = P_1 + P_2 + P_3 \ldots\ldots$
   Partial pressure of gas = Mole fraction of gas × Total pressure of gas
   Partial pressure of gas = Volume fraction of gas × Total pressure of gas
   Mole fraction $= \dfrac{\text{Individual mole}}{\text{Total mole}} = \dfrac{\text{Individual volume}}{\text{Total volume}}$
   $P_{\text{moist gas}} = P_{\text{dry gas}} + P_{\text{water vapour(Aqueous tension)(f)}}$

6. **Graham's Law of diffusion**
   Rate of diffusion (r) $= \dfrac{\text{Volume of gas diffused(V)}}{\text{Time taken for diffusion(t)}}$
   $$\dfrac{r_1}{r_2} = \sqrt{\dfrac{d_2}{d_1}} = \sqrt{\dfrac{M_2}{M_1}} = \dfrac{t_2}{t_1} = \dfrac{V_1}{V_2}$$

VERY SHORT ANSWER QUESTIONS

1. **2076 Set B Q.No. 4i** **2076 Set C Q.No. 4b** Give reasons: Gases do not settle at the bottom of the vessel. [1]

2. **2072 Set C Q.No. 3 ii** Explain, why: Gases do not settle on the bottom of container. [1]

3. **2071 Supp. Q.No. 4** On the basis of Boyle's law, explain why mountaineers carry oxygen cylinders with them. [2]

4. **2071 (Set C) Q.No. 4** Draw a volume vs temperature (°C) graph and find out the temperature correspondingly to zero volume. [2]

5. **2060 Q.No. 1** Find the number of moles of molecules present in 50 mL of an ideal gas exerting a pressure of 770 mm at 25°C (R = 0.0821 L atm $mole^{-1}K^{-1}$). [2]
   Ans: 2.06 × 10⁻³ mol

6. **2059 Q.No. 3** State Dalton's law of partial pressure. [2]

7. **2059 Q.No. 8** What is Universal gas constant? [2]

8. **2058 Q.No. 7** What is an ideal gas? Under what conditions will a gas behave nearly like an ideal gas? [2]

9. **2054 Q.No. 9** Sketch the diagram for the variation of volume of a given mass of ideal gas with temperatures at constant pressure. Indicate the absolute zero in the diagram. [2]

10. **2054 Q.No. 15** What do you mean by ideal gas and real gas? [2]

11. **2052 Q.No. 7 Group A** Draw volume (V) and temperature (t°C) relationship of gases at constant pressure. ~~Indicate the temperature at which the volume occupied by the gas pressure.~~ Indicate the temperature at which the volume occupied by the gas becomes zero. Name that temperature. [1.5]

12. **2051 Q.No. 1 Group A** At what condition the value of P×V is always constant? [2]

LONG ANSWER QUESTIONS

13. **2071 Supp. Q.No. 30** State Boyle's and Charle's Law: Derive Pv = nRT [2+3+5]
When 2 g of a gas (A) is introduced into an evacuated flask kept at 25°C, the pressure is found to be one atmosphere. If 3 g of another gas (B) is added to the same flask, the total pressure becomes 1.5 atmospheres at the same temperature. Assuming ideal behaviour of gases. Calculate the ratio of molecular masses.

Ans: Ratio: 1 : 3

14. **2071 (Set C) Q.No. 30** Write down the postulates of Kinetic molecular theory of gases. Why do gases show deviations from ideal behaviour at low temperature and high pressure? A saturated hydrocarbon having molecular formula C_nH_{2n+2} diffuses through a porous membrane twice as fast as sulphur dioxide. Calculate the volume occupied by the hydrocarbon at 27°C and 2 atmospheric pressure. [4 + 2+4]

Ans: 12.31 litre

15. **2071 (Set D) Q.No. 32** What are the postulates of Kinetic molecular theory of gas? Distinguish between an ideal gas and a real gas. An evacuated glass vessel weighs 50 g when empty, 148 g when filled with a liquid of density 0.98 g/cc and 50.5 g when filled with an ideal gas at 760 mm Hg at 27°C. Calculate the volume of the ideal gas STP. [4+2+4]

Ans: Volume = 91 cc

16. **2070 Supp. Q.No. 32** State and explain Graham's law of diffusion. What are the applications of Graham's law? Through the two ends of a glass-tube of length 2 meters, hydrogen chloride (HCl) and ammonia (NH₃) gases are allowed to enter. At what distance ammonium chloride will first appear? [3+1+6]

Ans: 1.189 m

17. **2070 Set C Q.No. 31** Derive PV = nRT. How did Charle's law give the concept of absolute scale of temperature? Two vessel of capacity 1.5 litres and 2 litres contain hydrogen gas and oxygen gas respectively under a pressure of 750 mm and 100 mm. The gases are mixed together in a 5 litre vessel. What will be the final pressure of mixture? [4+2+4]

Ans: 265 mm

18. **2070 Set D Q.No. 32** Explain, how Charle's law gave the concept of absolute scale of temperature. Derive the relation PV = nRT. A hydrocarbon CxHy has mass ratio between hydrogen and carbon 1:10.5. One litre of the hydrocarbon at 127°C and 1 atm pressure weights 2.8 g, find the molecular formula of the hydrocarbon. [2+4+4]

Ans: C_7H_8

19. **2067 Q.No. 30** State and explain Dalton's Law of partial pressure. What is the main application of this Law? A vessel Contains 12 g of an ideal gas at t°C temperature and 1 atm pressure. When the temperature is increased by 10°C at the same volume, the pressure increases by 10%. Calculate the volume and initial temperature. (Molecular mass = 120) [10]

Ans: 0.821 litre, 100K

20. **2064 Q.No. 30**
a. State and explain Graham's law of diffusion of gases. [5]
b. 5 gram of hydrogen diffused through a porous membrane in 30 minutes. Find the time required to diffuse the same amount of SO₂ gas at identical conditions. [5]

Ans: 5.29 minute

21. **2063 Q.No. 30(a)** **2060 Q.No. 33 (d)** Write the postulates of Kinetic theory of gas. [5]

22. **2063 Q.No. 30(b)** State and explain Charle's law. How is Charle's law explained qualitatively in the light of kinetic theory of gas? [5]

23. **2055 Q.No. 23** Give the postulates of Kinetic Molecular Model of gas. [5]

24. **2053 Q.No. 2 Group C**
a. State and explain Dalton's law of partial pressure.
b. A 1.00 L sample of dry gas at 25°C has the following compositions:
0.8904 g of N₂, 0.2741 g of O₂ 0.0152 g of Ar
0.00107 g of CO₂ Given R = 0.0821L atm. k⁻¹ mol⁻¹
What are the partial pressures for each components gas in the mixture? What is the total pressure? [5 + 5]

Ans: Partial pressure of (i) N₂ = 0.78 atm (ii) O₂ = 0.21 atm (iii) Ar = 0.0092 atm (iv) CO₂ = 2.43 × 10⁻⁶ atm, total pressure = 0.9997 atm

25. **2052 Q.No. 3 Group C**
a. State and explain Boyle's law. [10]
b. A carbon dioxide fire-extinguisher of 3 litres capacity contains 4.4 kg of carbon dioxide. What volume of gas could this extinguisher deliver at NTP?

Ans: 2237 L CO₂

26. **2051 Q.No. 3 Group B** What are the main points of Kinetic theory of gases? [5]

NUMERICAL PROBLEMS

27. **2076 Set B Q.No. 31** State Boyle's Law and draw (i) P vs V, (ii) V vs $\frac{1}{P}$ and (iii) PV vs P graphs to support Boyle's law. What is the practical significance of this law? A toy balloon blown up at 10°C, has a volume 960 cc, At this stage the balloon is distended to $\frac{7}{8}$ of its maximum stretching capacity. Will the balloon brust, if it is brought to a room having temperature 25°C? If not, calculate the temperature at which the balloon brust. [2+3+1+4]

Ans: 50.42°C

28. **2076 Set C Q.No. 31** State and explain Graham's Law of diffusion. Mention any two applications of this Law. A vessel of volume 100 mL contains 10% of oxygen and 90% of an unknown gas. The gases diffuse in 86 sec. through a small hole of the vessel. If pure oxygen diffuses in 75 sec. under same condition, find the molecular weight of the gas. [5+1+4]

Ans: 43.17 amu

29. **2075 GIE Q.No. 32** State Boyle's Law and derive $P_1V_1 = P_2V_2$. How would you justify Boyle's Law by graphical explanations?
A fire extinguisher of capacity 5 liters contains 2Kg of CO_2 gas. What volume of the gas will be delivered to extinguish fire at STP? [1+1+4+4]

Ans: 1013.78 litre

30. **2075 Set A Q.No. 30** What are the basic postulates of Kinetic theory of gases? State the proper conditions for the deviation of gases from their ideal behaviour. An evacuated glass vessel weighs 50 gm when empty, 148 g when filled with a liquid of density 0.98 g/mL and 50.5 g when filled with an ideal gas at 760 mmHg at 27°C. Determine the molecular mass of the gas. How many number of molecules are present in 12.3 g in the gas? [5+1+3+1]

Ans: 123.15 amu, 6.014 × 10²²

31. **2075 Set B Q.No. 32** **2072 Set D Q.No. 32** State and explain Dalton's law of partial pressure. What is its application? A spherical balloon of 21 cm diameter is to be filled with hydrogen gas at NTP from a cylinder containing hydrogen gas at 20 atms, and 27°C. If the cylinder can hold 2.66 litres of water at NTP, calculate the number of balloon that can be filled up. [5+1+4]

Ans: 10

32. **2074 Supp Q.No. 32** State and explain Graham's law of diffusion. 0.23 g of a volatile liquid occupies 126.4 cc at 27°C and 760 mm pressure. Calculate the molecular weight of the liquid. How many molecules of the liquid are present in 0.23g? [6+3+1]

Ans: 3.09 × 10²³

33. **2074 Set A Q.No. 32** State Boyle's Law and Charle's Law. Derive the relation PV = nRT. An evacuated glass vessel weighs 50 g when empty, 148 g when filled with a liquid of density 0.98 g/mL and 50.5 g, when filled with an ideal gas at 760 mm Hg at 27°C. Determine the molecular mass of the gas. How many numbers of molecules are present in 12.3 g in the gas? [2+4+3+1]

Ans: 6.014 × 10²¹

34. **2074 Set B Q.No. 30** State and explain Graham's law of diffusion of gas. Give its an application. 0.23 g of a volatile liquid occupies 126.4 cc at 27°C and 760 mm Hg pressure. Calculate the molecular weight of the liquid. How many molecules of the liquid are present in 0.23 g? [5+1+4]

Ans: 3.09 × 10²³

35. **2073 Supp Q.No. 30** What are the basic assumptions of Kinetic theory of gas? Why do gases deviate from its ideal behaviour at low temperature and high pressure? A Saturated hydrocarbon ($CnH2n+2$) diffuses through a porous membrane twice as fast as SO_2. Determine the molecular formula of the hydrocarbon. [5+1+4]

Ans: CH₄

36. **2073 Set C Q. No. 30** State Boyle's Law. Plot pressure–volume relationship to explain Boyle's law. Mention its important application.
A straight glass tube of length 25 cm has two inlets (A) and (B). NH_3 gas through the inlet (A) and HCl gas through the inlet (B) are allowed to enter the tube at the same time.

White fumes of NH_4Cl appear at a point (M) inside the tube. Find the distance M from A. [1+5+4]

Ans: 14.87 cm

37. **2073 Set D Q. No. 30** State Charle's Law. How did this law lead to the development of the absolute temperature scale? Plot temperature-volume relationship indicating absolute zero.
A saturated hydrocarbon (C_nH_{2n+2}) diffuse through a porous membrane twice as fast as sulphur dioxide. Determine the molecular formula of the hydrocarbon. [1+4+1+4]

Ans: CH₄

38. **2072 Supp Q. No. 32**
i. State and explain Graham's law of Gaseous diffusion. What is application? [2+3]
ii. The relative densities of carbon dioxide and ozone are 22 and 24 respectively. If 12 mL of carbon dioxide diffuse in 100 seconds, what volume of ozone will diffuse in the same time under similar condition? [5]

Ans: 11.48 mL

39. **2072 Set C Q.No. 32** **2072 Set E Q.No. 32** State Graham's law of diffusion of gas. Mention its applications.
A spherical balloon of 21 cm diameter is to be filled with hydrogen gas at NTP from a cylinder containing gas at 20 atm and 27°C. If the cylinder can hold 2.66 litres of water vapour at NTP, calculate the number of balloon that can be filled up. [5+1+4]

Ans: 10

40. **2069 (Set A) Q. No. 32** State Boyle's law and Charle's law. Derive the relation PV=n RT. Two moles of ammonia are enclosed in a five liters flask at 27°C. Calculate the pressure exerted by the gas assuming that the gas behaves like an ideal gas. [8+2]

Ans: 9.852 atm

41. **2069 (Set B) Q. No. 31** State Boyle's law and draw sketch graphs of:

i. P against V ii. P against $\frac{1}{V}$

iii. PV against P iv. PV against V

For a perfect gas at constant temperature. The mass of 525 cc of a gaseous compound at 28°c and 730 mm Hg pressure was found to be 0.9 g. What will be the volume of 2g of the gas at 30°C and 760 mm Hg pressure? [Given; R = 0.0821 litre atm K⁻¹mol⁻¹] [2+4+4]

Ans: 1.127 liter

42. **2068 Q.No. 30** Derive the relation ' PV = nRT'. Under what condition does a gas follow the above relation? How would you define universal gas constant 'R'? How much increase in temperature is necessary to increase volume of half litre of the gas by 40% at 25°C, keeping the pressure constant? [4+1+1+4]

Ans 119.2°C

43. **2066 Q.No. 30** State and explain the Graham's Law of diffusion. What is the main application of Graham's Law? A Flask of 0.3 litre capacity was weighed after it had been evacuated. It was then filled with a gas of unknown molecular mass at 1.0 atm pressure and temperature of 300K. The increase in mass of the flask was 0.977g. Calculate the molecular mass of the gas. [4+2+4]

Ans: 80.2 amu

44. 2065 Q. No. 30 What are the basic postulates of Kinetic theory of·gas? Why do gases not show ideal behaviour at low temperature and high pressure? An evacuated glass vessel weighs 50 g. when empty, 148 g when filled with a liquid of density of 0.98 g/cc, and 50.5 g when filled with an ideal gas at 760 mmHg and at 300K. Determine the molecular mass of the gas. [4+2+4]
Ans: 123.15 amu

45. 2063 Q.No. 23 A mixture of ozone and oxygen containing 20% by volume of ozone diffused through a porous plug in 172 seconds, while the same volume of pure oxygen took 164 seconds to diffuse through the same plug. Calculate the relative density of ozone. [5]
Ans: 24

46. 2062 Q.No. 1 Calculate the mass of oxygen gas whose volume is 320 mL at 17°C and 2 atmospheric pressure. [2]
Ans: 0.86 g

47. 2062 Q.No. 30 State Boyle's Law and Charle's Law. Derive PV = nRT 0.50 g of a volatile liquid was introduced into a globe of 1000 mL capacity. The globe was heated to 91°C, so that all the liquid vapourized exerted a pressure of 190 mm Hg. [2+4+4]
Ans: Molecular mass = 59.76 amu

48. 2061 Q.No. 24 State Graham's law of diffusion. How long will it take 500 mL of hydrogen gas to diffuse through a partition if 250 mL of oxygen diffuse in 50 minutes under similar conditions? [2+3]
Ans: 25 minute

49. 2060 Q.No. 4 The rate of diffusion of a saturated hydrocarbon ($C_n H_{2n+2}$) gas is 1.206 times that of SO_2 gas under identical conditions. Find the molecular mass and the value of 'n' for the gas. (Molecular mass of SO_2=64). [2]
Ans: Molecular mass = 44, n = 3

50. 2059 Q.No. 24 State Graham's law of diffusion. A vessel of volume 100 mL contains 10% O_2 and 90% unknown gas. The gases diffuse in 86 sec through a small hole of the vessel. If pure oxygen under the same condition diffuses in 75 sec find the molecular mass of the unknown gas. [1+4]
Ans: Molecular mass: 43.17

51. 2058 Q.No. 6 One litre of a gas at 0°C is heated to 100°C keeping pressure constant. What will be the new volume at 100°C? [2]
Ans: 1.366 litre

52. 2058 Q.No. 30 Outline the basic assumptions of Kinetic model of gas. What are relative diffusion rates of methane (CH_4) and sulphur dioxide (SO_2)? If these two gases are simultaneously introduced into opposite ends of 100 cm tube and allowed to diffuse toward each other, at what distance from the SO_2 end will the molecules of two gases meet? [10]
Ans: $\dfrac{\text{Rate }(CH_4)}{\text{Rate }(SO_2)}$ = 2:1, 33.33 cm

53. 2057 Q.No. 3 A gas X diffuses five times as rapidly as another gas y. Calculate the ratio of molecular mass of X and Y. [2]
Ans: X : Y = 1 : 25

54. 2057 Q.No. 30 State Boyle's law and Charle's law. Derive the relation PV = nRT. A gas cylinder cooking gas can withstand up to pressure 14.9 atm. The pressure gauge of cylinder indicates 12 atm at 27°C. Due to sudden fire in the building its temperature starts rising. At what temperature will the cylinder explode? [10]
Ans: above 99.5°C

55. 2056 Q.No. 25 State Graham's law of diffusion. How long will it take 600 mL of H_2 gas to diffuse through a porous partition, if 300 mL of O_2 diffuse through it in 10 minutes under identical conditions? [5]
Ans: 5 minutes

56. 2055 Q.No. 9 Two grams of hydrogen diffuses from a containers in 10 minutes. How many grams of oxygen would diffuse through the same container in the same time under similar conditions? [2]
Ans: 8 g

57. 2055 Q.No. 10 One mole of a gas occupies a volume of 1 litre at 27°C. What will be the pressure of the gas? [2]
Ans: 24.63 atm

58. 2054 Q.No. 31(b) A balloon can hold 1000 cc of air before bursting. The balloon can hold 975 cc of air at 5°C. Will it burst when it is taken into a home at 25°C? Assume that the pressure of the gas in the balloon remains constant. [2]
Ans: balloon will burst; 1045.14 cc

59. 2053 Q.No. 8 The value of carbon monoxide gas collected over water at 25°C is 680 cc with a total pressure of 752 mm Hg. The vapour pressure of water at 25°C is 23.8 mm Hg. Determine the partial pressure of CO in container. [1.5]
Ans: 728.2 mm Hg

3.2 Liquid State

FORMULAE
1. Solubility = $\dfrac{\text{Weight of solute in g}}{\text{Weight of solvent in g}} \times 100$

VERY SHORT ANSWER QUESTIONS

1. 2076 Set B Q.No. 3 Differentiate between evaporation and boiling. [2]

2. 2076 Set C Q.No. 3 At what condition does a liquid boil? Point out the effect of increasing temperature on boiling point of liquid. [1+1]

3. 2075 Set A Q.No. 3 'Cooling is caused by evaporation'. Give reason. [2]

4. 2075 Set B Q.No. 3 Mention two suitable examples to show evaporation causes cooling. [2]

5. 2074 Supp Q.No. 3 Define surface tension and write its unit. [2]

6. 2074 Set A Q.No. 3 Give proper reason for the following: [1+1]
   i. Evaporation takes place from the surface of liquid.
   ii. Liquid drops are spherical shape.

7. 2074 Set B Q.No. 3 Does atmospheric pressure affect boiling point of liquid? Explain. [2]

8. 2073 Supp Q.No. 3 Distinguish between continuous and discontinuous solubility curves. [2]

9. 2073 Set C Q. No. 3 Does temperature of boiling liquid increase, decrease or remain constant even though the heat is continued? Give reason. [2]

10. 2073 Set D Q.No. 3 Define discontinuous solubility curve. What types of salt are responsible for such curves? [1+1]

11. 2072 Supp Q. No. 4 How does surface tension work to form spherical shape of liquid drop? [2]

12. 2072 Set C Q.No. 3 Explain, why: Boiling point of water is lower at higher altitude. [1]

13. **2072 Set D Q.No. 3** Define the terms: [1+1]
    i. Aqueous tension   ii. Surface tension

14. **2072 Set E Q.No. 3** The boiling point of a liquid rises with increasing atmospheric pressure. Give reason. [2]

15. **2071 Supp. Q.No. 3** Give reasons why: [1+1]
    a. Water drops has a spherical shape?
    b. Alcohol can flow easily but honey can't?

16. **2071 (Set D) Q.No. 4** Boiling point of liquid P and Q are 70°C and 90°C respectively. Which of the two has higher vapour pressure at 70°C? Give reason. [2]

17. **2070 Supp. Q.No. 4** Differentiate boiling point from evaporation. [1+1]

18. **2070 Set C Q.No. 3** **2068 Q.No. 3** Define surface tension. Write its unit. [1+1]

19. **2070 Set D Q.No. 3** Write any two physical properties of liquid caused by surface tension. [1+1]

20. **2069 (Set B) Q. No. 3** State the physical principle behind the following phenomenon: [1+1]
    i. Rain drops are spherical.
    ii. A drop of ether on your skin disappears fast and the skin feels cool.

21. **2067 Q.No. 6** Give reason: [1+1]
    i. It is more efficient to wash clothes in hot water than cold water.
    ii. Evaporation takes place from the surface of the liquid.

22. **2066 Q.No. 5** How is boiling of Liquid different from Evaporation? [2]

23. **2065 Q. No. 4** What is surface tension? Mention any one physical properties of liquid due to surface tension. [2]

24. **2064 Q.No. 4** Why does boiling point of liquid rise on increasing pressure? [2]

25. **2063 Q.No. 4** What happens to the vapour pressure of a solvent, when non volatile solute particles are dissolved in it? [2]

26. **2063 Q.No. 9** Define the term coefficient of viscosity. [2]

27. **2062 Q.No. 3** Give reason: [2]
    a. Falling liquid drops are spherical
    b. Evaporation takes place from the surface of liquid

28. **2061 Q.No. 3** What do you mean by boiling point and evaporation? [2]

29. **2061 Q.No. 5** **2058 Q.No. 10** What is meant by viscosity? [2]

30. **2059 Q.No. 2** Define surface tension. [2]

31. **2056 Q.No. 5** How is surface tension of a liquid originated? [2]

32. **2055 Q.No. 11** What do you understand by the term 'Surface tension'? [2]

33. **2054 Q.No. 1** In terms of vapour pressure, what do you mean by a boiling point of a liquid? [2]

34. **2054 Q.No. 4** The meniscus for mercury in a glass tube is concave down ward. Explain. [2]

35. **2054 Q.No. 13** What do you understand by viscosity? [2]

36. **2054 Q.No. 18** What is the effect of temperature on: [2]
    a. Surface tension   b. Viscosity
    c. Vapour pressure of liquid

37. **2053 Q.No. 4 Group A** Why is Glycerine more viscous than water? [1.5]

38. **2053 Q.No. 5 Group A** Why is a mercury droplet spherical? [1.5]

39. **2052 Q.No. 1 Group A** Name the physical property behind rise of liquids in capillary tube. [1.5]

40. **2052 Q.No. 8 Group A** Define aqueous tension. Why is it subtracted from the total pressure to determine the pressure of a dry gas? [1.5]

41. **2052 Q.No. 18 Group A** What is evaporation? How does it differ from boiling? [1.5]

42. **2052 Q.No. 22 Group A** Define coefficient of viscosity. How coefficient of viscosity is related with viscous force? [1.5]

LONG ANSWER QUESTIONS

43. **2056 Q.No. 32 (c)** Write notes on solubility curve and its applications [5]

44. **2052 Q.No. 4 Group C** What are solubility curves? What information is obtained from solubility curve? [5]

NUMERICAL PROBLEMS

45. **2075 GIE Q.No. 3** 60 gram of saturated solution of a salt has the solubility 60 at 60°C. Calculate the weight of solute present in it. [2]
    Ans: 22.5 g

46. **2071 (Set C) Q.No. 3** A salt has solubility 80 and 160 respectively at 20°C and 60°C. Calculate the mass of the crystal formed on cooling 50 g saturated solution from 60° to 20°C. [2]
    Ans: 15.38 g

47. **2060 Q.No. 24** Define solubility of a salt. The solubility of salt in water at 75°C is 155. When 80 g of its saturated solution at 75°C was cooled to 15°C, 40 g of the salt was precipitate. Find the solubility of the salt at 15°C. [1+4]
    Ans: Solubility at 15°C = 27.46

48. **2054 Q.No. 30** What do you mean by solubility? Represent different types of solubility curves and give its applications. Calculate the weight of crystal formed on cooling 80 g of saturated solution from 60°C to 30°C. Solubility of salt at 60°C and 30°C are 132 and 95 respectively. [10]
    Ans: 12.76 g

49. **2052 Q.No. 4 (b)** The solubility of salt at 0°C is 12. How much salt will 50 g of its saturated solution contain at that temperature? [2]
    Ans: 5.35 g

3.3. Solid State

VERY SHORT ANSWER QUESTIONS

1. **2076 Set B Q.No. 4ii** Give reasons: Deliquescent substances turn into liquid when exposed to atmospheric air. [1]

2. **2076 Set C Q.No. 4a** Give reasons: Efflorescent substances lose water of crystallization after being exposed to air. [1]

3. **2075 GIE Q.No. 4** Distinguish between isotropic and anisotropic substance with an example of each. [1+1]

4. **2075 Set A Q.No. 4** **2075 Set B Q.No. 4** Differentiate between efflorescent and deliquescent substances with an example of each. [2]

5. **2074 Supp Q.No. 4** **2071 (Set D) Q.No. 3** **2069 (Set A) Q. No. 3** **2066 Q.No. 10** Differentiate between Crystalline solid and Amorphous solid with an example of each. [2]

6. 2074 Set A Q.No. 4 Differentiate between hygroscopic and deliquescent substance giving an example of each. [2]

7. 2074 Set B Q.No. 4 What is meant by water of crystallization? Write an example of it. [1+1]

8. 2073 Supp Q.No. 4 Mention any two important characteristics of each of the followings. [1+1]
   i. Deliquescent substance   ii. Crystalline Solid

9. 2073 Set C Q. No. 4 Give an example and one important characteristics of each of [1+1]
   i. Crystalline solid   ii. Efflorescent substance

10. 2073 Set D Q. No. 4 Mention any two important characters of each of the following: [1+1]
    i. Efflorescent substance   ii. Amorphous solid

11. 2072 Supp Q. No. 2 2072 Set D Q.No. 4 2070 Set D Q.No. 4 Differentiate between isotropic and anisotropic substance giving an example of each. [2]

12. 2072 Set C Q.No. 4 What is meant by the terms: [1+1]
    i. Isotropy   ii. hygroscopy

13. 2072 Set E Q.No. 4 What is meant by water of crystallization? Give any two correct examples of it. [1+1]

14. 2070 Supp. Q.No. 3 2070 Set C Q.No. 4 Give an example of each of the following. [4×0.5]
    i. Efflorescent substance   ii. Isotropic substance
    iii. Anisotropic substance   iv. Hygroscopic substance

15. 2069 (Set B) Q. No. 4 Write an example of each of the followings: [0.5×4]
    i. Crystalline solid   ii. Hygroscopic substance
    iii. Water of crystallization   iv. Isotropic substance.

16. 2068 Q.No. 4 Distinguish between Crystal Lattice and unit cell. [2]

17. 2065 Q. No. 10 Explain why sodium chloride does not conduct electricity in solid state but a good conductor when molten?[2]

Unit 4: Atomic Structure

VERY SHORT ANSWER QUESTIONS

1. 2076 Set B Q.No. 5 2076 Set C Q.No. 5 What is the conclusion made by de-Broglie? Write its mathematical relationship.[1+1]

2. 2076 Set B Q.No. 6 2076 Set C Q.No. 6 Identify the four quantum numbers of 19th electron of an element having atomic number 24. [2]

3. 2075 GIE Q.No. 5 Write down the electronic configuration of (i) copper (ii) potassium. [1+1]

4. 2075 GIE Q.No. 6 Which principle goes against the concept of Bohr's fixed orbits? State the principle. [1+1]

5. 2075 Set A Q.No. 5 Name the quantum number that specifies the shape of an orbital. What are the values of l and m for $4s^1$ electrone? [1+1]

6. 2075 Set A Q.No. 6 Calculate the atomic number and number of p-electrons of an atom whose valence shell electronic configuration is $4s^2$? [2]

7. 2075 Set B Q.No. 5 What are the values of quantum numbers n, l and m of the electrons for 3p and 2s? [1+1]

8. 2075 Set B Q.No. 6 Write the electronic configuration of [1+1]
   i. Mg^{++} ii. Cl^-.

9. 2074 Supp Q.No. 5 Name the quantum number that specifies the energy of an electron in an atom. What designation is given to an orbital having n = 3 and l = 2? [1+1]

10. 2074 Supp Q.No. 6 2074 Set A Q.No. 6 2074 Set B Q.No. 6 Calculate the atomic number and number of p-electrons of an atom whose valence-shell electronic configuration is $4s^2$. [1+1]

11. 2074 Set A Q.No. 5 What information is provided by the magnetic quantum number? Give the value of l and m for $3p_x$ orbital. [1+1]

12. 2074 Set B Q.No. 5 Name the quantum number that specifies the orientation of an orbital. What are the values of n and l for 3d orbital? [1+1]

13. 2073 Supp Q.No. 5 Assign the values of the quantum number n, l and m for the outermost electron in potassium atom. [2]

14. 2073 Supp Q.No. 6 Write down the electronic configuration of[1+1]
    i. Cu^{2+} ii. Ar

15. 2073 Set C Q. No. 5 Assign the value of quantum number n and l for the orbital designation [1+1]
    i. 2s   ii. $3p_x$.

16. 2073 Set C Q. No. 6 Write down the electronic configuration of[1+1]
    i. Cu   ii. Cl^-

17. 2073 Set D Q. No. 5 Assign the value of the quantum number n, l and m for the outermost electron in sodium atom. [1+1]

18. 2073 Set D Q. No. 6 Write down the electronic configuration of [1+1]
    i. Al^{3+} ii. S

19. 2072 Supp Q. No. 5 What is meant by quantization of angular momentum? [1+1]

20. 2072 Supp Q. No. 6 The valence shell electronic configuration of two atoms A and B are $4s^1$ and $3s^2 3p^5$ respectively.
    a. Write their atomic number
    b. Name their group position in the modern periodic table.[1+1]
    Ans: (a) A atom i.e. potassium is 19, B atom i.e. chlorine is 17
    (b) IA and VIIA

21. 2072 Set C Q.No. 5 Write down electronic configuration of:[1+1]
    i. K^+ ii. Cr
    Ans: (i) $1s^2 2s^2 2p^6 3s^2 3p^6$ (ii) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$

22. 2072 Set C Q. No. 6 Which quantum number specifies the shape of orbital? State the quantum number. [1+1]

23. 2072 Set D Q.No. 5 Calculate the atomic number of the following elements whose outermost electrons are represented by: [1+1]
    i. $3s^2 3p^2$ ii. $3d^6$
    Ans: (i) 14 (ii) 18

24. 2072 Set D Q.No. 6 What is meant by degenerate orbitals? Give suitable example of it. [1+1]

25. 2072 Set E Q.No. 5 Calculate the values of quantum numbers m and l of electrons for 3d and 3p orbitals. [1+1]

26. 2072 Set E Q.No. 6 Write down electronic configuration of [1+1]
    i. Cr   ii. K^+

27. 2071 Supp. Q.No. 5 Why is Hund's rule called rule of maximum multiplicity? [2]

28. 2071 Supp. Q.No. 6 What are the limitations of Bohr's model of atom? [2]

29. 2071 (Set C) Q.No. 5 Give the values of n, l and m for outer most electron of sodium. [2]

30. **2071 (Set C) Q.No. 7** **2071 (Set D) Q.No. 6** Which principle goes against the concept of Bohr's fixed orbits? State the principle. [1+1]

31. **2071 (Set D) Q.No. 5** Write the electronic configuration for the atom having atomic number 19. What are the values of n and l of its outermost electron? [1+1]

32. **2070 Supp. Q.No. 5** Mention any two limitation of Bohr's theory. [1+1]

33. **2070 Supp. Q.No. 6** What is Hund's rule? [2]

34. **2070 Set C Q.No. 6** **2070 Set D Q.No. 5** An atom 'A' has atomic number (Z=29). Calculate the total number of s-electrons of A⁺⁺. [2]
    Ans: 8

35. **2070 Set C Q.No. 8** What is Hund's rule? [2]

36. **2070 Set D Q.No. 6** State Pauli- exclusion principle. [2]

37. **2069 (Set A) Q. No. 5** Write the electronic configuration of the element with atomic number 18 and 26. [2]

38. **2069 (Set A) Q. No. 6** Name the spectral series which appears visual part of the electromagnetic spectrum. How is such seris originated? [2]

39. **2069 (Set B) Q. No. 5** An element has 2 electrons sin 'K' shell, 8 electrons in 'L' shell and 9 electrons in 'M' shell. Write its electronic configuration and calculate the total numbers of p-electrons. [1+1]
    Ans: Total no. of p-electrons = 12

40. **2069 (Set B) Q. No. 6** How are Balmer Series and Paschen Series orginated in hydrogen spectra? [1+1]

41. **2068 Q.No. 5** Give the values of all four quantum number of 11ᵗʰ electron of Magnesium (Atomic No.= 12) [2]

42. **2068 Q.No. 6** What observations did Rutherford's make the following conclusions? [1+1]
    i. The atomic centre is positively charged.
    ii. Most of the space inside the atom is hollow.

43. **2067 Q.No. 7** Write down all four quantum number for outermost electron of sodium atom. (Z = 11) [2]

44. **2067 Q.No. 8** What is Bohr's-Bury rule? [2]

45. **2066 Q.No. 6** What are the values of Principle quantum number (n) and azimuthal quantum number (l) for the following orbitals: [1+1]
    i. 3s   ii. 4p

46. **2066 Q.No. 7** An atom of an element has 24 electrons, what is the total number of s-electrons? [2]
    Ans: Total no. of s-electrons = 7

47. **2065 Q. No. 5** Why is the electron does not jump into the nucleus? [2]

48. **2065 Q. No. 6** What is meant by atomic spectrum? [2]

49. **2064 Q.No. 5** What observation did Rutherford lead to conclude that the nucleus of atom is very small but heavy mass? [2]

50. **2063 Q.No. 5** Write the ground state electronic configuration of Cu (Z = 29) and Cr (Z = 24) in terms of s, p and d orbitals. [2]
    Ans: Cu→ 1s² 2s² 2p⁶ 3s² 3p⁶ 3d¹⁰ 4s¹;
    Cr→ 1s² 2s² 2p⁶ 3s² 3p⁶ 3d⁵ 4s¹

51. **2062 Q.No. 9** Write the atomic number of elements whose outermost electronic configuration are represented by (a) 3s¹ (b) 3p⁶. [2]
    Ans: a = Na, b = Ar

52. **2060 Q.No. 6** An electron of an atom possesses the quantum numbers $n = 2$, $l = 0$ and $m = 0$. What do they mean? [2]

53. **2057 Q.No. 7** Write the electronic configuration of chromium (Atomic No. 24) and copper (Atomic No.= 29). [2]

54. **2057 Q.No. 11** What are values for n, l and m for $2p_x$ orbital? [2]

55. **2055 Q.No. 1** What is an atomic orbital? What are shapes of s orbital and p orbital? [1.5]

56. **2054 Q.No. 19** An atomic orbital has $n = 3$, what are the possible values of l and m? [2]

57. **2053 Q.No. 9 Group A** Write the electron configuration of chromium (Atomic No.= 24) in terms of s,p,d orbitals. [1.5]

58. **2052 Q.No. 2 Group A** Write the shapes of s and p orbitals. [1.5]

59. **2052 Q.No. 3 Group A** Give the electronic configuration of silver (Atomic No. 47) in terms of s, p and d orbitals. [1.5]

60. **2052 Q.No. 9 Group A** A scientist investigating the electron structure of the element concluded that the K, L and M shells were all full and that the N shell contained four electrons. What is the atomic number of that electron? [1.5]

61. **2052 Q.No. 19 Group A** For $n = 4$, write all possible values of l and m. [1.5]

62. **2051 Q.No. 5 Group A** Give the electronic configuration of copper (Atomic No. 29) in terms of s, p, d, f orbitals. [2]

SHORT ANSWER QUESTIONS

63. **2076 Set B Q.No. 24** Explain main postulates of Bohr's theory of atomic model. How did this theory justify the origin of spectral lines in hydrogen atom? [4+1]

64. **2076 Set C Q.No. 24** Why does hydrogen atom produce so many spectral lines eventhough it contains one electron? Draw a well-labelled diagram to explain the various spectral series observed in it. [1+4]

65. **2075 GIE Q.No. 23** What are the conclusions made by Rutherferd's ∝-ray scattering experiments about the structure of atom. Point out the defect of this model. [4+1]

66. **2075 Set A Q.No. 23** Describe Rutherford's nuclear model of an atom. Point out its limitations. [4+1]

67. **2075 Set B Q.No. 23** What are the differences between an atomic orbit and an atomic orbital? Draw the shapes of s and p orbitals. [2.5+2.5]

68. **2074 Supp Q.No. 23** Write down the essential postulates of Bohr's model of atom. How did it explain the stability of an atom? [5]

69. **2074 Set A Q.No. 23** What are the observations of Rutherford's α-ray scattering experiment. Write down the conclusions drawn from it about the structure of an atom. [2.5+2.5]

70. **2074 Set B Q.No. 23** Give the essential postulates of Bohr's atomic model. [2.5+2.5]

71. **2072 Supp Q. No. 24** What are quantum number? An atom has 20 electron. Find out:
    i. Its atomic number and total number of p-electrons.

ii. The values of azimuthal quantum number (*l*) and magnetic quantum number (*m*) of 19ᵗʰ electron.

iii. Its group position in the periodic table.   [1+1.5+1.5+1]

Ans: (i) 20 and 12 (ii) *l* = 0 , m = 0

72. 2072 Set C Q.No. 23 What are the basic postulates of Bohr's atomic mode? How is it applied to explain the origin of hydrogen spectra?   [4+1]

73. 2072 Set D Q.No. 23 How did Bohr's atomic model explain the origin of hydrogen spectra? Sketch and name various spectral species observed in the atomic spectrum of hydrogen.   [5]

74. 2072 Set E Q.No. 23 What are the observations of Rutherford's scattering experiment? And, write the conclusions drawn from the observations.   [2.5+2.5]

75. 2071 Supp. Q.No. 25 Describe Rutherford's α–ray scattering experiment which led to the discovery of nucleus. What are the defects of Rutherford's model of atom?   [4+1]

76. 2071 (Set C) Q.No. 23 What are the postulates of nuclear model of atomic structure according to Rutherford's α-particle scattering experiment? Point out it's limitation.   [4+1]

77. 2071 (Set D) Q.No. 23 Write down the essential postulates of Bohr's model of an atom. How does this model correct the defect of Rutherford's atomic model?   [4+1]

78. 2070 Supp. Q.No. 23 What are quantum number? An atom has 20 electrons. Find out:
i. Its atomic numbers and total number of p-electrons.
ii. The value of azimuthal quantum number (*l*) and magnetic quantum number (*m*) of the 19ᵗʰ electrons of the atom.
iii. Its group position in the periodic table.   [1+1.5+1.5+1]

79. 2070 Set C Q.No. 23 How does Bohr's theory explain the origin of hydrogen spectra? Name the different spectral lines with labelled diagram.   [1+4]

80. 2070 Set D .Q.No. 25 What are the conclusions made by Rutherford's from his ∝-ray scattering experiment about the structure of atom? Mention its limitation.   [4+1]

81. 2069 (Set A) Q. No. 25 State and explain Hund's rule of maximum multiplicity.   [1+4]

82. 2069 (Set B) Q. No. 24 What are the conclusions made by Rutherford's α-ray scattering experiment about the structure of atom? Point out its drawbacks.   [4+1]

83. 2068 Q.No. 23 How does Bohr's theory explain the origin of hydrogen spectra? Name the various Spectral Series observed in the atomic spectrum of hydrogen with a well labeled diagram.   [1+4]

84. 2067 Q.No. 25 Write down the essential postulates of Bohr's atomic mode. How did it overcome the Limitation of Rutherford's atomic model?   [4 + 1]

85. 2066 Q.No. 24 How does Bohr's theory explain the Origin of hydrogen spectra? Name the different spectral lines with a labelled diagram.   [1+4]

86. 2065 Q. No. 24 Define Aufbau Principle. An atom has 2 electrons in first (K) shell, 8 electrons in second (L) shell and 2 electrons in third (M) shell. If so, find out the following: [1+1+1+1+1]
a. Electronic configuration of the atom.

b. Total number of principles quantum numbers.
c. Total number of sub-shells
d. Total number of s-electrons

Ans: (a) 1s² 2s² 2p⁶ 3s² (b) 3 (c) 2 (d) 6

87. 2064 Q.No. 23 Explain hydrogen spectra in light of Bohr's theory. Why does hydrogen gas show large number of line spectra though H-atom contains one electron?   [4+1]

88. 2063 Q.No. 25 How does Bohr's atomic theory explain the origin of hydrogen spectra?   [5]

89. 2062 Q.No. 24 Write down the main postulates of Bohr's atomic model.   [5]

90. 2059 Q.No. 25 How does Bohr's theory predict the origin of line spectra of hydrogen atom?   [5]

91. 2055 Q.No. 21 Group B What experimental evidence led Rutherford to conclude that (a) the nucleus of the atom contains most of the atomic mass? (b) the nucleus of the atom is positively charged? (c) the atom consists of mostly empty space.   [5]

92. 2052 Q.No. 2 Group B Discuss how Bohr's was able to predict the line spectra of a hydrogen atom.   [5]

93. 2051 Q.No. 1 Group B Describe Bohr's model of the atom. Draw a picture labelling pertinent parts.   [5]

LONG ANSWER QUESTIONS

94. 2060 Q.No. 31
i. Discuss how Rutherford's nuclear model of atom is introduced on the basis of alpha particles scattering experiment. Point out the limitation of the model.
ii. How is the nuclear model of atom improved by Bohr's?
iii. Why is Bohr's atomic model appeared to be defective in the light of Heisenberg's uncertainty principle?   [4+1+3+2]

WRITE SHORT NOTES ON

95. 2073 Supp Q.No. 33iv Postulates of Bohr's atomic model.   [5]

96. 2073 Set C Q. No. 33i Rutherford's α-Scattering experiment and its conclusion   [5]

97. 2073 Set D Q. No. 33 I Rutherford's atomic model   [5]

98. 2055 Q.No. 31(a) Quantum numbers   [5]

99. 2058 Q.No. 33(b) Bohr's model and explanation of hydrogen spectrum.   [5]

Unit 5: Nuclear Chemistry

VERY SHORT ANSWER QUESTIONS

1. 2076 Set B Q.No. 7 2074 Set A Q.No. 7 What is meant by controlled nuclear fission? Write an important application of it.   [1+1]

2. 2076 Set C Q.No. 7 Give an use of each of the following: [1+1]
i. Controlled nuclear fission reaction
ii. Uncontrolled nuclear fission reaction.

3. 2075 GIE Q.No. 7 2072 Set C Q.No. 7 What is meant by artificial radioactivity? Give an example of it.   [1+1]

4. 2075 Set A Q.No. 7 Distinguish between artificial radioactivity and natural radioactivity.   [1+1]

5. 2075 Set B Q.No. 7 What are nuclear isotopes? Write an example of it.   [1+1]

6. **2074 Supp Q.No. 7** What is meant by nuclear fission reaction? Write an example of it. [1+1]

7. **2074 Set B Q.No. 7** Distinguish between controlled nuclear fission and uncontrolled nuclear fission. [1+1]

8. **2073 Supp Q.No. 7** Give any two differences between α-particles and β-particles. [1+1]

9. **2073 Set C Q. No. 7** How is natural radioactivity differed from artificial radioactivity? [2]

10. **2073 Set D Q. No. 7** Define nuclear fusion reaction giving an example. [1+1]

11. **2072 Supp Q. No. 7** Write fission and fusion reaction giving one example of each. [1+1]

12. **2072 Set D Q. No. 7** **2071 (Set C) Q.No. 6** **2071 (Set D) Q.No. 7** What is meant by thermonuclear reaction? Write a correct example of it. [1+1]

13. **2072 Set E Q.No. 7** How does natural radioactivity differ from artificial radioactivity? [1+1]

14. **2071 Supp. Q.No. 7** What is the difference between nuclear fission and nuclear fusion? [2]

15. **2070 Supp. Q.No. 7** **2070 Set C Q.No. 11** Define nuclear fission reaction and write an example for it. [1+1]

16. **2070 Set D Q. No. 7** What is meant by nuclear reaction? Give an example of it. [1+1]

17. **2069 Supp Q. No. 9** Give any two differences between nuclear reaction and chemical reaction. [2]

18. **2069 (Set A) Q. No. 7 OR** Write any two applications of each of the following isotope: ^{60}Co and ^{131}I. [2]

19. **2069 (Set B) Q. No. 7** Define Nuclear fusion and give an example of it. [1+1]

20. **2068 Q.No. 7** What are radioisotopes? Write one use of such isotopes. [1+1]

Unit 6: Electronic Theory of Valency and Bonding

VERY SHORT ANSWER QUESTIONS

1. **2076 Set B Q.No. 8** Write down the Lewis structure of each of the following: [1+1]
   i. H_2O^+ ii. N_2O

2. **2076 Set B Q.No. 9** **2072 Set C Q.No. 9** Give an example of each of such molecule having [1+1]
   i. Polar covalent bond
   ii. Non-polar covalent bond
   iii. Intermolecular hydrogen bond
   iv. Intramolecular hydrogen bond.

3. **2076 Set C Q.No. 8** Write down the Lewis structure of the following species: [1+1]
   i. N_2O ii. PO_4^{3-}

4. **2075 GIE Q.No. 8** Write Lewis structure of i) CO_2 ii) SO_4^{--} [1+1]

5. **2075 GIE Q.No. 9** Give an important applications of each of the followings: [1+1]
   i. Hydrogen bond   ii. Dipole moment

6. **2075 Set A Q.No. 8** Write down the Lewis structure of [1+1]
   i. H_2CO_3 ii. NH_4^+

7. **2075 Set A Q.No. 9** Mention two important applications of dipole moment. [1+1]

8. **2075 Set B Q.No. 8** Draw Lewis structure of: [1+1]
   i. HPO_4^{2-} ii. $CaCl_2$

9. **2075 Set B Q.No. 9** Define hydrogen bonding and write its two major effects on physical properties of the compounds. [1+1]

10. **2074 Supp Q.No. 8** **2074 Set B Q.No. 8** Write down the Lewis structure of [1+1]
    i. $Na_2S_2O_3$ ii. O_3

11. **2074 Supp Q.No. 9** H_2O gets angular structure whereas CO_2 gets linear, Why? [2]

12. **2074 Set A Q.No. 8** Write down the Lewis structure of: [1+1]
    i. N_2O ii. $HClO_4$

13. **2074 Set A Q. No. 9** How would you explain the polarity of a molecule on the basis of dipole moment? [2]

14. **2074 Set B Q.No. 9** Define dipole moment and give its an important application. [1+1]

15. **2073 Supp Q.No. 8** Draw the Lewis structure of [1+1]
    i. $COCl_2$ ii. $KClO_3$

16. **2073 Supp Q.No. 9** What is meant by intermolecular hydrogen bond? Give its an application. [2]

17. **2073 Set C Q. No. 8** Draw the Lewis structure of [1+1]
    i. KNO_3 ii. P_2O_5

18. **2073 Set C Q.No. 9** What is hydrogen bond? Give an example of intra-molecular hydrogen bond. [1+1]

19. **2073 Set D Q. No. 8** Draw the Lewis structure of [1+1]
    i. H_2SO_3 ii. N_2O

20. **2073 Set D Q. No. 9** Each carbon-oxygen bond in CO_2 is polar but CO_2 molecule is non-polar. Explain proper reason.

21. **2072 Supp Q. No. 8** **2070 Set C Q.No. 11 Or** What is Octet rule? Write the Lewis structure of $(NH_4)_2SO_4$. [1+1]

22. **2072 Supp Q. No. 9** Write a covalent compound formed by nitrogen and hydrogen. What is its Lewis structure? [2]

23. **2072 Set C Q.No. 8** The hypothetical atoms X and Y having outermost shell configuration $3s^2$ and $3s^2 3p^5$ respectively. Then, write Lewis structure of the compound formed between X and Y. [2]
    Ans: MgCl₂

24. **2072 Set D Q.No. 8** Two hypothetical atoms X and Y having outermost shell configuration $3s^2$ and $3s^2 3p^5$ respectively. Then, write Lewis structure of the compound formed between X and Y. [2]

25. **2072 Set D Q.No. 9** What is meant by the term polar covalent bond? Name any one compound having polar covalent bond. [1+1]

26. **2072 Set E Q.No. 8** Write down Lewis structure of
    i. HCO_3^- ii. $MgCl_2$ [1+1]

27. **2072 Set E Q.No. 9** Define dipole moment and write its two major applications. [1+1]

28. **2071 Supp. Q.No. 7 OR** What is octet rule? Name the two compounds in which octet rule is not followed. [1+1]

29. **2071 Supp. Q.No. 8** What is the resonance structure of SO_3 molecule? [2]

30. **2071 Supp. Q.No. 9** The SO_2 molecule has a dipole moment. Is the molecule linear or bent? Explain your reasoning. [2]

31. **2071 (Set C) Q.No. 9** Differentiate between polar and non-polar covalent bonds with an example of each. [2]

32. **2071 (Set C) Q.No. 8** Write the Lewis structure of: [1+1]
   a. CH_3OH b. $CaCO_3$

33. **2071 (Set D) Q.No. 9** Write down the Lewis structure of the compound formed by two elements A and B whose outermost electrons are represented by $3s^2$ and $3s^23p^5$ respectively. [2]

34. **2071 (Set D) Q.No. 8** What is meant by intra-molecular hydrogen bonding? Give an example of it. [1+1]

35. **2070 Supp. Q.No. 8** Give any two applications of dipole moment. [1+1]

36. **2070 Supp. Q.No. 9** Explain why:
   i. Ammonia is highly soluble in water.
   ii. H_2O is liquid where as H_2S is gas. [1+1]

37. **2070 Set C Q.No. 13** Write any two applications of dipole moment. [1+1]

38. **2070 Set C Q.No. 16** Mention the requirements for a molecule to fulfil for the formation of hydrogen bond. [2]

39. **2070 Set D Q.No. 7 Or** Write a Covalent Compound formed by nitrogen and oxygen. What is its Lewis structure? [1+1]

40. **2070 Set D Q.No. 8** Define Polar Covalent bond and give an example of it. [1+1]

41. **2070 Set D Q.No. 9** How does hydrogen bond affect the physical properties of compound? [2]

42. **2069 (Set A) Q. No. 7** What type of hydrogen bond is found in ammonia? Give any one important use of hydrogen bond. [2]

43. **2069 (Set A) Q. No. 8** **2060 Q.No. 10** Define dipole moment. What is its unit? [1+1]

44. **2069 (Set B) Q. No. 8** Write down the Lewis structure of:
   i. KNO_3 ii. HCO_3^-

45. **2069 (Set B) Q. No. 9** What is hydrogen bond? Given an example of intermolecular hydrogen bond. [1+1]

46. **2068 Q.No. 7 OR** Define Octet rule. Name the two compounds in which Octet rule is not obeyed. [1+1]

47. **2068 Q.No. 9** Write down the Lewis structure of :
   i. NH_4NO_3 ii. H_2O_2 [1+1]

48. **2068 Q.No. 10** Give reason:
   i. Ammonia has higher boiling point than Phosphine.
   ii. CO_2 molecule gets linear structure. [1+1]

49. **2067 Q.No. 10** How would you explain metallic bond in light of electron-sea model? [2]

50. **2067 Q.No. 11** Explain why: [1+1]
   i. HCl has polar character though it has covalent bond.
   ii. CO_2 is a linear molecule but H_2O is not.

51. **2067 Q.No. 13** Write down the Lewis structure of: [1+1]
   i. H_3BO_3 ii. NO_2^-

52. **2066 Q.No. 9** Write one important property of the compound formed by the two atoms X and Y whose valence shell electronic configurations are $3s^1$ and $3s^23p^5$ respectively. [2]

53. **2066 Q.No. 11** What is dipole moment? Mention its one important application. [1+1]

54. **2065 Q. No. 11** What is hydrogen bond? Write an example. [2]

55. **2065 Q. No. 8** Write the Lewis structure of the compound formed by two elements A and B whose atomic numbers are 12 and 17 respectively. [2]
   Ans: $MgCl_2$

56. **2064 Q.No. 7** Each carbon-oxygen bond in CO_2 is polar but CO_2 molecule is non-polar. Give reason. [2]

57. **2064 Q.No. 9** Two elements A and B have outer most shell electronic configuration $3s^1$ and $2s^2 2p^4$ respectively, then name the chemical formed between them. [2]

58. **2063 Q.No. 8** Write the Lewis structure for NH_4^+ and H_2SO_4. [2]

59. **2063 Q.No. 11** What is meant by hydrogen bonding? Give an example of intermolecular hydrogen bonding. [2]
   Ans: NH_3 is an example

60. **2062 Q.No. 4** Write an example of intermolecular and intramolecular hydrogen bondings. [2]

61. **2062 Q.No. 7** Write the Lewis Structure of: [2]
   a. H_2O_2 b. HNO_3

62. **2062 Q.No. 11** What is meant by metallic bond? [2]

63. **2061 Q.No. 4** **2054 Q.No. 12** Why water is an excellent solvent for a polar substance? [2]

64. **2061 Q.No. 6** Why are solid sodium chloride and diamond non-conductor of electricity? [2]

65. **2061 Q.No. 7** Define hydrogen bond. Give an example of intermolecular hydrogen bond. [2]

66. **2061 Q.No. 12** Write the electronic configuration of elements with the atomic number 19 and 24. Give the name of these elements. [2]

67. **2061 Q.No. 16** Write Lewis structure of NO_2 and N_2O_3. [2]

68. **2060 Q.No. 7** Why are metals malleable and ductile? [2]

69. **2059 Q.No. 4** Why is solid sodium chloride a non conductor of electricity? [2]

70. **2058 Q.No. 8** Write the Lewis dot structure of BF_3 molecule and justify the formulation of coordinate covalent compounds by BF_3. [2]

71. **2058 Q.No. 11** Why does water have such a relatively high boiling point? [2]

72. **2057 Q.No. 8** Give Lewis structure of potassium carbonate. [2]

73. **2056 Q.No. 4** Write the Lewis structure of NH_4Cl molecule. [2]

74. **2056 Q.No. 9** Give an example of intermolecular hydrogen bond. How is it originated? [2]

75. **2055 Q.No. 3** **2051 Q.No. 3 Group A** Distinguish between a covalent and coordinate covalent bond. [2]

76. **2055 Q.No. 16** Draw Lewis structure of N_2O_5. [2]

77. **2054 Q.No. 5** What is octet rule? [2]

78. **2054 Q.No. 17** Write the Lewis structure of SO_2 molecule. [2]

79. **2053 Q.No. 3 Group A** Write Lewis electron dot formula for carbon dioxide. [1.5]

80. **2053 Q.No. 11 Group A** What types of bonds are involved in oxygen and calcium fluoride molecules? [1.5]

81. **2053 Q.No. 12 Group A** Write the Lewis structure of SO_4^{-2}. [1.5]

82. **2052 Q.No. 6 Group A** Explain why CO_2 got linear structure while H_2O got angular structure. [1.5]

83. **2052 Q.No. 13 Group A** Write the Lewis structure of CCl_4. [1.5]

84. 2052 Q.No. 16 Group A 2051 Q.No. 2 Group A Define Lewis base. Give an example of Lewis base. [1.5]

85. 2052 Q.No. 25 Group A How does a covalent bond differ from an ionic bond? [1.5]

Short Answer Questions

86. 2060 Q.No. 23 Discuss the formation of potassium chloride and carbon tetrachloride molecules on the basis of electronic theory of valency. Give any two characteristics of ionic and covalent compounds. [5]

87. 2059 Q.No. 23 The elements X and Y have the atomic numbers 11 and 17 respectively. [5]
   i. Write the electric configuration of the elements.
   ii. State the type of bond when they combine to form a compound.
   iii. In which group of periodic table do they belong?

88. 2053 Q.No. 3 Group B X, Y and Z represent elements of atomic number 1, 6 and 17 respectively. [5]
   a. Write the electron structure of X, Y and Z.
   b. Place the elements in the appropriate group of the periodic table.
   c. Write the formula and the Lewis structures of the covalent compounds formed between: (i) X and Y (ii) X and Z

Write Short Notes On

89. 2063 Q.No. 33b Covalent bonding. [5]
90. 2060 Q.No. 33b Resonance [5]

Unit 7: Periodic Classification of Elements

Very Short Answer Questions

1. 2076 Set B Q.No. 10 Which one has greater electron affinity and why? Cl or F. [2]

2. 2076 Set C Q.No. 10 Which one has greater ionization energy and why? Na^+ or Ne [1+1]

3. 2075 GIE Q.No. 10 2073 Supp. Q.No. 10 2072 Set D Q.No. 10 2067 Q.No. 9 2066 Q.No. 8 2063 Q.No. 10 State modern periodic law. [2]

4. 2075 Set A Q.No. 10 2074 Set A Q.No. 10 Which ion would you expect to have larger size and why? Mg^{++} or Na^+ [1+1]

5. 2075 Set B Q.No. 10 Which of the following is the smallest in size? N^{3-}, O^{2-}, F^-, and Na^+. Give appropriate reason. [2]

6. 2074 Supp. Q.No. 10 Which ion would you expect to have smaller size and why? Mg^{++} or Na^+. [1+1]

7. 2074 Set B Q.No. 10 Which ion would you expect to have smaller size and why? Na^+ or Ne [2]

8. 2073 Set C Q.No. 10 2072 Set C Q.No. 10 2070 Set C Q.No. 5 State Mendeleev's Periodic law. [2]

9. 2073 Set D Q.No. 10 Predict which of the following pair has larger electron affinity and why? O and F. [2]

10. 2072 Supp Q.No. 10 2070 Supp. Q.No. 10 Which ion would you expect to have smaller size and why Be^{++} or Li^+. [2]
    Ans: Be^{++}

11. 2072 Set E Q.No. 10 Which of the following is the smallest in size? N^{3-}, O^{2-}, I^{-1} and Na^+. Give appropriate reason. [1+1]

12. 2071 Supp. Q.No. 10 What is electron affinity? Give one important factor which influences the magnitude of electron affinity. [2]

13. 2071 (Set C) Q.No. 10 Why is first ionization energy of Mg is greater than that of Na? [2]

14. 2071 (Set D) Q.No. 10 Which one N or O has more electron affinity and why? [2]

15. 2070 Set D Q.No. 10 On what basis does Mendeleev's periodic Law differ from Modern periodic Law? [1+1]

16. 2069 (Set A) Q.No. 10 Define ionization energy and atomic radius. [1+1]

17. 2069 (Set B) Q.No. 10 Write any two demerits of Mendeleev's periodic table. [1+1]

18. 2068 Q.No. 8 What is the basic difference between modern periodic table and Mendeleev's periodic table? [1+1]

19. 2065 Q.No. 7 Why is ionization energy of oxygen less than that of nitrogen? [2]

20. 2064 Q.No. 6 The first ionization energy of noble gases is higher than that of halogens. Explain. [2]

21. 2062 Q.No. 6 Why is the size of Cl^- ion is larger than Cl atom where as size of K^+ ion is smaller than that of K atom? [2]

22. 2060 Q.No. 8 Compare the size of F^- and Na^+ with the atomic size of Neon. [2]

23. 2059 Q.No. 6 Why is the ionisation energy of lithium greater than sodium? [2]

24. 2058 Q.No. 9 2055 Q.No. 8 What was the basis of the classification of elements in Mendeleev's periodic table? [2]

25. 2057 Q.No. 12 Arrange the elements Na, Li and K in the increasing order of first ionization energy. [2]

26. 2056 Q.No. 7 Why do atomic radii decrease across a period and increase in a group with the increase of atomic number? [2]

27. 2055 Q.No. 4 Why do the Oxide, O^{2-} and sulphide, S^{2-} have negative charge? [2]

28. 2054 Q.No. 6 Why Ionization energies of alkalis metals decreases as the atomic number increases. [2]

29. 2053 Q.No. 1 2052 Q.No. 14 Group A Why do metals form positive ions and non-metals form negative ions? [1.5]

30. 2053 Q.No. 10 Group A Which of the following pairs would have a larger size and why? [2]
    a. K or K^+ b. F or F^-

31. 2053 Q.No. 14 Group A Why does the first ionization energy increase from left to right in a given period of the periodic table? [2]

32. 2052 Q.No. 5 Group A Ar comes before K in the periodic table, but Ar has a larger relative atomic mass than K. Explain. [1.5]

33. 2052 Q.No. 11 Group A Why does the atomic size increase in going down any family of the periodic table? [1.5]

34. 2051 Q.No. 11 Group A Is a potassium atom larger, smaller or the same size as a potassium ion? Explain. [2]

Short Answer Questions

35. 2073 Supp Q.No. 23 What is periodicity and its causes? How do atomic radii vary in a group and why? [1+4]

36. **2073 Set C Q. No. 23** What is periodicity and its causes? How do atomic radii vary in a period and why? [2.5+2.5]

37. **2073 Set D Q. No. 23** What property did Mendeleev's use to classify the element in his periodic table? Point out the anamolies in the Mendeleev's periodic table. [1+4]

38. **2072 Supp Q. No. 25** State Mendeleev's periodic law. What are the anomalies of Mendeleev's periodic table? How are these anomalies removed in modern periodic table? [5]

39. **2071 Supp. Q. No. 23** What is periodicity? How do atomic radii vary in a group and in a period? [1+2+2]

40. **2069 (Set A) Q. No. 24** State Modern Periodic law. What are the advantages of modern periodic table? [1+4]

41. **2068 Q. No. 24** Define ionization energy. How do 'Nuclear charge' and Size of the atom' influence the magnitude of the ionization energy? Ionization energy of 'N' is higher than that of 'O'. Give reason. [1+3+1]

42. **2058 Q.No. 25**
a. How does atomic size vary within a horizontal row of the periodic table? Explain how this variation arises?
b. The Mg^{2+} and Na^+ have same number of electrons (ten). Which ion would you expect to have the smaller radius? Explain. [5]

43. **2051 Q.No. 2 Group B** "Periodicity in chemical properties is based on atomic structure." Explain. [5]

WRITE SHORT NOTE ON

44. **2076 Set B Q.No. 33ii** **2075 Set A Q.No. 33i** **2074 Supp Q.No. 33iv** **2071 Set D Q.No. 33b** **2069 Set B Q. No. 33c** Advantages of modern periodic table. [5]

45. **2076 Set C Q.No. 33iii** **2075 Set B Q.No. 33ii** Defect of Mendeleev's Periodic table. [5]

46. **2075 GIE Q.No. 33iv** Mendeleev's periodic table and its demerits. [5]

47. **2074 Set A Q.No. 33iii** **2074 Set B Q.No. 33i** **2071 Set C Q.No. 33d** Mendeleev's periodic table and its anomalies [5]

48. **2072 Set C Q.No. 33a** **2071 Supp. Q.No. 33a** Characteristic of s, p, d and f blocks of element [5]

49. **2072 Set D Q.No. 33a** Affecting factors on magnitude of ionization energy. [5]

50. **2072 Set E Q.No. 33 i** Merits of modern periodic table. [5]

51. **2070 Supp. Q.No. 33 (b)** **2064 Q.No. 33(a)** **2053 Q.No. 4a Group C** Modern periodic table [5]

52. **2070 Set C Q.No. 33a** **2066 Q.No. 33 b** Periodic properties of elements. [5]

53. **2070 Set D Q.No. 33d** Disadvantage of Mendeleev's periodic table. [5]

54. **2067 Q.No. 33a** Electron affinity and ionisation potenital. [5]

55. **2065 Q. No. 33 a** Modern Periodic Law and advantages of Modern Periodic Table. [5]

Unit 8: Oxidation and Reduction

VERY SHORT ANSWER QUESTIONS

1. **2076 Set B Q.No. 11** Assign oxidation number to the underlined element in each of the following: [1+1]
   i. $\underline{N}_2O_2$ ii. $NaH_2\underline{P}O_4$
   Ans: (i) +2 (ii) Ans: +5

2. **2076 Set C Q.No. 11** Assign the oxidation number to the underlined element in each of the following compound: [1+1]
   i. $\underline{C}_2H_5OH$ ii. $\underline{Pb}_3O_4$
   Ans: (i) −2 (ii) $\frac{8}{3}$

3. **2075 GIE Q.No. 11** Calculate the oxidation number of chlorine in [1+1]
   i. $\underline{Cl}O_3^-$ ii. $NaO\underline{Cl}$
   Ans: (i) +5 (ii) +1

4. **2075 Set A Q.No. 11** Calculate the oxidation number of [1+1]
   i. N in NH_4Cl ii. S in $NaHSO_3$
   Ans: (i) −3 (ii) +4

5. **2075 Set B Q.No. 11** What is meant by the term oxidation number? Calculate the oxidation number of nitrogen in ammonium sulphate. [1+1]
   Ans: −3

6. **2074 Supp Q.No. 11** **2074 Set B Q.No. 11** Calculate the oxidation number of [1+1]
   i. C in HCOONa   ii. Cl in $KClO_3$
   Ans: (i) +2 (ii) +5

7. **2074 Set A Q.No. 11** Calculate the oxidation number of: [1+1]
   i. N in NH_4OH ii. Cr in $K_2Cr_2O_7$
   Ans: (i) −3 (ii) +6

8. **2073 Supp Q.No. 11** Define oxidation number, what is the oxidation number of P in $Ca_3(PO_4)_2$? [1+1]
   Ans: +5

9. **2073 Set C Q. No. 11** Define oxidation number. What is the oxidation number of Boron in $Na_2B_4O_7$? [1+1]
   Ans: +3

10. **2073 Set D Q. No. 11** Define oxidation number. What is the oxidation number of P in NaH_2PO_2? [1+1]
    Ans: +1

11. **2072 Supp. Q. No. 11** Calculate the oxidation number of sulphur in (i) $SOCl_2$ (ii) H_2SO_3. [1+1]
    Ans: (i) $SOCl_2$ = +4 (ii) H_2SO_3 = +4.

12. **2072 Set C Q. No. 11** Define the term oxidation number. What is the oxidation number of Fe in $Na_4[Fe(CN)_6]$? [1+1]
    Ans: Fe = +2

13. **2072 Set D Q.No. 11** Calculate oxidation number of: [1+1]
    i. Cl in $KClO_3$ ii. P in NaH_2PO_4
    Ans: (i) +5 (ii) +5

14. **2072 Set E Q. No. 11** Determine oxidation number of the underlined element in the following species. [1+1]
    i. $\underline{C}_2H_2O_4$ ii. $\underline{Cr}_2(SO_4)_3$
    Ans: (i) +3 (ii) +3

15. **2071 Supp. Q. No. 11** Calculate the oxidation number of Mn atom in MnO_4^-. [2]
    Ans: +7

16. **2071 (Set C) Q.No. 11** Calculate the oxidation number of nitrogen in [1+1]
    a. $NaNO_3$ b. NH_4^+
    Ans: (a) + 5 (b) − 3

17. **2071 (Set D) Q.No. 11** Calculate the oxidation number of underlined atom in the following compounds: [1+1]
    a. $\underline{N}H_4NO_3$ b. $\underline{Cr}_2O_7^{-2}$
    Ans: (a) − 3 (b) + 6

18. **2070 Supp. Q.No. 11** Calculate the oxidation number of carbon in [1+1]
    i. CH_3OH ii. $C_6H_{12}O_6$
    Ans: (i) −2 (ii)

19. **2070 Set C Q.No. 10** Calculate the oxidation number of: [1+1]
a. carbon in $H_2C_2O_4$ b. phosphorous in H_3PO_4
Ans: (a) +3 (b) +5

20. **2070 Set D Q.No. 11** Find the Oxidation number of nitrogen in [1+1]
a. Ammonia   b. Ammonium Sulphate
Ans: (a) –3 (b) –3

21. **2069 (Set A) Q. No. 11** Calculate the oxidation number of :
i. C in $C_2H_2O_4$ ii. Mn in MnO^-_4 [1+1]
Ans: (i) +3 (ii) +7

22. **2069 (Set B) Q. No. 11** Calculate the oxidation number of carbon in:
i. $C_2H_2O_4$ ii. CO_3^{--} [1+1]
Ans: (i) + 3 (ii) + 4

23. **2068 Q.No. 11** How would you show the following reaction is a redox reaction?
$Mg + Cl_2 \longrightarrow MgCl_2$ [2]

24. **2064 Q.No. 8(a)** Calculate the oxidation number of Carbon in $H_2C_2O_4$. [2]
Ans: +3

25. **2064 Q.No. 8(b)** Calculate the oxidation number of Phosphorous in $H_2PO_4^-$. [2]
Ans: + 5

26. **2063 Q.No. 7** Balance the following chemical equation by oxidation number change method or ion electron method.
$Cu + HNO_3 \longrightarrow Cu(NO_3)_2 + NO_2 + H_2O$ [2]

27. **2052 Q.No. 10** Calculate the oxidation number of underlined atoms in the following [2]
a. $\underline{N}H_4NO_3$ b. $\underline{Mn}O_4^{-2}$
Ans: (a) –3 (b) + 6

28. **2061 Q.No. 8** Calculate the oxidation number of $\underline{S}$ in $Na_2S_2O_3$ and $H_2S_2O_7$. [2]
Ans: +2 and + 6

29. **2060 Q.No. 9** How is the following ionic equation a Redox reaction? [2]
$Cl_2 + 2OH^- \longrightarrow Cl^- + ClO^- + H_2O$

30. **2057 Q.No. 10** Calculate the oxidation number of S in $K_2S_2O_3$ and SO_2Cl_2. [2]
Ans: +2 and + 6

31. **2056 Q.No. 8** Define oxidation number of an element in a compound. Calculate the oxidation number of P in H_3PO_4. [2]
Ans: +5

32. **2054 Q.No. 3** Assign oxidation numbers to the underlined elements in each of the following formulas. [2]
$\underline{Mn}O_4^-$, $Ti\underline{Cl}_4$, $\underline{N}H_3$
Ans: +7, +4, – 3

33. **2053 Q.No. 13 Group A** What is the oxidation number of oxygen in H_2O_2 and Phosphorus in PO_4^{-3}? [1.5]
Ans: –1 and + 5

34. **2052 Q.No. 12 Group A** Give the oxidation number of sulphur and chromium in SO_4^{-2} and $Na_2Cr_2O_7$ respectively. [1.5]
Ans: +6, +6

35. **2051 Q.No. 4 Group A** What is the oxidation number of Chromium in Potassium chromate? [2]
Ans: +6

SHORT ANSWER QUESTIONS

36. **2076 Set B Q.No. 23** Define reducing agent giving an example. Balance the following redox reaction by oxidation number or ion-electron method: [1+4]
$MnO_2 + HCl \longrightarrow MnCl_2 + Cl_2 + H_2O$

37. **2076 Set C Q.No. 23** Define redox reaction. Balance the following equation by oxidation number or ion-electron method. [1+4]
$KMnO_4 + HCl \longrightarrow KCl + MnCl_2 + H_2O + Cl_2$

38. **2075 GIE Q.No. 25** Define electronic concept of oxidation giving an example. Balance the following equation by oxidation number or ion-electron method. [1+4]
$Zn + HNO_3 \longrightarrow Zn(NO_3)_2 + NO_2 + H_2O$

39. **2075 Set A Q.No. 24** Oxidation and Reduction is simultaneous process. Explain Balance the following equation by oxidation number or ion electron method. [5]
$C + H_2O_2 \longrightarrow CO + H_2O$

40. **2075 Set B Q.No. 24** Distinguish between oxidation and reduction. Balance the following equation by oxidation number or ion electron method. [2+3]
$N_2H_4 + ClO_3^- \longrightarrow NO + Cl^- + H_2O$

41. **2074 Supp Q.No. 24** Justify by giving and example that oxidation and reduction go side by side. Balance the following equation by oxidation number or ion electron method. [1+4]
$FeCl_3 + H_2S \longrightarrow FeCl_2 + HCl + S$

42. **2074 Set A Q.No. 24** Give an example to show oxidation and reduction go simultaneously. Balance the following equation by oxidation number or ion electron method, [2+3]
$HNO_3 + H_2S \longrightarrow SO_2 + NO_2 + H_2O$

43. **2074 Set B Q.No. 24** 'Oxidation and reduction is simultaneous process.' Explain. Balance the equation by oxidation number or ion electron method. [2+3]
$HNO_3 + H_2S \longrightarrow SO_2 + NO_2 + H_2O$

44. **2073 Supp Q.No. 24** **2073 Set C Q. No. 24** **2073 Set D Q. No. 24** Balance the following equation by oxidation number or ion-electron method and point out oxidant and reductant. [4+1]
$Zn + NaNO_3 + NaOH \longrightarrow Na_2ZnO_2 + NH_3 + H_2O$

45. **2072 Supp Q. No. 23** Define Redox reaction. Balance the following equation by oxidation number method indicating oxidizing and reducing agent: [1+4]
$C_{12}H_{22}O_{11} + HNO_3 \longrightarrow NO_2 + C_2H_2O_4 + H_2O$

46. **2072 Set C Q.No. 24** Define the term (i) oxidant (ii) reductant. Balance the following redox reaction by oxidation number or iron electron method indicating oxidant and reducant: [2+3]
$N_2H_4 + ClO_3^- \longrightarrow NO + Cl^- + H_2O$

47. **2072 Set D Q.No. 24** Define redox reaction. Balance the following equations by oxidation number or ion electron method. $MnO_4^- + H_2O_2 + H^+ \longrightarrow MnO_2 + O_2 + H_2O$ [2+3]

48. **2072 Set E Q.No. 24** Distinguish between oxidant and reductant. Balance the following equation. [5]
$C_2H_2O_4 + MnO_4^- + H^+ \longrightarrow CO_2 + Mn^{2+} + H_2O$

49. **2071 (Set C) Q.No. 25** What is meant by redox reaction? Balance the following equation by oxidation number method indicating oxidant and reductant: [1+4]
$KMnO_4 + Na_2O_2 + H_2SO_4 \longrightarrow K_2SO_4 + MnSO_4 + Na_2SO_4 + H_2O + O_2$

50. **2071 (Set D) Q.No. 25** Distinguish between oxidant and reactant. Balance the following equation by oxidation number method. [1+4]
$KMnO_4 + HCl \longrightarrow KCl + MnCl_2 + H_2O + Cl_2$

51. **2070 Supp. Q.No. 24** Define oxidiation number and balance the following equation by oxidation number or ion-electron method indicating oxidant and reductant: [1+4]
$$CuSO_4 + HI \longrightarrow Cu_2I_2 + H_2SO_4 + I_2$$

52. **2070 Set C Q.No. 24** What is oxidation number? Balance the following equation by oxidation number or ion-electron method.   [1+4]
$$Cu + HNO_3 \longrightarrow Cu(NO_3)_2 + NO + H_2O.$$

53. **2070 Set D Q.No. 24** What is meant by oxidation number? Balance the following equation by oxidation number or ion-electron method indicating oxidant reluctant.
$$NaOH + S \longrightarrow Na_2S + Na_2S_2O_3 + H_2O$$ [1+4]

54. **2069 (Set A) Q. No. 23** What is meant by redox reaction? Balance the following equation by oxidation number or ion-electron method: [1+4]
$$KMnO_4 + C_2H_2O_4 + H_2SO_4 \longrightarrow K_2SO_4 + MnSO_4 + CO_2 + H_2O$$

55. **2069 (Set B) Q. No. 25** What is meant by oxidation number? Balance the following equation by oxidation number or ion-electron method:
$$MnO_4^- + C_2H_2O_4 + H^+ \longrightarrow Mn^{++} + H_2O + CO_2.$$ [1+4]

56. **2067 Q.No. 24** Balance the following redox reaction by oxidation number of ion-electron method and point out the oxidant and reductant.   [4+1]
$$K_2Cr_2O_7 + SnCl_2 + HCl \longrightarrow CrCl_3 + SnCl_4 + KCl + H_2O$$

57. **2066 Q.No. 25** Prove that Oxidation and Reduction is simultaneous process.' Balance the following equation by oxidation number method or ion-electron method.   [2+3]
$$MnO_2 + HCl \longrightarrow MnCl_2 + Cl_2 + H_2O$$

58. **2065 Q. No. 25** What is oxidation number? Balance the following equation by oxidation number or ion-electron method: [1+4]
$$KI + H_2SO_4 \longrightarrow K_2SO_4 + I_2 + H_2S + H_2O$$

59. **2064 Q.No. 24** Define redox reaction. Balance the following equation by Oxidation number or ion-electron method. Also point out the oxidant and reductant:
$$I_2 + HNO_3 \longrightarrow HIO_3 + NO_2 + H_2O$$ [5]

60. **2062 Q.No. 25** Point out the oxidant and reductant in the following redox reaction and balance the reaction by oxidation number or ion electron method.   [1.5+3.5]
$$NaOH + Br_2 \longrightarrow NaBrO_3 + NaBr + H_2O$$

61. **2057 Q.No. 24** Define oxidation and reduction in terms of electronic concept. Balance the following reaction by ion electron or oxidation number method   [2+3]
$$Cu + HNO_3 \longrightarrow Cu(NO_3)_2 + NO + H_2O$$

62. **2056 Q.No. 24** Specifying oxidation half, reduction half, oxidizing agent and reducing agent balance the equation by ion electron or O.N. method: [5]
$$Fe^{2+} + H^+ + NO_3^- \longrightarrow Fe^{3+} + NO + H_2O$$

LONG ANSWER QUESTIONS

63. **2059 Q.No. 31**
a. Define oxidation and reduction in terms of electronic concept.
b. You are given the equation
$$Zn + HNO_3 \longrightarrow Zn(NO_3)_2 + N_2O + H_2O$$
   i. Explain with electronic concept which substance is oxidized and which is reduced?

ii. Balance the equation by ion electron or oxidation number method.
iii. Indicate the number of HNO_3 molecules acting as an oxidizing agent and as an acidic agent.   [2+3+3+2]

64. **2055 Q.No. 28**
a. Define oxidation and reduction (electronic interpretation). [10]
b. Balance the following equations, identifying in each case the oxidizing and the reducing agent:
i. $H_2S + H_2O_2 \longrightarrow S + H_2O$
ii. $C + HNO_3 \longrightarrow NO_2 + H_2O + CO_2$
iii. $MnO_4^- + S^{2-} + H_2O \longrightarrow MnO_2 + S + OH^-$
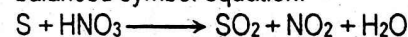
65. **2054 Q.No. 29** With a suitable example explain the terms: [10]
a. Oxidizing agent
b. Reducing agent
c. Oxidation
d. Reduction and balance the following reactions by oxidation number method
i. $Cr_2O_7^{2-} + Fe^{2+} + H^+ \longrightarrow Cr^{3+} + Fe^{3+} + H_2O$
ii. $Zn + HNO_3 \longrightarrow Zn(NO_3)_2 + N_2O + H_2O$

66. **2053 Q.No. 3 Group C**
a. What do you mean by redox-reaction? [10]
b. Balance the following redox-reaction by oxidation number method
$$KMnO_4 + KCl + H_2SO_4 \longrightarrow MnSO_4 + K_2SO_4 + H_2O + Cl_2$$
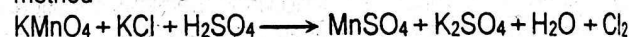
67. **2052 Q.No. 2 Group C** Define oxidation reduction in terms of loss and gain of electrons. Illustrate your answer with balanced symbol equation.   [10]
$$S + HNO_3 \longrightarrow SO_2 + NO_2 + H_2O$$
In the above reactants which one is oxidized and which one is reduced?

68. **2051 Q.No. 2 Group C**
a. Define oxidation and reduction.   [10]
b. Balance the following oxidation-reduction equations (You may use either ion-electron method or oxidation number method)
i. $HNO_3 + H_2S \longrightarrow NO + S + H_2O$
ii. $KMnO_4 + KCl + H_2SO_4 \longrightarrow MnSO_4 + K_2SO_4 + H_2O + Cl_2$

WRITE SHORT NOTES ON

69. **2071 Supp. Q.No. 33d** Electronic interpretation of oxidation and reduction.   [5]

70. **2068 Q.No. 33 d** Oxidation and reduction in term of electronic concept and oxidation number.   [5]

## Unit 9: Equilibria

VERY SHORT ANSWER QUESTIONS

1. **2076 Set B Q.No. 12** State law of mass action.   [2]

2. **2076 Set C Q.No. 12** **2072 Set C Q.No. 12** Define equilibrium constant. What information would you expect when equilibrium constant $K_c > 1$?   [1+1]

3. **2075 GIE Q.No. 12** Define equilibrium constant (K_c). Give the relationship K_p between K_c for the following reaction.   [1+1]
$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$

4. **2075 Set A Q.No. 12** Define equilibrium constant. Write equilibrium constant Kc for the reaction. [2]

$$CaCO_3(s) \underset{\Delta}{\rightleftharpoons} CaO(s) + CO_2(g)$$
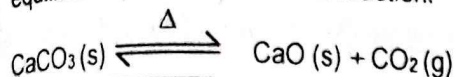
5. **2075 Set B Q.No. 12** What is meant by equilibrium constant (Kc)? Write down the expression of equilibrium constant for the following reaction. [1+1]

$$3Fe(s) + 4H_2O(g) \rightleftharpoons Fe_2O_3(s) + 4H_2(g)$$
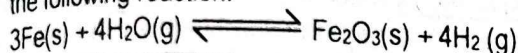
6. **2074 Supp Q.No. 12** What is the effect of increase of pressure and decrease of temperature in the following chemical equilibrium? [1+1]

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) + heat.$$
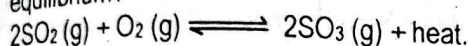
7. **2074 Set A Q.No. 12** **2074 Set B Q.No. 12** Write the relationship between Kp and Kc for the reaction. [1+1]

$$PCl_5(g) \longrightarrow PCl_3(g) + Cl_2(g)$$
$$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$$
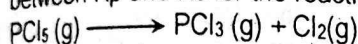
8. **2073 Supp Q.No. 12** Write the expression for equilibrium constant (Kc) for the following reactions: [1+1]
i. $2Cu(NO_3)_2(s) \rightleftharpoons 2CuO(s) + 4NO_2(g) + O_2(g)$
ii. $FeO(s) + CO(g) \rightleftharpoons Fe(s) + CO_2(g)$
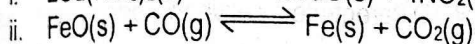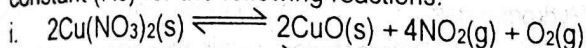
9. **2073 Set C Q. No. 12** **2073 Set D Q. No. 12** Write the expression for equilibrium constant (Kc) for;
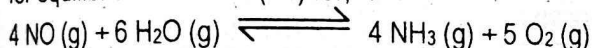
$$4NO(g) + 6H_2O(g) \rightleftharpoons 4NH_3(g) + 5O_2(g)$$
What is the relationship between Kc and Kp for the above reaction? [1+1]

10. **2072 Supp Q. No. 12** What is the relationship between Kp and Kc for the following gaseous reaction?
i. $N_2 + 3H_2 \rightleftharpoons 2NH_3$
ii. $N_2 + O_2 \rightleftharpoons 2NO$ [1+1]
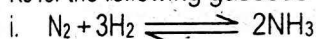
11. **2072 Set D Q.No. 12** Define equilibrium constant (Kc). Why is backward reaction favoured when Kc < 1? [1+1]

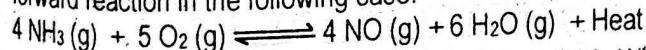12. **2072 Set E Q.No. 12** Define equilibrium constant (Kc) and write the relationship between Kp and Kc for the following reaction: [1+1]

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g).$$

13. **2071 Supp Q.No. 12** State Le-Chaterlier principle. What is the effect of temperature on the equilibrium of the following reaction:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \quad (\Delta H = -93.6kJ) \quad [2]$$
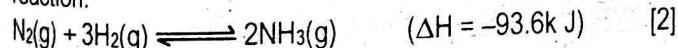
14. **2071 (Set C) Q.No. 12** Predict the favourable conditions for forward reaction in the following case: [2]

$$4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g) + Heat$$

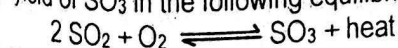15. **2071 (Set D) Q.No. 12** Define equilibrium constant (Kc). What would be the expression for Kc in the following reaction. [1+1]

$$C(s) + CO_2(g) \rightleftharpoons 2CO(g)$$
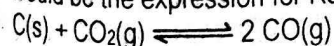
16. **2070 Supp. Q.No. 12** State law of mass action and write Kc for the following equilibrium reaction. [1+1]

$$CaCO_3(s) \underset{\Delta}{\rightleftharpoons} CaO(s) + CO_2(g)$$

17. **2070 Set C Q. No. 7** Mention proper conditions for maximum yield of SO₃ in the following equilibrium reaction [2]

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

18. **2070 Set D Q.No. 12** What is meant by equilibrium constant (Kc)? Write a chemical equilibrium in which Kc become equal to Kp. [1+1]
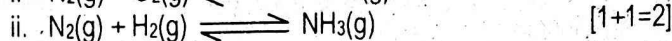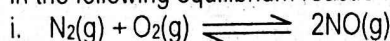
19. **2069 (Set A) Q. No. 12** What is the effect of increasing pressure and decreasing temperature on the following equilibrium? [2]

$$N_2 + 3H_2 \rightleftharpoons 2NH_3 + heat$$
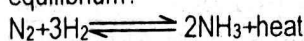
20. **2069 (Set B) Q. No. 12** Define law of mass action. What is the relation between Kp and Kc for the following reaction? [1+1]

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$
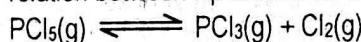
21. **2068 Q.No. 12** What happens when the pressure is increased in the following equilibrium reaction:
i. $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$
ii. $N_2(g) + H_2(g) \rightleftharpoons NH_3(g)$ [1+1=2]

22. **2067 Q.No. 12** What is meant by the term active mass? express the active mass of the reactants in the following reaction $2P + Q \longrightarrow$ products. [1+1]

23. **2066 Q.No. 12** What happens when pressure is increased in the following equilibrium reactions? [1+1]
$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$
$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$
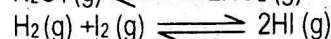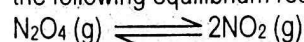
24. **2065 Q. No. 12** Define equilibrium constant. Write the expression of equilibrium constant (kc) for the following reaction:
$$CaCO_3(S) \rightleftharpoons CaO(s) + CO_2(g) \quad [2]$$
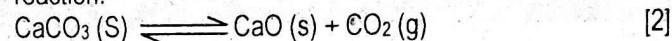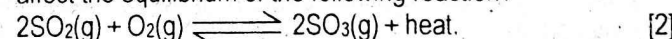
25. **2064 Q.No. 10** Why is the formation of SO₃ favoured by increasing pressure and decreasing temperature on the following system?
$$2SO_2(g) + O_2(g) \rightleftharpoons 3SO_3(s) + heat \quad [2]$$
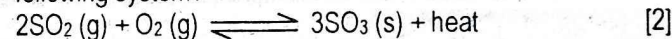
26. **2064 Q.No. 33(d)** Write short notes on Le–Chatelier's Principle. [2]

27. **2063 Q.No. 6** How do increase in termperature and pressure affect the equilibrium of the following reaction?
$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) + heat. \quad [2]$$
Ans: Backward direction; forward direction

28. **2062 Q.No. 8** Why does pressure have no effect on $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$? Write Kc for the reaction. [2]

29. **2060 Q.No. 11** Write down the relation between Kp and Kc. What is condition for a gaseous reaction to have Kp = Kc? [2]

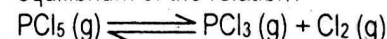30. **2059 Q.No. 9** How does temperature change affect the equilibrium of the given reaction? [2]
$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g), \Delta H = -22.4 \text{ Kcal/mole}$$
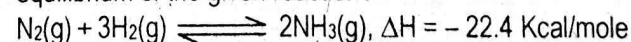
31. **2056 Q.No. 11** Predict the effect of temperature on the equilibrium of the reaction: [2]
$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g), H = -93.6 kJ$$
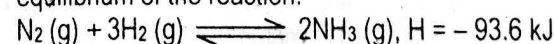
SHORT ANSWER QUESTIONS

32. **2058 Q.No. 24** What would be the effect on the position of equilibrium of the relation? [5]
$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$
Of (a) adding Cl₂ (b) adding PCl₃ (c) decreasing the pressure by increasing the volume of the system (d) increasing temperature (the reaction is endothemic in the forward reaction) (e) adding a catalyst.

33. **2057 Q.No. 25** State Le-Chatlier's principle. How does the change in temperature and pressure affect the equilibrium of the following reaction? [1+2+2]
$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + 22.4 \text{ K Cal}$$
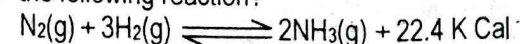
WRITE SHORT NOTES ON

34. 2076 Set B Q.No. 33iv 2076 Set C Q.No. 33iv 2074 Supp Q.No. 33iii 2072 Supp Q. No. 33ii 2072 Set C Q.No. 33b 2072 Set D Q.No. 33b 2071 Set D Q.No. 33c 2070 Set C & D Q.No. 33c Relationship between Kp and Kc. [5]

35. 2075 GIE Q.No. 33ii 2074 Set A Q.No. 33iv 2074 Set B Q.No. 33ii 2071 Set C Q.No. 33c Law of mass action and characteristics of equilibrium constant. [5]

36. 2075 Set B Q.No. 33i 2073 Supp Q.No. 33iii 2069 (Set B) Q. No. 33d Application of Le-Chatelier's principle in chemical equilibrium. [5]

37. 2073 Set C Q. No. 33ii 2073 Set D Q. No. 33ii 2072 Supp Q. No. 33i 2070 Supp. Q.No. 33c Le-Chatelier's principle and its application [5]

38. 2072 Set E Q.No. 33 iii Law of mass action and chemical equilibrium [5]

39. 2067 Q.No. 33b /2061 Q.No. (d) Le-Chatelier's Principle. [5]

40. 2063 Q.No. 33(a) 2066 Q.No. 33 a 2059 Q.No. 33(a) Law of mass action [5]

Section B - Inorganic Chemistry

Unit 10: Non - Metals I

10.1 Hydrogen

VERY SHORT ANSWER QUESTIONS

1. 2076 Set B Q.No. 14 What is meant by para-hydrogen? How is it converted into ortho-hydrogen? [1+1]

2. 2075 Set A Q.No. 13 Illustrate with an example to show nascent hydrogen is more powerful reducing agent than dihydrogen. [2]

3. 2075 Set B Q.No. 14 Mention an important application of each of the following. [0.5×4=2]
   i. Ozone-layer   ii. Heavy water
   iii. Dihydrogen   iv. Tritium

4. 2074 Supp Q.No. 13 Which one is more stable and why Ortho Hydrogen or Para Hydrogen? [1+1]

5. 2074 Set A Q.No. 13 Which one is the least abundant isotope of hydrogen? Mention its two uses. [1+1]

6. 2074 Set B Q.No. 13 Mention an important uses of each of the following [0.5×4]
   i. Deuterated water   ii. Tritium
   iii. Nascent hydrogen   iv. Ozone layer

7. 2073 Supp Q.No. 13 Which one is more stable? [1+1] Ortho-hydrogen or para-hydrogen. How is ortho-hydrogen converted into para-hydrogen?

8. 2073 Set C Q. No. 13 Distinguish between atomic hydrogen and nascent hydrogen. [2]

9. 2073 Set D Q. No. 13 What is nascent hydrogen? Mention an example to show nascent hydrogen is more powerful reducing agent than molecular hydrogen. [1+1]

10. 2072 Set E Q.No. 13 Name the isotopes of hydrogen and mention an important use of heavy hydrogen. [1+1]

11. 2071 Supp. Q.No. 13 Name the isotopes of hydrogen. In what respect do they differ from one another? [2]

12. 2071 (Set C) Q.No. 14 Mention one use of each of the following [0.5 × 4 = 2]
   a. Nascent hydrogen   b. Deuterium
   c. Heavy water   d. Ozone

13. 2069 (Set A) Q. No. 13 Name the isotopes of hydrogen. Which of the isotope of hydrogen is radioactive? [1+1]

14. 2069 (Set B) Q. No. 14 Give a reaction to show nascent hydrogen is more powerful reducing agent than molecular hydrogen. [2]

15. 2068 Q.No. 13 Mention one important use of each of the followings: [0.5×4=2]
   i. Heavy water   ii. Tritium
   iii. Nascent hydrogen   iv. Deuterium

16. 2066 Q.No. 14 Mention an important use of each of the followings: [0.5×4=2]
   i. Heavy water   ii. Ozone Layer
   iii. Hydrogen gas   iv. Deuterium

17. 2059 Q.No. 13 Differentiate between ortho and para hydrogen. [2]

18. 2054 Q.No. 7 Give a reaction which shows that water contains hydrogen. [2]

19. 2054 Q.No. 8 When steam is passed through red hot coke, a mixture of two gasses is obtained. Name the gases and write the reaction involved. [2]

20. 2054 Q.No. 27(c) What happens when Zinc dust is added to an acidified solution of potassium permanganate? [2]

21. 2052 Q.No. 21 Show that nascent hydrogen is powerful reducing agent than molecular hydrogen. [1.5]

22. 2052 Q.No. 23 List all the possible isotopes of hydrogen. Name the isotope which does not contain neutron. [1.5]

WRITE SHORT NOTES ON

23. 2051 Q.No. 4 Group C Isotopes of Hydrogen [2]

10.2. Oxygen

VERY SHORT ANSWER QUESTIONS

1. 2076 Set B Q.No. 13 Give reason to show [1+1]
   i. Al_2O_3 is an amphoteric oxide
   ii. BaO_2 is a peroxide.

2. 2075 GIE Q.No. 13 2071 (Set D) Q.No. 14 Give reason [1+1]
   i. CO_2 as an acidic oxide.
   ii. Al_2O_3 as an amphoteric oxide.

3. 2075 Set B Q.No. 13 Classify the following oxides. [0.5×4=2] BaO_2, Al_2O_3, Fe_3O_4, N_2O_3

4. 2073 Set C Q. No. 14 What are oxides? Write an example of [1+1]
   i. Amphoteric oxide   ii. Mixed oxide

5. 2072 Supp Q. No. 13 Classify the following oxides: N_2O_3, NO, BaO_2, Fe_3O_4 [2]

6. 2072 Set C Q.No. 14 Classify the following oxides giving suitable reason: [1+1]
   i. BaO_2 ii. Al_2O_3
   Ans: (i) Peroxide (ii) Amphoteric

7. **2070 Set C Q.No. 12** Mention one example of each of the followings: [2]
   a. Peroxide   b. Neutral oxide

8. **2070 Set D Q.No. 13** Classify the following oxides: N_2O_3, NO, BaO_2 and Fe_2O_3. [4×0.5]

9. **2069 (Set A) Q. No. 14** Name the allotropes of oxygen. Give an important use of each. [1+1]

10. **2067 Q.No. 14** Mention one example of each of the following:[0.5×4]
    i. allotrope of oxygen
    ii. most abundant isotope of hydrogen
    iii. amphoteric oxide
    iv. neutral oxide

11. **2065 Q. No. 15** Classify the following oxides with reason: Al_2O_3, CO_2 [2]

12. **2063 Q.No. 12** What are oxides? Give an example of an amphoteric oxide.   Ans: ZnO

13. **2061 Q.No. 26** What are oxides? Classify the following oxides justifying the classification: [5]
    a. NO   b. CO_2
    c. ZnO   d. CaO

14. **2058 Q.No. 16** What are Neutral and Amphoteric Oxides? Give one example of each. [2]

15. **2057 Q.No. 13** Write the names of any two neutral oxides with their formulae. [2]

16. **2053 Q.No. 24 Group A** Choose oxide from the following that you would expect to be acidic. Give reaction to justify. Your choice Na_2O, ZnO, MgO, SO_3. [1.5]

10.3.Ozone

VERY SHORT ANSWER QUESTIONS

1. **2076 Set C Q.No. 13** How does chlorofluoro carbon deplet ozone layer? [2]

2. **2075 GIE Q.No. 14** **2071 Set C Q.No. 13** Why is ozone layer formed at stratosphere? Give an importance of ozone layer. [1+1]

3. **2075 Set A Q.No. 14** Why is ozone layer formed on stratosphere? Name any one substance which is responsible for ozone layer depletion. [1+1]

4. **2074 Supp Q.No. 14** How are chlorofluorocarbon responsible for the depletion of ozone layer? [2]

5. **2074 Set A Q.No. 14** **2074 Set B Q.No. 14** Suggest your ideas to protect Ozone layer from its depletion. [2]

6. **2073 Supp Q.No. 14** **2073 Set D Q. No. 14** How does formation of Ozone take place in stratosphere? Give any two uses of Ozone. [1+1]

7. **2072 Set C Q.No. 13** What happens when: [1+1]
   i. Silent electric discharges is passed through pure and dry oxygen.
   ii. Mercury is exposed to ozonised atmosphere.

8. **2072 Set D Q.No. 13** **2068 Q.No. 14** How does CFC deplete Ozone layer? [2]

9. **2072 Set E Q.No. 14** Write down balanced chemical equation for the formation of ozone from oxygen. What is meant by tailing of mercury? [1+1]

10. **2071 Supp. Q.No. 14** What is meant by ozone hole? [2]

11. **2070 Supp. Q.No. 13** How is ozone layer formed in the stratosphere? Give its one use. [1+1]

12. **2070 Set C Q.No. 19** How is Ozone formed in the stratosphere? [2]

13. **2070 Set D Q.No. 14** **2069 (Set B) Q. No. 13** How is oxygen converted into ozone? Mention major one use of ozone. [1+1]

14. **2064 Q.No. 14** Write the resonating structure of ozone. [2]

15. **2062 Q.No. 12** Write resonance structures of ozone. [2]

10.4.Water

VERY SHORT ANSWER QUESTIONS

1. **2076 Set C Q.No. 9** Name any two properties of water in which hydrogen bonding is evident. [1+1]

2. **2076 Set C Q.No. 14** What is meant by heavy water? Mention its any two applications. [1+1]

3. **2072 Supp Q. No. 14** What is meant by heavy water? Write important use of it. [1+1]

4. **2072 Set D Q.No. 14** Why is water called universal solvent? [2]

5. **2071 (Set D) Q.No. 13** Why is water an excellent solvent for polar substances? [2]

6. **2070 Supp. Q.No. 14** Mention an important application of each:[1+1]
   i. Heavy water   ii. Tritium

10.5 Nitrogen and Its Compounds

VERY SHORT ANSWER QUESTIONS

1. **2063 Q.No. 16** What happens when the precipitate obtained by the addition of $AgNO_3$ solution on sodium chloride is treated with ammonia solution? [2]
   Ans: $[Ag(NH_3)_2]$ Cl (diammine silver (I) Chloride is formed and ppt dissolves)

2. **2062 Q.No. 14** What happens when freshly prepared ferrous sulphate is added to the mixture of conc. nitric acid and conc. sulphuric acid? [2]

3. **2061 Q.No. 15** Explain why ammonia gas cannot be dried by passing through conc. H_2SO_4 acid? [2]

4. **2061 Q.No. 17** In the ring test of nitrate what chemical compound is formed? [2]

5. **2060 Q.No. 27ii** **2059 Q.No. 32i** **2053 Q.No. 7b** **2052 Q.No. 7c & d** **2051 Q.No. 7b** What happens when: [1.5×7]
   a. Gas obtained by heating slaked lime and ammonium chloride is passed through copper sulphate solution.
   b. Dilute nitric acid reacts with magnesium.
   c. A mixture of ammonia and oxygen is passed over platinum gauze heated to 800° C.
   d. A solution of sodium nitrate and ammonium chloride is heated to boiling.
   e. Zinc is added in a hot alkaline solution of potassium nitrate.
   f. Mercurous nitrate paper is exposed in ammonia gas.
   g. Mercurous nitrate paper is placed over a jar containing ammonia gas.

6. **2059 Q.No. 17** Write the action of aquaregia on gold. [2]

7. **2055 Q.No. 15** Write equations for the reactions between: [2]
   a. ammonia and copper (II) oxide,
   b. ammonia and chlorine

8. 2053 Q.No. 15 Group A How does an ammonia molecule differ from ammonium ion? [2]

9. 2051 Q.No. 9 Write the names of any two metals which can liberate Hydrogen gas from Nitric Acid. [2]

SHORT ANSWER QUESTIONS

10. 2075 GIE Q.No. 27 Give balanced chemical equation for the preparation of ammonia from nitrogen and hydrogen. How does ammonia reacts with: [1+1+1+1+1]
    i. Mercurous paper
    ii. Nessler's reagent
    iii. Oxygen
    iv. Sodium metal

11. 2075 Set A Q.No. 28 How is ammonia manufactured by Haber's process? Write the action of ammonia on copper sulphate solution. [4+1]

12. 2075 Set B Q.No. 28 How is nitric acid prepared from catalytic oxidation of ammonia? [5]

13. 2074 Supp Q.No. 28 How is ammonia manufactured by Haber's process? What happens when ammonia solution is passed through Nesseler's reagent? [4+1]

14. 2074 Set B Q.No. 28 How is ammonia manufactured by Haber's process? What happens when ammonia is passed through heated CuO? [4+1]

15. 2072 Set C Q.No. 28 Starting from ammonia how would you obtain nitric acid? What is the action of nitric acid on:
    i. Fe
    ii. KI
    Why is conc. nitric acid stored in dark brown bottle?[1.5+1.5+1+1]

16. 2072 Set D Q.No. 28 How is nitric acid prepared from catalytic oxidation of ammonia? [5]

17. 2072 Set E Q.No. 28 Describe the physical and chemical principle for the manufacture of ammonia by Haber's process. Sketch a neat diagram for it. [5]

18. 2071 Supp. Q.No. 27 Describe Haber's Process for the manufacture of ammonia. What happens when sodium hydroxide is heated with white phosphorus? [4+1]

19. 2071 (Set C) Q.No. 27 Starting from ammonia, how would you prepare nitric acid. Give balanced chemical reaction for the reaction of conc. nitric acid with (a) copper and (b) magnesium. How would you perform the test of NO_3^- ion in its aqueous solution? [1+1+1+2]

20. 2071 (Set D) Q.No. 27 Give balance chemical equation for the preparation of ammonia from nitrogen and hydrogen. What are the proper physical conditions for better yield of ammonia? Write the action of ammonia on:
    a. mercurous nitrate paper.
    b. $CuSO_4$ solution
    c. CuO [1+1+1+1+1]

21. 2070 Supp. Q.No. 27 Give the balanced chemical equations for the preparation of nitric acid from ammonia. How does nitric acid react with: [1+2+2]
    i. Zinc
    ii. Iron

22. 2070 Set D Q.No. 27 Write balanced chemical reaction for the preparation of ammonia by Haber's process. How does ammonia react with
    a. Sodium b. chlorine c. $CuSO_4$ solution [2+3]

23. 2069 (Set B) Q. No. 29 Sketch a well-labelled digram for the manufacture of ammonia by Haber's process. Write physical and chemical principles involved in it. Why can't NH_3 be dried by passing over conc. H_2SO_4? [4+1]

24. 2067 Q.No. 27 What are the necessary physical conditions and chemical principle involved in the manufacture of ammonia gas by Haber's process? Why is ammonia highly soluble in water? [4+1]

25. 2063 Q.No. 27(ii) What happens when:
    The gas obtained by heating ammonium chloride with quick lime is passed through copper sulphate solution?
    Ans: Gas is NH_3; tetramine copper (II) sulphate is formed

26. 2062 Q.No. 27 Describe the principle involved in the manufacture of ammonia by Haber's process. What happens when ammonia gas is passed through heated CuO? [4+1]

27. 2060 Q.No. 26 Discuss the principle and draw a self explanatory sketch for the manufacture of ammonia by Haber's synthesis. [3+2]

28. 2057 Q.No. 26 Write down the manufacture of HNO_3 by catalytic oxidation of ammonia. [5]

29. 2054 Q.No. 26 Describe the principle involved in the manufacture of ammonia gas by Haber's process. [5]

LONG ANSWER QUESTIONS

30. 2076 Set B Q.No. 30
    a. Write down the principle and procedure with self-explanatory diagram for the manufacture of nitric acid by catalytic oxidation of ammonia. How does Conc. HNO_3 react with:[3+3]
        i. KI
        ii. Zn
    b. Explain, why? [2+2]
        i. Conc. HNO_3 is stored in dark bottle.
        ii. Iron becomes passive when treated with Conc. HNO_3

31. 2076 Set C Q.No. 30
    a. Write down the principle and procedure with self-explanatory diagram for the manufacture of nitric acid by catalytic oxidation of ammonia. How does Conc. HNO_3 react with [3+3]
        i. P_4
        ii. Zn
    b. Explain, why? [2+2]
        i. Conc.nitric acid is stored in dark bottle.
        ii. Iron becomes passive when treated with Conc.nitric acid.

32. 2074 Set A Q.No. 30 How is ammonia manufactured by Haber's process? What happens when ammonia is passed through
    i. Copper sulphate solution
    ii. Heated copper oxide
    Give reactions for the conversion of ammonia to nitric acid. [6+2+2]

33. 2073 Supp Q.No. 32 Write the principle and process along with self-explanatory diagram for the manufacture of ammonia by Haber's Synthesis. How does ammonia react with:
    i. excess chlorine
    ii. Nessler's reagent
    iii. $FeCl_3$ solution
    Why does ammonia turn mercurous nitrate paper black?[6+3+1]

34. 2073 Set C Q. No. 32 2073 Set D Q. No. 32 Write the principle and process involved along with self-explanatory diagram of the manufacture of nitric acid by catalytic oxidation of ammonia. How does concentrated nitric acid react with:
    i. Iron
    ii. Iodine
    Why is conc. HNO_3 stored in dark bottle? [6+1.5+1.5+1]

35. **2072 Supp Q. No. 31** Write balanced chemical equation for the preparation of nitric acid from ammonia. Sketch a labeled diagram. How does conc. Nitric acid react with (i) Copper (ii) Phosphorous.
Give the composition of aqua-regia. What is the laboratory test of nitrate ion?   [5+1+1+1+2]

36. **2070 Set C Q.No. 30** Describe the principle and draw a self explanatory sketch for the manufacture of ammonia by Haber's synthesis. How does ammonia reacts with: [6+4]
a. CO_2 gas   b. $CuSO_4$ solution
c. Na-metal   d. Chlorine in excess

37. **2069 (Set A) Q. No. 31** Describe Haber's process for the manufacture of ammonia. Why is NH_3 not dried over conc. H_2SO_4 and anhydrous $CaCl_2$? what is the action when ammonia is passed to mercurous nitrate paper and $FeSO_4$ solution?   [6+2+2]

38. **2068 Q. No. 31** How is nitric acid manufactured by catalytic oxidation of ammonia? Sketch a well-labelled diagram for it. What are the actions of: [6+1+1+1+1]
i. Conc. nitric acid upon iron.
ii. Dilute nitric acid upon Magnesium.
iii. A mixture of HNO_3 conc. HCl upon gold.
Why is conc. nitric acid stored in dark brown bottle?

39. **2066 Q. No. 31** Write down the principle and sketch a labelled diagram for the manufacture of nitric acid by the oxidation of ammonia. What happens when: [6+1+1+2]
i. Conc. nitric acid is exposed to light for long time.
ii. Iron is treated with highly conc. nitric acid.
iii. Freshly prepared $FeSO_4$ solution is added to equal-volume mixture of conc.H_2SO_4 and conc.HNO_3.

40. **2065 Q. No. 31** Describe the principle and draw a self explanatory sketch for the manufacture of ammonia by Haber's synthesis. How does ammonia reacts with: [6+4]
a. Carbon dioxide   b. Copper Sulphate solution
c. Sodium metal   d. Chlorine gas in excess

41. **2064 Q.No. 31** Describe the manufacture of nitric acid by catalytic oxidation of ammonia. Write a chemical reaction to show nitric acid contains nitrogen.   [8+2]

42. **2061 Q.No. 30** Describe the manufacture of nitric acid by oxidation of ammonia. Give the action of very dilute and dilute nitric acid on the magnesium metal.   [7+3]

43. **2056 Q.No. 30** Describe the manufacture of nitric acid by Ostwald's process giving a neat and labelled diagram. How is nitric acid detected in the laboratory?   [8+2]

Unit 11: Non-Metals II

11.1 Halogens: (Chlorine, Bromine and Iodine)

VERY SHORT ANSWER QUESTIONS

1. **2069 (Set A) Q. No. 15** Why can't HBr and HI be prepared by treating conc. H_2SO_4 with bromide and iodide?   [2]

2. **2063 Q.No. 18** Give the action of (i) KI on copper sulphate solution (ii) Heat on lime stone.   [2]
   Ans: (i) dark brown iodine is precipitated (ii) CO_2 is produced

3. **2062 Q.No. 13** Why can't HI be prepared by the action of conc. H_2SO_4 on NaI?   [2]

4. **2061 Q.No. 19** What happens when KBr is heated with conc. H_2SO_4 acid?   [2]

5. **2058 Q.No. 15** How would you obtain bromine from HBr?   [2]

6. **2057 Q.No. 15** Give a chemical reaction to show oxidising action of chlorine.   [2]

7. **2056 Q.No. 15** Give any one chemical reaction to prepare chlorine gas from hydrochloric acid.   [2]

8. **2054 Q.No. 16** A test tube contains a solution of one of the following salts: NaCl, NaBr, and NaI. Describe a single test that can distinguish among these salts.   [2]

9. **2051 Q.No. 15** Why are the halogens never found in the free state in nature?   [2]

SHORT ANSWER QUESTIONS

10. **2076 Set B Q.No. 26** Why can't HBr and HI be prepared by heating Conc. H_2SO_4 with bromide and iodide respectively? Write down correct reactions to prepare them. How would you test the presence of Br^- ions in its aqueous solution?   [2+2+1]

11. **2076 Set C Q.No. 26** Write down chemical reaction for the preparation of iodine from Sea weeds. How does iodine react with   [2+2+1]
i. Hot and Conc. NaOH   ii. NH_3
What is meant by tincture of iodine?

12. **2075 GIE Q.No. 28** Explain, How bromine is manufactured from Carnallite? What happens when Br_2 reacts with hot and conc. NaOH solution?   [4+1]

13. **2075 Set A Q.No. 27** Give balanced chemical reaction for the preparation of chlorine in the laboratory. Compare the bleaching action of Cl_2 and SO_2.   [1+4]

14. **2075 Set B Q.No. 27** Write down a balanced chemical reaction for the preparation of Cl_2 at laboratory. What is the action of Cl_2 on (i) NH_3 (ii) Conc. NaOH (iii) H_2S. How would you test the presence of Cl^- in its aqueous solution?   [1+3+1]

15. **2074 Supp Q.No. 26** Why can't HI be prepared by using NaI and Conc. H_2SO_4? Give the balanced chemical reaction for the preparation of HCl. How would you test the presence of Cl^- or Br^- in its aqueous solution?   [2+1+2]

16. **2074 Set A Q.No. 27** Why can't HBr prepared by using NaBr and conc. H_2SO_4? Give a balanced chemical reaction for the preparation of HCl. How would you test presence of the Cl^- or Br^- ions in its aqueous solution?   [2+1+2]

17. **2074 Set B Q.No. 27** Give balanced chemical reactions for the preparation of HCl and HBr in the laboratory. How would you test the presence of Cl^-, Br^- and I^- ion in its aqueous solution?   [2+3]

18. **2073 Supp Q.No. 28** **2073 Set C Q. No. 28** **2073 Set D Q. No. 28** Describe the preparation of bromine from carnallite. What happens when bromine is passed through hot and conc. NaOH ?   [4+1]

19. **2072 Supp Q. No. 26** How is bromine manufactured from Carnallite? Give a chemical reaction for the test of bromide ion in the aqueous solution.   [5]

20. **2072 Set C Q.No. 27** **2072 Set D Q.No. 27** Give a balanced chemical reaction for the preparation of chlorine in the laboratory. How does Cl_2 react with conc. NaOH? Mention uses of chlorine.   [1.5+1.5+2]

21. 2072 Set E Q.No. 27 Write down the balanced chemical reaction for the preparation of
    i. HCl   ii. HBr
    How are chloride, bromide and iodide ions tested in the laboratory? [2+3]

22. 2071 Supp. Q.No. 26 What is Carnallite? How is bromine manufactured from carnallite? Give the action of Br_2 on hot NaOH. [1+3+1]

23. 2071 (Set C) Q.No. 29 How is bromine manufactured from Carnallite? What happens when Br_2 reacts with Hot and conc. NaOH solution? [4 + 1]

24. 2071 (Set D) Q.No. 29 Explain, how bromine is manufactured from Carnallite? Why are halides found in sea water? [4+1]

25. 2070 Supp. Q.No. 28 How is bromine manufactured from Carnallite? Mention the test of bromide ions present in its aqueous solution. [4+1]

26. 2070 Set C Q.No. 25 Write an account for the manufacture of bromine from Carnallite. How does bromine reacts with hot and conc. NaOH? [4+1]

27. 2070 Set D Q.No. 28 How is bromine manufactured from Carnallite? Write any one use of bromine. [4+1]

28. 2069 (Set A) Q. No. 26 Compare and contrast the properties of HCl, HBr and HI [5]

29. 2069 (Set B) Q. No. 28 Why can't HBr and HI be prepared by the action of conc. H_2SO_4 on bromide and iodide respectively? Suggest alternative methods for the preparation of HBr and HI. How would you test chloride ion in the aqueous solution? [2+2+1]

30. 2068 Q.No. 28 Give an account of the manufacture of bromine from Carnallite. How does bromine react with hot and conc. NaOH? [4+1]

31. 2067 Q.No. 26 Give suitable balanced chemical reaction for each:
    i.   Laboratory preparation of HCl.
    ii. Laboratory preparation of HI. [1.5+1.5+2]
    How would you test the presence of Cl^- ion in the aqueous solution?

32. 2066 Q.No. 26
    a. What happens when gas obtained by heating NaCl and Conc. H_2SO_4 is passed through hot and conc. Solution of NaOH?
    b. Why can't HI be prepared by heating NaI with conc.H_2SO_4? [3+2]

33. 2065 Q. No. 26 Write down the principle for the preparation of hydroiodic acid (HI) in laboratory. How does HI react with:
    a. MnO_2
    b. $CuSO_4$ solution [3+2]

34. 2064 Q.No. 26 Describe the manufacture of bromine from Carnallite. [5]

35. 2063 Q.No. 26 How is bromine manufactured from Carnallite?

36. 2061 Q.No. 25 Describe how HI is prepared. Why it cannot be prepared in the same way as HCl? [3+2]

37. 2059 Q.No. 32 (d) What happens when Chlorine gas is passed into a dilute solution of caustic soda? [2]

38. 2054 Q.No.27(a) What happens when Concentrated HCl is added to $KMnO_4$. [1]

LONG ANSWER QUESTIONS

39. 2061 Q.No. 32 2058 Q.No. 31 How is bromine manufactured? How does it react with (a) KI solution (b) hot NaOH solution (c) SO_2 solution? [5+1+2+2]

11.2. Carbon

VERY SHORT ANSWER QUESTIONS

1. 2076 Set B Q.No. 15 What products would you expect when CO is [1+1]
   i.   heated with H_2 in presence of ZnO + Cu
   ii. passed over heated caustic soda under pressure

2. 2076 Set C Q.No. 15 What happens when the gas obtained by heating methanoic (oxalic) acid and conc. sulphuric acid is passed through heated caustic soda under pressure? [1+1]

3. 2075 GIE Q.No. 15 What happens when [1+1]
   i.   Carbon monoxide is passed over heated caustic soda?
   ii. Phosphine is passed into $CuSO_4$ solution?

4. 2075 Set A Q.No. 15 What is meant by allotropy? Name the latest discovered allotropic form of carbon and give its one use. [1+1]

5. 2075 Set B Q.No. 15 Give balanced chemical equation for the preparation of CO from oxalic acid. What happens when CO is passed through heated Nickel Powder? [1+1]

6. 2074 Supp Q.No. 15 2074 Set B Q.No. 15 What is meant by allotropy? Name the hardest allotrope of carbon and its use. [1+1]

7. 2074 Set A Q.No. 15 2072 Set D Q.No. 15 Give a balanced chemical reaction for the preparation of CO in the laboratory. Why is CO harmful gas? [1+1]

8. 2073 Supp Q.No. 15 What happens when the gas obtained by heating methanoic acid and conc. H_2SO_4 is passed through heated ferric oxide. [2]

9. 2073 Set C Q. No. 15 Suggest a reason as to why CO is poisonous? [2]

10. 2073 Set D Q. No. 15 What happens when the gas obtained by heating methanoic acid and conc. Sulphuric acid is heated with Fe_2O_3? [2]

11. 2072 Supp. Q. No. 16 2070 Supp. Q.No. 16 What happens when carbon monoxide is:
    i.   Heated with hydrogen in presence of ZnO + Cu. [1]
    ii. Treated with Cl_2 in presence of sunlight. [1]

12. 2072 Set C Q.No. 15 Write down balanced chemical equations giving proper products for the following statements: [1+1]
    i.   Water gas is heated over ZnO + Cu
    ii. Carbon monoxide is passed over heated caustic soda.

13. 2072 Set E Q.No. 15 Predict the proper products and write balanced equation for the following:

    i. $CO + H_2 \xrightarrow[\Delta]{ZnO + Cu}$ ii. $HCOOH \xrightarrow[\Delta]{Conc. H_2SO_4}$

    Ans: (i) CH_3OH methanol (ii) CO

14. 2071 Supp. Q. No. 116 What is allotropy? Write the name of recently discovered allotropy of carbon. [1+1]

15. 2071 (Set C) Q.No. 16 What is meant by fullerene? Mention its use. [2]

16. 2071 (Set D) Q.No. 16 (b) Give balanced chemical equation for the preparation of carbon-monoxide [1]

17. 2069 (Set A) Q. No. 16 What happens when the gas obtained by heating oxalic acid and conc. H_2SO_4 is passed through:
    i. NaOH solution
    ii. Finely divided Nickel [1+1]

18. 2068 Q.No. 15 I What happens when: Carbon monoxide is heated with hydrogen in pressence of ZnO and Cu? [1]

19. 2067 Q.No. 15 What is allotropy? Name the latest discovered allotropic form of carbon. [1+1]

20. 2065 Q. No. 14 How would you convert CO into CO_2 and vice versa? [2]

21. 2064 Q.No. 13 Write a chemical reaction to show the reducing action of CO. [2]

22. 2063 Q.No. 13 What is meant by allotropy? Give examples of crystalline allotrope of Carbon. [2]

23. 2061 Q.No. 14 What is dry ice? Why it is called so? [2]

24. 2061 Q.No. 18 Why is carbon monoxide is extremely poisonous? [2]

25. 2060 Q.No. 14 What happens when oxalic acid crystals are heated with concentrated sulphuric acid? [2]

26. 2060 Q.No. 17 Why is carbon used as the most common reducing agent in thermal metallurgy? [2]

27. 2059 Q.No. 15 What hapens when a piece of burning magnesium is dropped into a jar full of carbon dioxide? [2]

28. 2058 Q.No. 18 What happens when carbon monoxide is passed over heated finely divided nickel? [2]

29. 2056 Q.No. 12 Define the terms 'allotropes' with examples. [2]

30. 2052 Q.No. 24 Group A Carbon monoxide is used as a reducing agent in metallurgy but not carbon dioxide. Why?[1.5]

SHORT ANSWER QUESTIONS

31. 2061 Q.N.28c 2056 Q.No. 27a & b 2051 Q.No. 7d What happens when:
    a. Carbon monoxide is passed over finelly divided nickel at 80°C.
    b. a gas obtained from a mixture of marble and dilute hydrocholoric acid is passed into lime water till excess.
    c. a gas obtained from a mixture of copper turnings and hot conc. Sulphuric acid is passed into chlorine water.
    d. Carbon monoxide is passed over finely divided nickel. [5]

32. 2059 Q.No. 26 How is carbon monoxide prepared from oxalic acid in the laboratory? Give its action with heated nickel.[4+1]

33. 2057 Q.No. 27 Define allotropy. Show that diamond and graphite consist of carbon only. [2+3]

34. 2056 Q.No. 26 How is carbon monoxide gas prepared in the laboratory from oxalic acid crystals? [5]

35. 2055 Q.No. 25 2051 Q.No. 4 Group B How is carbon monoxide prepared in the laboratory? [5]

36. 2053 Q.No. 4 Group B Give the laboratory method of preparation of carbon monoxide. [5]

WRITE ON SHORT NOTES:

37. 2058 Q.No. 33(a) Allotropes of carbon [5]

11.3. Phosphorous

VERY SHORT ANSWER QUESTIONS

1. 2075 Set A Q.No. 16 Give a balanced chemical reaction for the preparation of phosphine in the laboratory. How does it react with oxygen? [1+1]

2. 2074 Supp Q.No. 16 Give a balanced chemical reaction for the preparation of PH_3 in the laboratory. What happens when it is treated with O_2? [1+1]

3. 2074 Set B Q.No. 16 Give a balanced chemical reaction for the preparation of orthophosphoric acid. Mention its an important use. [1+1]

4. 2071 Set D Q.No. 16 a Give balanced chemical equation for the preparation of phosphine [1]

5. 2070 Supp. Q.No. 15i Write the molecular formula of Hypophosphoric acid [0.5]

6. 2070 Set D Q.No. 15a 2069 Set B Q. No. 16c Write the molecular formula of hypophosphorous acid. [0.5]

7. 2069 Set B Q.No. 16b Write molecular formulae of orthophosphoric acid [0.5]

8. 2068 Q.No. 15 ii What happens when: White phosphorous is heated with concentrated solution of Caustic Soda? [1]

9. 2067 Q.No. 16 Write balanced chemical equation for the preparation of phosphine gas in the laboratory. [2]

10. 2066 Q.No. 17 Name any two allotropes of phosphorous why is phosphorous stored in water? [1+1]

11. 2065 Q. No. 16 d Give an important uses of each of Red Phosphorus [0.5]

12. 2064 Q.No. 16(a) Write chemical action of white phosphorous on conc. nitric acid. [2]

13. 2064 Q.No. 16(b) Write chemical action of white phosphorous on aqueous KOH solution. [2]

14. 2062 Q.No. 15 What happens when white phosphorous is exposed to air? [2]

15. 2061 Q.No. 13 2057 Q.No. 14 How is white phosphorous converted to red phosphorous? [2]

16. 2059 Q.No. 14 What is the effect of heat on orthophosphoric acid? [2]

17. 2056 Q.No. 14 What happens when white phosphorus is heated with aqueous caustic soda? [2]

18. 2054 Q.No. 11 Write the Lewis structure of orthophosphoric acid and phosphate ions. [2]

19. 2051 Q.No. 10 Group A Name different amorphous forms of phosphorous. [2]

SHORT ANSWER QUESTIONS

20. 2063 Q.No. 27 (i) What happens when: The gas produced by the action of white phosphorous with sodium hydroxide is passed through silver nitrate solution? [5]
    Ans: Gas is phosphine; reduces $AgNO_3$ to Ag

21. 2061 Q.No. 28 (e) 2060 Q. 27(i) 2055 Q.No. 27(b) What happens when:
    a. White phosphorous is heated with strong caustic potash solution.

b. While phosphorus is allowed to react with hot concentrated aqueous solution of sodium hydroxide.

c. NaOH is heated with yellow phosphorous.   [5]

WRITE SHORT NOTES ON

22. **2051 Q.No. 4a Group (C)** Phosphorous allotropes.   [5]

11.4. Sulphur

VERY SHORT ANSWER QUESTIONS

1. **2070 Supp. Q.No. 15ii** **2070 Set D Q.No. 15b** **2069 Set B Q. No. 16d** Write the molecular formula of Hypo.   [0.5]

2. **2070 Set C Q.No. 21** Write the molecular formula of 'Hypo' and also write one use.   [1+1]

3. **2066 Q.No. 15** What happens when gas obtained by heating oxalic acid in presence conc. H_2SO_4 is passed through heated caustic soda?   [2]

4. **2064 Q.No. 15** Why does conc. H_2SO_4 diluted by adding acid into water but not water into acid in the laboratory?   [2]

5. **2063 Q.No. 15** What happens when H_2S is passed through acidified potassium permanganate solution?   [2]
   Ans: H_2S reduces $KMnO_4$ to $MnSO_4$

6. **2060 Q.No. 15** Write any two differences between the bleaching action of Cl_2 and SO_2.   [2]

7. **2055 Q.No. 17** Explain with reason, why: [2]
   a. Conc. H_2SO_4 should always be added to H_2O but never H_2O to the acid?
   b. Sugar is charred in contact with conc. H_2SO_4?

8. **2053 Q.No. 6 A** Acid rain forms when oxides of sulphur and nitrogen react with water. What are these oxides chemically?[1.5]

9. **2053 Q.No. 23 A** Identify a viscous liquid that react with table sugar ($C_{12}H_{22}O_{11}$) giving a charred (black) mass. Give the reaction involved.   [1.5]

10. **2051 Q.No. 17 A** How is the moisture present in SO_2 gas removed?   [2]

SHORT ANSWER QUESTIONS

11. **2076 Set B Q.No. 28** How is sulphur dioxide gas prepared in laboratory? Write reactions to show SO_2 acts as both an oxidising as well as a reducing agent.   [3+2]

12. **2076 Set C Q.No. 28** Starting from Iron pyrites, how would you obtain Conc.sulphuric acid? Give a reaction to show Conc.H_2SO_4 acts as,
   i. a dehydrating agent   ii. a precipitating agent.
   How is Conc. H_2SO_4 diluted with water?   [2+2+1]

13. **2074 Set A Q.No. 28** Describe the Kipp's apparatus method for the manufacture of H_2S. Give a reaction to show H_2S is a reducing agent.   [4+1]

14. **2073 Supp Q.No. 26** Starting from sulphur, how would you obtain sulphuric acid? Give a reaction of each to show conc. H_2SO_4 act as
   i. an oxidising agent   ii. a precipitating agent
   How is conc. H_2SO_4 dilluted?   [2+1+1+1]

15. **2073 Set C Q. No. 26** Starting from sulphur, how would you obtain sulphuric acid? (reaction only). Prove that conc. H_2SO_4 acts as;   [2+1+1+1]
   i. An oxidizing agent   ii. A dehydrating agent
   What is the test reaction of sulphate ion?

16. **2073 Set D Q. No. 26** Starting from sulphur, how would you obtain sulphuric acid? (reaction only). How does conc. H_2SO_4 react with;   [2+1+1+1]
   i. Sugar   ii. P_4
   What is conc. Sulphuric acid diluted by adding water but not water to acid?

17. **2072 Supp Q. No. 27** How is SO_2 prepared in the laboratory? Write its bleaching actions.   [3+2]

18. **2070 Set C Q.No. 26** How is sulphur dioxide prepared in laboratory? What happens when SO_2 is passed through acidified solution of potassium dichromate?   [3+2]

19. **2069 (Set A) Q. No. 27** Write the chemical reaction for the laboratory preparation of H_2S. How does Kipp's apparatus work to supply H_2S gas in salt analysis?   [1+4]

20. **2068 Q.No. 26** Write balanced chemical reactions for the laboratory preparation of:
   i. Hydrogen Sulphide   ii. Sulphur dioxide
   What happens when a moist red flower is introduced into a gas jar containing SO_2 gas?
   Give a reaction of each to show:
   i. SO_2 as an oxidising agent
   ii. H_2S as an analytical agent   [1+1+1+1+1]

21. **2066 Q.No. 27** Write down the principle and sketch a labelled diagram for the laboratory preparation of H_2S. Why is H_2S called an analytical agent?   [3+2]

22. **2065 Q. No. 27** How is Sulphur dioxide prepared in laboratory? What happens when SO_2 is passed through acidified solution of potassium permanganate?   [3+2]

23. **2064 Q.No. 27** Describe the preparation of H_2S gas in the laboratory. How does it act upon:
   a. acidified potassium dichromate solution.
   b. SO_2 - water?   [3+1+1]

24. **2061 Q.No. 27** How is H_2S gas prepared in the laboratory? Give two reactions to show that H_2S is a reducing agent.[3+2]

25. **2060 Q.27(iii)** **2059 Q.32(iii)** **2053 Q.N. 7(a)** **2051 Q.No. 7 Group B** What happens when: [5]
   a. Sulphur dioxide is passed through potassium iodate solution.
   b. Hydrogen sulphide is passed through bromine water.
   c. Sulphur dioxide gas is passed into an aqueous solution of potassium permanganate.

26. **2059 Q.No. 27** Write the chemical reactions involved in the manufacture of sulphuric acid by Contact process. How does conc H_2SO_4 react with copper turnings?   [4+1]

27. **2058 Q.No. 26** Write down the flow sheet diagram and principle involved in the manufacture of sulphuric acid.   [5]

28. **2054 Q.No. 23** How is hydrogen sulphide obtained in the laboratory? Draw a labelled diagram and give the reaction evolved.   [5]

29. **2054 Q.No. 24** Give two examples of reactions in which H_2SO_4 behaves as: [5]
   i. strong acid,   ii. a dehydrating agent,
   iii. an oxidising agent

30. **2053 Q.No. 1 Group B** Draw a self explanatory diagram for the manufacture of sulphuric acid by Contact process.   [5]

31. **2053 Q.No. 5 Group B** Compare the bleaching properties of SO_2 and Cl_2.   [5]

32. **2051 Q.No. 5 Group B** How would you show that sulphuric acid acts as: [5]
    a. an acid
    b. an oxidizing agent
    c. a dehydrating agent

LONG ANSWER QUESTIONS

33. **2075 GIE Q.No. 30** Draw a self explanatory sketch for the manufacture of Sulphuric acid by Contact process and explain the principle and procedure involved in it. How does Conc. H_2SO_4 reacts with   [7+1+1+1]
    i. Sugar   ii. Copper
    How would you test sulphate ion in its aqueous solution?

34. **2075 Set A Q.No. 32** **2074 Set B Q.No. 32** Write the principle and process with self-explanatory diagram for the manufacture of sulphuric acid by contact process. What are the action of conc. sulphuric acid on:
    i. sucrose   ii. HI and
    iii. P_4
    Give the test of sulphate ion in its aqueous solution.   [6+4]

35. **2075 Set B Q.No. 30** Describe laboratory method of preparation of hydrogen sulphide. What is the action of H_2S on (i) acidified $K_2Cr_2O_7$ (ii) $FeCl_3$.
    Write the application of H_2S in salt analysis.   [4+2+4]

36. **2074 Supp Q.No. 30** How is sulphuric acid manufactured by Contact process? Write the action of Conc. H_2SO_4 on
    i. Glucose   ii. Phosphorous
    iii. Copper
    Give an important use of Conc. H_2SO_4 [6+4]

37. **2072 Set C Q:No. 30** **2072 Set D Q.No. 30** How is pure sulphur dioxide prepared in the laboratory? How does sulphur dioxide react with: [4+3+3]
    i. acidified $KMnO_4$ ii. $Fe_2(SO_4)_3$
    iii. HI
    How is bleaching action of SO_2 differed from Cl_2?

38. **2072 Set E Q.No. 30** Describe laboratory method of preparation of hydrogen sulphide. What is the action of H_2S on (i) acidified $K_2Cr_2O_7$ (ii) $FeCl_3$? Write the application of H_2S in salt analysis.   [4+4+2]

39. **2071 Supp. Q.No. 31** Discuss the principle involved in the manufacture of sulphuric acid by Contact process with a neat and self explanatory diagram. How would you show that sulphuric acid acts as: [6+2+2]
    a. an acid   b. a dehydrating agent?

40. **2071 (Set C) Q.No. 31** Describe the principle and stepwise procedure for the manufacture of sulphuric acid by Contact process giving a self explanatory sketch. Why is it called Contact process? Write the action of conc. H_2SO_4 with (i) phosphorous (ii) oxalic acid. How would you dilute conc. sulphuric acid?   [6+1+2+1]

41. **2071 (Set D) Q.No. 30** Draw a self explanatory sketch for the manufacture of sulphuric acid by Contact process and explain the principle and procedure involved in it.
    Why is it called Contact process? How does (i) conc. H_2SO_4 react with (i) sugar (ii) copper. Write down the test reaction of sulphate ion in its aqueous solution?   [6+1+2+1]

42. **2070 Supp. Q.No. 30** Sketch a well labelled diagram for the manufacture of sulphuric acid by Contact process. Write physical and chemical principles involved in it. What is the action of conc. H_2SO_4 on;
    i. oxalic acid   ii. phosphorous
    iii. $BaCl_2$ solution.
    Why does H_2SO_4 always act as an oxidising agent but not reducing agent?   [3+6+1]

43. **2070 Set D Q.No. 31** Starting from iron-pyrites, how would you obtain dilute sulphuric acid by Contact process? Explain with a labelled diagram. Give the action of Conc. H_2SO_4 on (a) sucrose (b) HI.
    What is the test of sulphate ion?   [7+1+1+1]

44. **2069 (Set B) Q. No. 32a**
    a. Write balanced chemical equation for the preparation of hydrogen sulphide at laboratory and explain with a labelled diagram how Kipp's apparatus works to supply H_2S gas during salt analysis.
    b. Give a chemical reaction to show:
    i. Conc.H_2SO_4 acts as dehydrating agent
    ii. SO_2 acts as bleaching agent.
    iii. H_2S as an analytical agent.   [1+4+1+2+2]

45. **2067 Q.No. 31** Starting from Iron pyrites, how would you obtain Sulphuric acid? Draw a self explanatory sketch for it. How does conc. Sulphuric acid react with (i) Phosphorous, (ii) Sugar. Why is SO_3 not directly absorbed by water? Write molecular formula of hypo.   [3+3+1+1+1+1= 10]

46. **2063 Q.No. 32** Write the principle involved along with a self-explanatory diagram for the manufacture of sulphuric acid by Contact process. Give two reactions each to show that concentrated sulphuric acid is a: (a) Dehydrating agent (b) Oxidising agent

47. **2062 Q.No. 31** Describe the principle and process for the manufacture of Sulphuric acid with a labelled diagram by Contact method. Why is concentrated acid diluted by adding acid into water but not water into acid? What happens when?   [7+1+1+1]
    a. Copper turning is heated with conc. H_2SO_4.
    b. Cane sugar is heated with conc. H_2SO_4.

48. **2060 Q.No. 32**
    i. How is pure hydrogen sulphide gas prepared from commercial ferrous sulphide in the laboratory?
    ii. Write the action of the gas on (a) Lead acetate paper (b) Silver powder (c) acidified potassium dichromate solution.
    iii. How is the gas used in qualitative analysis?   [5+3+2]

49. **2057 Q.No. 31** Describe the preparation of SO_2 in the laboratory. Give its action upon (i) Cl_2 water and (ii) acidified $K_2Cr_2O_7$.   [6+2+2]

WRITE THE SHORT NOTES ON:

50. **2055 Q.No. 31d** **2053 Q.No. 4 Group C**
    a. Uses of H_2S as analytical reagent.
    b. Allotropic forms of sulphur.

11.5. Boron and Silicon

VERY SHORT ANSWER QUESTIONS

1. **2076 Set B Q.No. 16** Write down the molecular formula and one use of each of the following: [4×0.5]
   i. Boric acid   ii. Borax
   iii. Silica gel   iv. Sodium silicate.

2. **2076 Set C Q.No. 16** Write down the molecular formulae and an important use of each of the following: [4×0.5]
   i. Boric acid   ii. Borax
   iii. Silica gel   iv. Calcium silicate

3. **2075 GIE Q.No. 16** Mention one use of each of the following: [4×0.5]
   i. Silica gel   ii. Carborundum
   iii. Silica garden   iv. Fullerene

4. **2074 Set A Q.No. 16** Write down the molecular formula and use of each of the following; [1+1]
   i. Boric acid   ii. Orthophosphoric acid

5. **2072 Set D Q.No. 16** Give one important application of each of the following: [0.5×4]
   i. Silica gel   ii. Carborundum
   iii. Sodium Silicate   iv. borax

6. **2070 Supp. Q.No. 15** Write the molecular formula of [2×0.5]
   i. Borax   ii. Silica gel

7. **2070 Set C Q.No. 22** Write the formulae and uses of borax and boric acid. [1+1]

8. **2070 Set D Q.No. 15c** Write the molecular formula of borax [0.5]

9. **2070 Set D Q.No. 15d** Write the molecular formula of silica gel. [0.5]

10. **2069 (Set B) Q. No. 16a** Write molecular formulae of the followings: Borax [0.5]

11. **2065 Q. No. 16 a** Give an important uses of each of the following: Boron [1]

12. **2065 Q. No. 16 c** Give an important uses of each of the following: Silicon [1]

13. **2060 Q.No. 13** Write the formula of Borax and boric acid. [2]

11.6. Noble Gas: Position in Periodic Table, Occurrence and Uses

VERY SHORT ANSWER QUESTIONS

1. **2071 Supp. Q.No. 15** **2051 Q.No. 12 Group A** Why are noble gases chemically inert? [2]

2. **2065 Q. No. 16 b** Give an important uses of noble gases [0.5]

3. **2063 Q.No. 14** What are noble gases? Write any one use of noble gases. [2]

11.7. Environmental Pollution

VERY SHORT ANSWER QUESTIONS

1. **2075 Set B Q.No. 16** Name the chemicals which are responsible for acid rain. What is the harmful effect of acid rain? [1+1]

2. **2073 Set C Q. No. 16** **2073 Set D Q. No. 16** How is SO_2 responsible for acid rain? [2]

3. **2073 Supp Q.No. 16** Mention a major effect of each of the followings: [4×0.5]
   i. Acid rain   ii. Green house effect
   iii. Photochemical smog   iv. Water pollution

4. **2072 Supp Q. No. 15** Name the major gas for each which are responsible for: [4×0.5]
   i. Green house effect   ii. Photochemical smog
   iii. Acid rain   iv. Air pollution

5. **2072 Set C Q.No. 16** What is meant by photochemical smog? [2]

6. **2072 Set E Q.No. 16** Oxides of sulphur and nitrogen are responsible for acid rain. Give reason. [2]

7. **2071 (Set C) Q.No. 15** What is meant by photochemical smog? Name any two gases present in it. [1+1]

8. **2071 (Set D) Q.No. 15** Name any two gaseous compounds of each which are responsible for: [1+1]
   a. Photochemical smog   b. Green house effect

9. **2070 Set D Q.No. 16** How is acid rain formed? [2]

10. **2069 (Set B) Q. No. 15** What are the major components of photochemical smog? Write its effect. [1+1]

11. **2068 Q.No. 16** What is meant by acid rain? Give one major effect of acid rain. [1+1]

12. **2060 Q.No. 12** Name any one pollutant of photochemical smog and state one of its effects. [2]

Unit 12: Metal and Metallurgical Principles

VERY SHORT ANSWER QUESTIONS

1. **2076 Set B Q.No. 17** Distinguish between alloys and amalgams giving an example of each. [1+1]

2. **2076 Set C Q.No. 17** Differentiate between flux and slag giving an example of each. [1+1]

3. **2075 GIE Q.No. 17** What is meant by concentration in metallurgy? Name any two process involved in it. [1+1]

4. **2075 Set A Q.No. 17** Define the following terms giving a suitable example of each. [1+1]
   i. metalloids   ii. amalgams

5. **2075 Set B Q.No. 17** **2072 Set E Q.No. 17** Name any four important ores which are found in different parts of Nepal. [2]

6. **2074 Supp Q.No. 17** Define the terms: Gangue and Slag, giving proper example of each. [2]

7. **2074 Set A Q.No. 17** What is meant by slag? Write an example of it. [2]

8. **2074 Set B Q.No. 17** Define the following terms giving a suitable example of each. [1+1]
   i. Gangue   ii. Slag

9. **2073 Supp Q.No. 17** **2073 Set C Q. No. 17** **2073 Set D Q. No. 17** 'Every ore is a mineral but every mineral is not ore'. Give reason. [2]

10. **2072 Supp Q. No. 17** Differentiate between Pyrometallurgy and Electrometallurgy. [1+1]

11. **2072 Set C Q.No. 17** Write the basic principle of gravity separation method for concentrating an ore. What types of ores are concentrated by this method? [1+1]

12. **2072 Set D Q.No. 17** Write the basic principle of froth flotation method for concentrating an ore. What types of ore are concentrated by this process? [1+1]

13. **2071 Supp. Q.No. 17** Define the terms Flux and Gangue. [1+1]

14. **2071 (Set C) Q.No. 17** Give any two formula of ores of each which are applied for the following metallurgical operations: [1+1]
   a. Froth floatation   b. Leaching

15. **2071 (Set D) Q.No. 17** What is meant by hydrometallurgy? Give an example of it.   [1+1]

16. **2070 Supp. Q.No. 17** **2067 Q.No. 17** Distinguish between flux and slag, giving an example of each.   [1+1]

17. **2070 Set C Q.No. 14** **2069 (Set B) Q. No. 17** Distinguish between metal and metalloid with an example of each.   [1+1]

18. **2070 Set D Q.No. 17** Write a chemical reaction involved in   [2]
   a. Carbon reduction process
   b. Alumino Thermite process.

19. **2069 (Set A) Q. No. 17** What are the differences between minerals and ores? Give one example of each.   [1+1]

20. **2068 Q.No. 17** Which process is applied for the concentration of sulphide ore and why?   [1+1]

21. **2068 Q.No. 18** Can Sodium be extracted by the electrolysis of aqueous solution of sodium chloride? If not why?   [2]

22. **2066 Q.No. 18** What are the main differences between Calcinations and roasting?   [1+1]

23. **2065 Q. No. 18** What is meant by Slag? Why is it important in metallurgy?   [2]

24. **2063 Q.No. 17** Define the following terms: (i) Roasting (ii) Calcinations   [2]

25. **2062 Q.No. 17** What is meant by Alumino Thermite process?[2]

26. **2061 Q.No. 11** **2056 Q.No. 16** **2057 Q.No. 16** Distinguish between calcinations and roasting.   [2]

27. **2052 Q.No. 15 Group A** Which metals can be extracted from the following ores: [1.5]
   galena, cinnabar and argentite

28. **2051 Q.No. 13 Group A** Name the process for concentration of sulphide ore.   [2]

Short Answer Questions

29. **2075 Set A Q.No. 29** Write short notes on.   [2.5 + 2.5]
   i. Froth floatation process   ii. Hydrometallurgy

30. **2074 Supp Q.No. 29** Write short notes on: [2.5+2.5]
   i. Carbon reduction process   ii. Froth floatation process.

31. **2074 Set A Q.No. 29** Write short notes on: [2.5+2.5]
   i. Hydrometallurgy   ii. Zone of refining

32. **2074 Set B Q.No. 29** Write short notes on: [2.5+2.5]
   i. Froth floatation process   ii. Alumino thermite process.

33. **2073 Supp Q.No. 27** Differentiate between   [2.5+2.5]
   i. Gravity separation and Magnetic separation method.
   ii. Carbon reduction and electrolytic reduction process.

34. **2073 Set C Q. No. 27** **2073 Set D Q. No. 27** Differentiate between: [2.5+2.5]
   i. Calcination and roasting
   ii. Carbon reduction and thermite process

35. **2072 Supp Q. No. 28** How are metals generally extracted from ores and purified?   [5]

36. **2071 Supp. Q.No. 28** Differentiate between calcinations and roasting in metallurgy.   [5]

37. **2070 Supp. Q.No. 29** Give a brief account for the following process.   [3+2]
   i. Electrometallurgy   ii. Carbon reduction

38. **2069 (Set A) Q. No. 28** Describe the smelting process in the extraction of metal from their ores.   [5]

39. **2069 (Set B) Q. No. 30a** Give a brief account of the following terms: [2.5+2.5]
   i. Smelting process   ii. Alumino thermite process

40. **2052 Q.No. 1 Group B** Give one characteristics relation used as a test for each of the following classes of salts:
   a. carbonates   b. chlorides
   c. nitrate   d. sulphates   [5]

41. **2052 Q.No. 6 Group B** What is metallurgy? How metal is extracted from its ore?   [5]

Unit 13: Alkali and Alkaline Earth Metals

13.1 Alkali Metals

Very Short Answer Questions

1. **2076 Set B Q.No. 18** Why are alkali metals impart characteristic colours when introduced to the flame?   [2]

2. **2076 Set C Q.No. 18** Sodium metal burns with air giving golden yellow flame. Why?   [2]

3. **2075 Set B Q.No. 18** Give reason.   [1+1]
   i. Sodium metal gets tarnished in air.
   ii. Carbon reduction process is not applied for the extraction of alkali metals.

4. **2072 Set D Q.No. 18** Give reason: [1+1]
   i. Alkali metal imparts characteristic colour to the flame test.
   ii. Sodium metal gets tarnished in air.

5. **2072 Set E Q.No. 18** Why is carbon reduction process not applied for the extraction of alkali metal? Name any one suitable method for the extraction of these metals.   [2]

6. **2070 Set C Q.No. 15** Can sodium be extracted by the electrolysis of aqueous solution of sodium chloride? If not why?   [2]

7. **2070 Set D Q.No. 18** Starting from sodium, how would you prepare $Na_2CO_3 10H_2O$?   [2]

8. **2069 (Set A) Q. No. 18** Mention the biological importance of potassium and sodium metals.   [1+1]

9. **2069 (Set B) Q. No. 18** How is Caustics Soda converted into:[1+1]
   i. Washing soda   ii. Baking soda

10. **2060 Q.No. 16** What would happen when the nitrate of an alkali metal is heated?   [2]

11. **2059 Q.No. 18** What is the biological importance of sodium?[2]

12. **2058 Q.No. 17** Write the chemical formulae of washing soda and baking soda. What are their uses?   [2]

13. **2057 Q.No. 17** What happens when a piece of sodium is dropped into water?   [2]

14. **2056 Q.No. 17** What happens when a piece of sodium is exposed to air?   [2]

15. **2055 Q.No. 18** What are the chemical formulae of caustic soda, washing soda and baking soda? What are their main uses?   [2]

16. 2053 Q.No.20 Group A Why alkali metals can not be obtained by chemical reduction method? [1.5]

17. 2051 Q.No. 8 Group A What is the main product obtained when sodium is allowed to react with dry ammonia at 300° – 400°C? [2]

18. 2050 Q.No. 7 What happens when
   a. Sodium chloride is heated with yellow phosphorous. [2]
   b. Sodium chloride is heated with manganese dioxide and conc. sulphuric acid.

SHORT ANSWER QUESTIONS

19. 2066 Q.No. 29 How is sodium hydroxide manufactured? Give a reaction to convert caustic soda into washing soda. [4+1]

20. 2063 Q.No. 28 Write the principle involved in the extraction of sodium from sodium chloride, and also draw a self-explanatory diagram for the Down's process for the extraction of sodium. [5]

21. 2061 Q.No. 28d 2052 Q.No. 7a what happens when
   a. Sodium hydroxide is heated with yellow phosphorous. [5]
   b. A piece of sodium is exposed to air.

22. 2057 Q.No. 28 Write down the principles involved in the manufacture of caustic soda by Solvay Kellner's process. What is its action upon white phosphorous? [3+2]

23. 2056 Q.No. 28 How is sodium extracted from sodium chloride using Down's electrolytic cell? [5]

24. 2054 Q.No. 21 Give the characteristics of alkali metals? [5]

25. 2054 Q.No. 22 Describe the steps involved in the manufacture of sodium carbonate by Solvay's process. [5]

26. 2052 Q.No. 4 Group B Describe the manufacture of sodium hydroxide by Castner-Kellner cell. [5]

27. 2051 Q.No. 6 Group B Describe in brief the manufacture of sodium hydroxide by Castner-Kellner's process. [5]

LONG ANSWER QUESTIONS

28. 2076 Set B Q.No. 32 Explain the principle and procedure involved in the manufacture of washing soda by ammonia-soda process. Sketch a well-labelled diagram for it. How would you convert washing soda into
   i. Soda ash
   ii. Sodium silicate respectively?
   Write down important uses of washing soda. [6+2+2]

29. 2076 Set C Q.No. 32 Explain the principle and procedures involved in the manufacture of washing soda by ammonia soda method. Sketch a well-labelled diagram for it. What happens when washing-soda is
   i. Fused with excess and (SiO₂)
   ii. Heated upto 750°C.
   Write down the uses of washing soda. [6+2+2]

30. 2075 GIE Q.No. 31 Explain the chemistry of Castner-Kellner process for the manufacture of Caustic Soda. Write down the action of Caustic Soda with Zn. How is Caustic Soda converted into Washing Soda? [7+1+2]

31. 2075 Set A Q.No. 31 Sketch a well labelled diagram for the manufacture of sodium by Down's process. What are the advantages of this process? Give reactions for the conversion of sodium into washing soda. [6+2+2]

32. 2075 Set B Q.No. 31 Sketch a neat and well-labeled diagram for the manufacture of sodium carbonate by Solvey's ammonia process. Explain the chemical principle involved. What is the advantage of this process? Write down the molecular formula of (i) soda ash (ii) baking soda (iii) washing soda. [6+4]

33. 2074 Supp Q.No. 31 Sketch a well labelled diagram for the manufactured of NaOH by Castner–Kellner's method and explain the principle and procedure for it. What in the action of caustic soda on
   i. Chlorine   ii. Zinc
   Convert caustic soda into sodium silicate. [6+2+2]

34. 2074 Set A Q.No. 31 Write the principle and process along with self-explanatory diagram for the manufacture of sodium by Down's method. Why is sodium fire at laboratory not extinguished by adding water? Mention any two advantages of Down's process. How is sodium converted into washing soda? [6+1+1+2]

35. 2074 Set B Q.No. 31 Sketch a neat and well labeled diagram for the manufacture of sodium by Down's process. What are the advantages of this process? Give reactions for the conversion of sodium into washing soda. [6+2+2]

36. 2073 Supp Q.No. 31 Sketch a well labeled diagram of Down's Cell for the manufacture of sodium. Explain the principle and procedure involve on it. What are the advantages of this process? Why does sodium impart characteristics colours to the flame? Convert sodium into washings soda. [6+2+2]

37. 2073 Set C Q. No. 31 Sketch a well-labeled diagram for the manufacture of washing soda by Solvay's ammonia process and explain the principle and procedure for it. What happens when washing soda is: [6+3+1]
   i. Exposed to air
   ii. Fused with excess sand (SiO₂)
   iii. Heated upto 750°C
   iv. Give two major uses of washing soda.

38. 2073 Set D Q. No. 31 Sketch a well-labeled diagram for the manufacture of Caustic soda (NaOH) by Castner Kellner's process. Explain the principle and procedure involve on it. What happens when Caustic soda is: [6+1+1]
   i. Heated with sulphur   ii. Treated with zinc

39. 2072 Supp Q. No. 30 Describe the manufacture of caustic soda using Kellner-Solvay process. Write the action of NaOH with [6+4]
   i. Chlorine   ii. Sulphur
   iii. Phosphorous   iv. Zinc.

40. 2072 Set C Q.No. 31 2072 Set D Q.No. 31 How is sodium metal extracted by Down's process? Why is the mixture of CaCl₂ and KF added to NaCl during the extraction of sodium? How is sodium converted into Na₂SiO₃? [6+2+2]

41. 2072 Set E Q.No. 31 Sketch a neat and well-labelled diagram for the manufacture of sodium carbonate by Solvay's ammonia process. Explain the chemical principle involved. What is the advantage of this process? Write down the molecular formula of [6+1+1+1]
   i. Soda ash   ii. Baking soda
   iii. Washing soda.

52. **2071 Supp. Q.No. 32** Describe the principle behind manufacture of sodium hydroxide by Kellner Solvay cell. Also give its properties and uses. [6+2+2]

43. **2070 Supp. Q.No. 31** Give any three points to distinguish alkali metals from alkaline earth metals. How is sodium carbonate manufactured by Solvay-ammonia process? Why is it difficult to get potassium carbonate by this method? [3+6+1]

44. **2070 Set C Q.No. 32** Explain the chemistry of Down's process for the extraction of sodium. What happens when:
a. Sodium is treated with NH_3
b. Sodium is exposed to moist air.
Why is sodium fire not extinguished by adding water in laboratory? [6+1.5+1.5+1]

45. **2070 Set D Q.No. 30** Sketch a well labelled diagram for the manufacturing of sodium hydroxide and explain the principle involved in the process. How does it react with
a. CO_2 b. Zn   [6+2+2]
Write any two uses of sodium hydroxide.

46. **2069 (Set A) Q. No. 30** Sketch a well labelled diagram for the extraction of sodium by Down's process and explain the principle involved in the process. [6+2+2]
a. Why is sodium metal is kept in kerosene?
b. Alkali metal impart characteristic colour to the flame. Give reason.

47. **2069 (Set B) Q. No. 30b** How is sodium extracted by Down's process? [5]

48. **2068 Q.No. 32** Write the chemical principle and stepwise procedure involved in the manufacture of sodium carbonate by Solvay process and sketch a well-labelled diagram for it. What are the merits of this process? Give any two use of sodium carbonate. What happens when washing soda is heated? [6+2+1+1]

49. **2067 Q.No. 32** Explain the Chemistry of Down's Process of extraction of sodium. What happens when: [5+1+1+1+1+1]
i. Sodium is treated with ammonia
ii. Washing soda is heated.
iii. CO_2 is passed through NaOH solution.
iv. Sodium burns with carbondioxide.
Why is sodium Fire not extinguished by adding water?

50. **2065 Q. No. 32** Explain the principle and process and write a well labelled diagram for the manufacture of Washing Soda by Solvay's Ammonia process. Write the molecular formula of Baking Soda and Soda ash. How would you convert NaOH into Washing Soda? [7+1+2]

51. **2062 Q.No. 32** How is sodium extracted by Down's process? Sketch a diagram for Down's cell and write reactions involved. What are the difficulties on obtaining sodium by this process and how are they removed? How does sodium react with: [7+1.5+1.5]
a. Moist air   b. NH_3

52. **2061 Q.No. 31** Describe the manufacture of sodium carbonate by ammonia soda process. Also mention the function of limestone in the manufacturing process. [8+2]

53. **2059 Q.No. 30** Describe the extraction of sodium by Down's process. Write the action of sodium with
a. NH_3 b. H_2O [6+2+2]

54. **2058 Q.No. 32** Describe the manufacture of sodium hydroxide stressing on principle and diagrammatic sketch. How does it react with white and red phosphorus? [10]

WRITE SHORT NOTES ON

55. **2060 Q.No. 33(c)** Characteristics of alkali metals [5]

13.2 Alkaline Earth Metals

VERY SHORT ANSWER QUESTIONS

1. **2075 GIE Q.No. 18** Mention the bleaching action of bleaching powder. [2]

2. **2075 Set A Q.No. 18** **2074 Supp Q.No. 18** **2067 Q.No. 18** What happens when [1+1]
i. Gypsum salt is heated at 120ºC.
ii. Chlorine gas is passed through slaked lime.

3. **2074 Set A Q.No. 18** **2074 Set B Q.No. 18** What happens when; [1+1]
i. Bleaching powder is treated with dil. H_2SO_4
ii. Gypsum salt is heated above 130ºC

4. **2073 Supp Q.No. 18** Give a balanced chemical reaction for the preparation of slaked-lime. How would you obtain lime water from slaked-lime? [1+1]

5. **2073 Set C Q. No. 18** What is the action of heat on [1+1]
i. Epsom salt   ii. Gypsum salt

6. **2073 Set D Q. No. 18** Give a balanced chemical reaction for the preparation of slaked lime. How would you obtain lime water from slaked lime? [1+1]

7. **2072 Supp Q. No. 18** **2070 Supp Q. No. 18** Starting from quick lime, how would you prepare bleaching powder? [2]

8. **2072 Set C Q. No. 18** Define the terms: [1+1]
i. dead burnt plaster   ii. setting of plaster of paris

9. **2071 Supp. Q. No. 18** Write down the balanced chemical reaction for the preparation of
a. Quick lime   b. Plaster of Paris [1+1]

10. **2071 (Set D) Q.No. 18** Define the terms: [1+1]
a. dead burnt plaster   b. available chlorine

11. **2066 Q.No. 16** Starting from quick lime, how would you prepare lime water? What is meant by milk of lime? [1+1]

12. **2065 Q. No. 17** Write down a chemical reaction to prepare plaster of paris from gypsum. Why is plaster of paris suitable for immobilising of broken limbs? [2]

13. **2064 Q.No. 17** What is meant by slaking of lime? How is lime water prepared from slaked lime? [2]

14. **2062 Q.No. 16** How is plaster of paris prepared? [2]

15. **2062 Q.No. 28(b)** Explain with suitable chemical reactions. [2]
a. Quick lime produces hissing sound when added into cold water.

16. **2055 Q.No. 19** How is quick lime prepared from marble? Give pertinent equation. [2]

17. **2053 Q.No. 21 Group A** Write the chemical formula and one of the uses of Epsom salt, plaster of paris and quick lime. [1.5]

18. **2051 Q.No. 14 Group A** Name the alkaline earth metals and write their symbols also. [2]

19. **2051 Q.No. 16 Group A** Give the formulae of Bleaching powder and blue vitriol. [2]

SHORT ANSWER QUESTIONS

20. 2076 Set B Q.No. 27 Give the chemistry of plaster of pairs. [5]

21. 2076 Set C Q.No. 27 2075 GIE Q.No. 29 2070 Set C Q.No. 27 2059 Q.No. 33b 2058 Q.No. 28 2051 Q.No. 4c Write down the chemistry of quick lime. [5]

22. 2075 Set B Q.No. 29 2071 (Set C) Q.No. 28 Write down the chemistry of Epsom salt. [5]

23. 2072 Set C Q.No. 29 2072 Set E Q.No. 29 Write down the chemistry of bleaching powder. [5]

24. 2072 Set D Q.No. 29 Write down the chemistry of lime water. [5]

25. 2071 (Set D) Q.No. 28 Write the chemistry of plaster of pairs. [5]

26. 2070 Set D Q.No. 29 Give the chemistry of quick-lime. What happens when water is added to quick-lime? [4+1]

27. 2069 (Set B) Q. No. 27 Give any two characters of alkaline earth metals. How would you obtain
   i. Lime water
   ii. Plaster of paris from quick-lime.
   Mention any one use of bleaching powder. [2+2+1]

28. 2068 Q.No. 29 Give a suitable chemical reaction of each for the preparation of: [1+1+1+1+1]
   i. Epsom salt   ii. Bleaching powder
   iii. Quick lime
   What happens when water is added to quick lime? What is meant by setting of plaster?

29. 2064 Q.No. 28 Write down the preparation, properties and uses of bleaching powder. [5]

30. 2053 Q.No. 6 Group b How is bleaching powder manufactured? Give a neat labelled diagram and reactions involved. [5]

31. 2052 Q.No. 5 Group B Give the characteristics of alkaline earth metals. [5]

LONG ANSWER QUESTIONS

32. 2071 Supp. Q.No. 32 OR b Describe the preparations, Properties and uses of Bleaching powder. [5]

Section C: Organic Chemistry

Unit 14: Introduction to Organic Chemistry

14.1 Fundamental Principles

VERY SHORT ANSWER QUESTIONS

1. 2072 Supp Q. No. 20 2070 Set D Q.No. 21 Explain why,
   i. Sodium extract is alkaline in nature. [1]
   ii. Organic compound are combustible. [1]

2. 2071 (Set D) Q.No. 21 How would you detect the presence of sulphur in the organic compound? [1+1]

3. 2070 Supp. Q.No. 21 What is the composition of Lassaigne's extract if the organic compound contains nitrogen? Why is it usually alkaline in nature? [1+1]

4. 2068 Q.No. 22 How would you detect the presence of nitrogen and sulphur together in the organic compound? [2]

5. 2067 Q.No. 21 Why is Lassaigne's extract boiled with concentrated nitric acid while testing for halogen? [2]

6. 2062 Q.No. 22 Why is it necessary to prepare sodium extract for the detection of foreign elements in organic compounds? [2]

7. 2059 Q.No. 19 Why is aqueous solution of sodium extract alkaline? [2]

8. 2057 Q.No. 19 For detection of elements (N, halogens, S) in organic compounds, why is sodium fusion carried out? [2]

SHORT ANSWER QUESTIONS

9. 2075 Set A Q.No. 26 Give the chemistry of the Lassaigne's test for the detection of nitrogen in organic compounds. [5]

10. 2075 Set B Q.No. 25 What is meant by homologous series? Write a homologous series containing –CHO as functional group. Mention any three important characteristics of homologous series. [1+1+3]

11. 2074 Supp Q.No. 25 2074 Set B Q.No. 26 Give the chemistry of the Lassaigne's test for the detection of nitrogen in organic Compounds. [5]

12. 2074 Set A Q.No. 25 How would you detect the presence of nitrogen in organic compound by Lassaigne's test method? [5]

13. 2072 Set C Q.No. 25 2072 Set D Q.No. 25 What is meant by functional group? Write the functional group of (i) alcohol (ii) ester (iii) acid hydride (iv) aldehyde. Mention an example of each compound containing these functional group. [1+4]

14. 2072 Set E Q.No. 25 Why is organic compound fused with sodium metal before testing for foreign elements? Give the Lassaigne's test for nitrogen. [1+4]

15. 2070 Supp. Q.No. 26 Define Homologous series and write a series containing -CHO as functional group. What are the structural formulae and IUPAC name of [1+2+2]
   i. 4th member of carboxylic acid
   ii. 1st member of amide
   iii. 3rd member of acid chloride

16. 2070 Set C Q.No. 29 Define Homologous series. What are the characteristic feature homologous series. Give the IUPAC name of the first member of ketone series. [1+3+1]

17. 2070 Set D Q.No. 26 Define Homologous series and write its important characteristics. What is the IUPAC name of 1st member of ketone? [1+3+1]

18. 2068 Q.No. 27 What is meant by homologous series? Mention any four characteristics of it and write down the structure formulae of the third member of the following homologous series:
   i. Alkanamide   ii. Alkanol
   iii. Alkyne   iv. Alkanoic acid [1+2+2=5]

19. 2065 Q. No. 29 Define Homologous Series. What are the characteristic features of a homologous series? [1+4]

WRITE SHORT NOTES ON

20. 2076 Set B Q.No. 33i 2075 GIE Q.No. 33iii 2071 Supp.Q.No. 33b 2066 Q.No. 33 d 2061 Q.No. 33c Detection of nitrogen in the organic compound. [5]

21. 2076 Set B Q.No. 33iii 2076 Set C Q.No. 33ii 2075 Set A Q.No. 33iv 2074 Supp Q.No. 33(i) 2074 Set A Q.No. 33i 2074 Set B Q.No. 33iv 2073 Supp Q.No. 33i 2073 Set D Q. No. 33 iii 2069 Set B Q. No. 33a Characteristics of homologous series. [5]

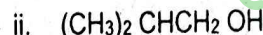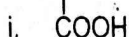22. 2075 GIE Q.No. 33i Homologous series of organic compound. [5]

23. 2075 Set B Q.No. 33iv | 2073 Supp Q.No. 33ii | 2073 Set C Q. No. 33iv
2073 Set D Q. No. 33 iv | 2072 Set C Q.No. 33d | 2072 Set D Q.No. 33d
2071 Set C Q.No. 33b | 2071 Set D Q.No. 33d | 2070 Set C Q.No. 33d
Lassaigne's test of nitrogen. [5]

24. 2073 Set C Q.No. 33iii Homologous series and its characteristics.[5]

25. 2072 Supp Q.No. 33iii Homologous series of organic compound.[5]

26. 2072 Set E Q. No. 33 ii | 2071 Supp. Q.No. 33c | 2071 Set C Q.No. 33a
2069 Set A Q.No. 33c | 2064 Q.No. 33b | 2063 Q.No. 33d | 2057 Q.No. 33d
2059 Q.No. 33d | 2060 Q.No. 33a Homologous series [5]

27. 2071 (Set D) Q.No. 33 (a) Classification of hydrocarbon [5]

28. 2069 (Set A) Q. No. 33d Detection of foreign element inorganic
compound [5]

29. 2068 Q.No. 33 c Detection of sulpher and halogens in organic
compound [5]

30. 2066 Q.No. 33 c Functional group [5]

31. 2063 Q.No. 33(c) Inductive effect [5]

32. 2058 Q.No. 33(a) sp^3 hybridization [5]

33. 2056 Q.No. 32(a) Homology [5]

14.2. Nomenclature of Organic Compounds

VERY SHORT ANSWER QUESTIONS

1. 2076 Set B Q.No. 19 Give the IUPAC name of the following
organic compounds: [1+1]
   i. $(CH_3)_3C-OH$ ii. CH_3COOCH_3

2. 2076 Set C Q.No. 19 Give the IUPAC name of the following
organic compounds: [1+1]
   i. $(CH_3)_2CH-OCH_3$ ii. CH_3CONH_2

3. 2075 GIE Q.No. 19 Give the IUPAC name of the following
compounds. [1+1]
   i. $CH_3-CH_2-O-CH_2-CH_2-OCH_3$
   ii. $CH_3-CH_2COOCH_3$

4. 2075 Set A Q.No. 19 Write down IUPAC name of the following
compounds. [1+1]
   i. $CH_3O-CH_2-CH_2-OCH_3$ ii. $CHCl_3$
   Ans: (i) 1, 2-dimethoxyethane (ii) 1, 1, 1-trichloromethane

5. 2075 Set B Q.No. 19 Write down IUPAC name of the following
compounds. [1+1]

   i. HO—C(=O)—CH₂—CH₂—C(=O)—OH

   ii. (CH₃)₂CH—CH=CH—C(=O)—Cl

   Ans: (i) Butane-1,4-dioic acid (ii) 4-methylpent-2-enoyl chloride

6. 2074 Supp Q.No. 19 Write down IUPAC name of the following
organic compounds. [1+1]
   i. $(CH_3)_2C = CH - CHO$ ii. COOH–COOH
   Ans: (i) 3-methylbut-2-enal (ii) Ethane-1, 2-dioic acid

7. 2074 Set A Q.No. 19 Write down IUPAC name of the following
organic compounds, [1+1]
   i. $CH_3—O—CH_2—CH_2—O—CH_3$ ii. $CHCl_3$
   Ans: (i) 1, 2-dimethoxyethane (ii) 1, 1, 1-trichloromethane

8. 2074 Set B Q.No. 19 Write down IUPAC name of the following
compounds [1+1]
   i. COOH–COOH   ii. $(CH_3)_2 CHCH_2 OH$
   Ans: (i) Ethane-1, 2-dioic acid (ii) 2-methylpropan-1-ol

9. 2073 Supp Q.No. 19 Write down the structure of the following
organic compounds. [1+1]
   i. Ethane-1, 2-dioic acid   ii. Methyl methanoate

10. 2073 Set C Q. No. 19 Give the structure of the following
organic compounds; [1+1]
   i. But-2-ene-1,4-dial   ii. Methylmethanoate

11. 2073 Set D Q. No. 19 Give the structure of the following
compounds: [1+1]
   i. 2,3-dimethylbut-2-ene   ii. Ethylethanoate

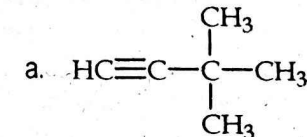12. 2072 Set C Q.No. 19 Write down IUPAC name of the following
compounds: [1+1]

   i. $H_2C=CH-CH_2-C(=O)-H$
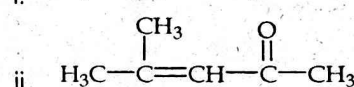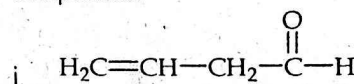
   ii. $H_3C-C(CH_3)=CH-C(=O)-CH_3$

   Ans: (i) 3-butenal (ii) 4-methylpent-3-en-2-one

13. 2072 Set D Q.No. 19 Write down IUPAC name of the following
compounds: [1+1]
   i. $HO—CH_2—CH_2—OH$

   ii. $H_3C-C(CH_3)=CH-C(=O)-CH_3$

   Ans: (i) Ethane-1,2-diol (ii) 4-methylpent -3-en-2-one

14. 2072 Set E Q.No. 19 Write down IUPAC name of the following
compounds: [1+1]

   i. $H_3C—O—CH(CH_3)—CH_3$

   ii. $H_3C-C(=O)-O—CH_3$
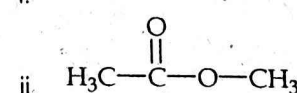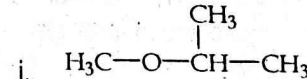
   **Ans: (i) 2-methoxypropane (ii) Methylethanoate**

15. 2071 (Set C) Q.No. 19 Give the IUPAC name of the following
compounds: [1+1]

   a. $H_3C-C(=O)-CH_2-C(=O)-OH$

   b. $H_3C—O—CH_2—CH_2—O—CH_3$

   Ans: (a) 3-ketobutanoic acid (b) 1,2-dimethoxyethane

16. 2071 (Set D) Q.No. 19 Give the IUPAC name of the following
compounds. [1+1]

   a. $HC≡C-C(CH_3)_2-CH_3$

   b. $H_3C—CH(COOH)—CH_2—NH_2$
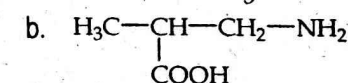
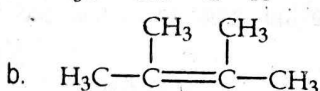   **Ans: (a) 3,3-dimethylbut-1-yne (b) 3-amino-2-mehtylpropanoic acid**

17. **2070 Supp. Q.No. 19** Write down IUPAC name of the following organic compounds.   [1+1]

    i. $H_3C-CH-CH_2-OH$
             |
             OCH_3

    ii. $H_3C-CH-CH_2-CH_3$
              |
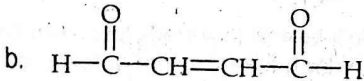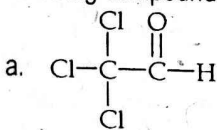 $COOH$
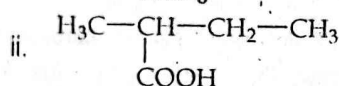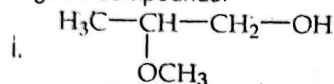
    Ans: (i) 2-methoxypropan-1-ol (ii) 2-methylbutanoic acid

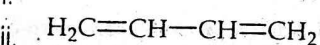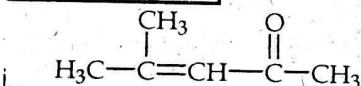18. **2070 Set C Q.No. 20** Write down the IUPAC name of the following compounds.   [1+1]

    a. $H_3C-CH-C-H$ (with OCH₃ and O: $\overset{OCH_3}{\underset{}{}} \overset{O}{\underset{}{}}$)

    b. $H_3C-C=C-CH_3$ (with CH₃, CH₃)
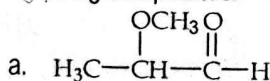
    Ans: 2-methoxypropanal (b) 2,3-dimethylbut-2-ene

19. **2070 Set D Q.No. 19** Write down the IUPAC name of the following compounds.   [1+1]

    a. $Cl-C-C-H$ (with Cl, Cl and O)

    b. $H-C-CH=CH-C-H$ (with O, O)

    Ans: (a) 2,2,2-trichloroethanal (b) But-2-ene-1,4-dial

20. **2069 (Set B) Q. No. 19** Write down the IUPAC name of: [1+1]

    i. $H_3C-C=CH-C-CH_3$ (with CH₃, O)

    ii. $H_2C=CH-CH=CH_2$

    Ans: (a) 4-methylpent-3-en-2-one (b) But-1,3-diene

21. **2069 (Set B) Q. No. 20** Indicate the primary, secondary and tertiary carbon of the following hydrocarbon and give its IUPAC name.   [1+1]

    $H_3C-HC-CH_2-C-CH_3$ (with CH₃, CH₃, CH₃)
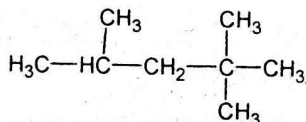
    Ans: 2, 2, 4- trimethylpentane

22. **2068 Q.No. 19** Assign the IUPAC name of following compounds: [1+1]

    i. $H_2C=CH-CH-CH_3$ (with CH₃)

    ii. $H-C-OCH_3$ (with O)
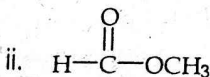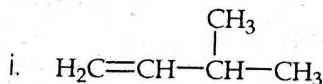
    Ans: (i) 3-methylbut-1-ene (ii) Methylmethanoate

23. **2067 Q.No. 19** Write down the IUPAC name of the following compounds: [1+1]

    a. $C-H$ (O), $HC-OH$, $C-H$ (O)

   b. $H_3C-CH_2-C=C-CH_2-OH$ (with CH₃, OH)
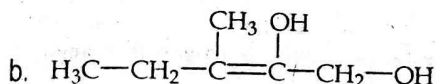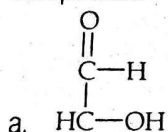
    Ans: (a) 2-hydroxypropane-1, 3- dial (b) 3-methylpent-2-ene-1,2-diol

24. **2066 Q.No. 21** Write down the IUPAC name of the following compounds: [1+1]

    i. $H_2C-CH-CH_2$ (with OH OH HO)

    ii. $H_3C-HC-C=C-CH_3$ (with CH₃, CH₃, Br)
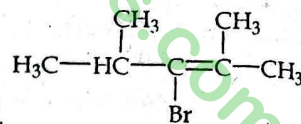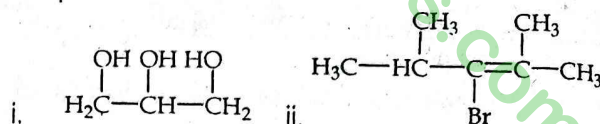
    Ans: (i) Propane-1,2,3-triol (ii) 3-bromo-2,4-dimethylpent-2-ene

25. **2065 Q. No. 22** Write down the IUPAC name of the following compounds: [2]

    a. $H_3C-CH-CHO$ (with OCH₃)

    b. $H_3C-C=C-CH_3$ (with CH₃, CH₃)
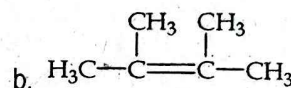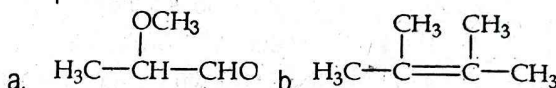
    Ans: (a) 2-methoxypropanal (b) 2,3-dimethylbut-2-ene

26. **2064 Q.No. 21** Write the IUPAC name of   [2]

    a. $(CH_3)_3CCHBrCH_2CH_3$.   b. $CH_3CH_2OCH(CH_3)_2$.

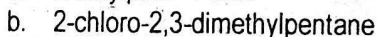   **Ans: (a) 3-bromo-2,2-dimethylpentane (b) 2-ethoxypropane**

27. **2063 Q. No. 22** Write the IUPAC name of the following compounds   [2]

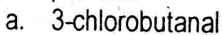   i. $(CH_3)_2CHOCH_3$ ii. $(CH_3)_3CCOCH_2CH_3$
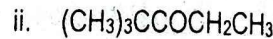
    Ans: (i) 2-methoxypropane (ii) 2,2-dimethylpentan-3-one

28. **2061 Q.No. 22** Write the structure of the following organic compounds: [2]

    a.   2-ethylpent -1-ene

    b.   2-chloro-2,3-dimethylpentane

29. **2059 Q.No. 21** Give the formula of the following organic compounds.   [2]

    a.   3-chlorobutanal   b.   2, 2-dimethylpropane

30. **2057 Q.No. 21** Write the structures of the following organic compounds: [2]

    a.   2 - methylpropan -1- ol   b.   3-methylbutanoic acid
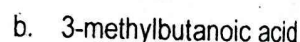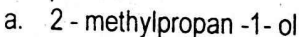
WRITE SHORT NOTES ON

31. **2067 Q.No. 33d** IUPAC rules.   [5]

14.3. Structure Isomerism in Organic Compounds

VERY SHORT ANSWER QUESTIONS

1. **2075 GIE Q.No. 21** Write down the functional isomer of propanoic acid and give its IUPAC name.   [1+1]

2. **2075 Set A Q.No. 22** Write down the functional isomer of (i) Methoxy ethane (ii) Propanoic acid and give their structural formula.   [1+1]

3. **2074 Supp Q.No. 22** What is the structural formula of ethanoic acid? Write its functional isomer and IUPAC name.   [1+1]

4. **2074 Set A Q.No. 22** Give functional isomers of ethanoic acid and propanone with their structural formula.   [1+1]

5. **2074 Set B Q.No. 22** Write down the functional isomers of [1+1]
    i.   propan-1-ol
    ii.   methylmethanoate and give their IUPAC name.

6. **2072 Supp Q. No. 19** Give possible isomers of $C_3H_6O_2$ and write their IUPAC name.   [2]

7. **2072 Set C Q.No. 21** Write down the functional isomers of the following compounds and give their IUPAC name: [1+1]
    i. $CH_3 – CH_2 – CH_2 OH$ ii. $CH_3 – CH_2 – COOH$

8. **2072 Set D Q.No. 21i** Define the terms: isomerism   [1]

2071 Supp. Q.No. 19 Give a functional isomer of C_3H_7OH and write it's IUPAC name. [2]

2070 Set C Q.No. 18 Write the functional Isomers of $C_2O_2H_4$ and give their IUPAC name. [1+1]

2069 (Set A) Q. No. 19 Give possible isomers of C_4H_{10} and write their IUPAC name. [1+1]

2068 Q.No. 20 Write down a functional isomer of CH_3-CH_2-OH and give its IUPAC name. [1+1]

2066 Q.No. 22 Give the two functional group isomers of C_3H_6O and write their IUPAC name. [1+1]

2060 Q.No. 19 Write the isomers of $C_2H_4O_2$ and give their IUPAC names. [2]

2059 Q.No.20 Write the isomers of C_2H_6O and give their IUPAC names. [2]

2056 Q.No. 19 Write the isomers of C_4H_{10} and give their IUPAC names. [2]

SHORT ANSWER QUESTIONS

2067 Q.No. 28 Define isomerism. Write down two structure isomers and their IUPAC names of each of the following:[2.5×2]
i. C_3H_6O ii. C_4H_8

2063 Q.No. 29 Write the possible isomers of C_6H_{14} and give their IUPAC names. [2.5+2.5]

2058 Q.No. 29 Write down all possible isomers of C_6H_{14} and give their IUPC name. [5]

WRITE SHORT NOTES ON

2076 Set C Q.No. 33i **2070 Supp. Q.No. 33d** **2069 Set B Q.No. 33b** **2065 Q. No. 33c** **2062 Q.No. 33(ii)** Structure isomerism in organic compounds. [5]

2070 Set D. Q.No. 33b Isomerism in organic compound. (Structure isomer only) [5]

2057 Q.No. 33(c) Isomers of C_6H_{14} [5]

14.4 Preliminary Idea of Reaction Mechanism

VERY SHORT ANSWER QUESTIONS

2076 Set B Q.No. 20 Define inductive effect and write its one use. [1+1]

2076 Set C Q.No. 20 What are electrophiles? Write any two examples. [1+1]

2075 Set B Q.No. 21 Define the terms. [1+1]
i.   Inductive effect   ii.   Electrophile

2073 Supp Q.No. 20 Define inductive effect and give its an important application. [1+1]

2073 Set C Q. No. 20 What is an electrophile? Give an example of it. [1+1]

2073 Set D Q. No. 20 How is an electrophile differed from nucleophile? Give a suitable example of each. [1+1]

2071 Supp Q.No. 20 Define nucleophiles giving examples.[1+1]

2071 (Set C) Q.No. 21 What is meant by inductive effect? Give its one application. [1+1]

2069 (Set B) Q. No. 21 What is meant by electrophile? Write suitable example of it. [1+1]

2065 Q. No. 20 Distinguish between electrophile and nucleophile with an example of each. [2]

2061 Q.No. 21 **2057 Q.No. 22** **2056 Q.No.20** Define electrophile and nucleophile giving one example from each. [2]

WRITE SHORT NOTES ON

2072 Supp Q. No. 33iv Inductive effect.

Unit 15: Hydrocarbons
15.1 Sources

VERY SHORT ANSWER QUESTIONS

2075 GIE Q.No. 22 **2072 Set D Q.No. 21ii** Define octane number.[2]

2072 Supp. Q. No. 21 What do you understand by anti-knocking agent? Give an example of it. [2]

2072 Set E Q.No. 21 Define the terms: [1+1]
i.   octane number   ii.   gasoline additive

2071 (Set C) Q.No. 22 Define antiknocking agent and write an example of it. [1+1]

2071 (Set D) Q. No. 22 Define gasoline additive and give an example of gasoline additive. [1+1]

2070 Set C Q.No. 9 **2070 Set D Q. No. 22** **2067 Q.No. 22** What is the function of Tetraethyl Lead (TEL) in gasoline? [2]

2066 Q.No. 20 Which terminology is used to grade the quality of fuel? Define the terminology. [1+1]

2065 Q. No. 21 What are anti-knocking agents? Name one important anti-knocking agent. [2]

2064 Q.No. 19 What is meant by the octane number of a fuel is 80? [2]

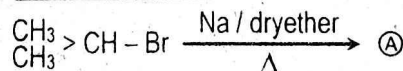**2062 Q.No. 19** A fuel has octane number 80. What does it mean? [2]

15.2 Alkanes (Saturated Hydrocarbons)

VERY SHORT ANSWER QUESTIONS

2076 Set B Q.No. 22 Write suitable chemical reaction for the preparation of methane from
i.   Sodium ethanoate (CH_3COONa)
ii.   Methyl magnesium iodide ($CH_3 MgI$). [1+1]

2076 Set C Q.No. 21 Identify Ⓐ and give its IUPAC name. [2]

$$\begin{matrix}CH_3\\CH_3\end{matrix} > CH-Br \xrightarrow[\Delta]{Na\,/\,dryether} Ⓐ$$

2074 Supp Q.No. 20(ii) **2074 Set B Q.No. 20** **2069 (Set A) Q. No. 22a** Write an example of each of the followings: Wurtz reaction [1]

2074 Set A Q.No. 20 Write reaction for the preparation of Methane from, [1+1]
i. CH_3MgBr ii. CH_3COONa

2073 Supp Q.No. 22 How is methane prepared from [1+1]
i. CH_3MgBr ii. $CH_3COO\,Na$

2073 Set C Q. No. 22 **2073 Set D Q. No. 22** How would you prepare methane from [1+1]
i.   Chloromethane   ii.   Sodium ethanoate

2072 Set C Q.No. 20 (i) Write an example of each of the following: decarboxylation reaction [1]

2072 Set D Q.No. 22 (ii) **2062 Q.No.20** What happens when: sodium acetate is heated with soda-lime? [1]

9. **2072 Set E Q.No. 20** What products would you expect when 2-bromopropane is heated [1+1]
   i. with Na/dry ether   ii. with alc. KOH

10. **2071 Supp. Q.No. 22** What is cracking of petroleum? [2]

11. **2070 Set C Q.No. 17** Write the chemical reaction when, Bromoethane is heated with sodium metal in presence of dry ether. [2]

12. **2070 Set D Q.No. 20** **2064 Q.No. 20** A holoalkane 'X' undergoes Wurtz reaction to give 2,3-dimethylbutane as the major product. Identify 'X' and write chemical reaction. [1+1]

   Ans: 2-halopropane = $CH_3 - \overset{\overset{CH_3}{|}}{CH} - X$
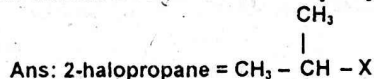
13. **2069 (Set A) Q. No. 21** What is cracking? Mention any one example of it. [1+1]

14. **2066 Q.No. 19a** Write the Chemical reactions when: Bromoethane is heated with sodium metal in presence of dry ether. [1]

15. **2062 Q.No.20** What happens when sodium acetate is heated with Soda-lime? [2]

16. **2064, Q.No. 22** Convert methane to ethane. [2]

17. **2063 Q.No.20** What is meant by Green house effect? Name any one gas contributing to the Green house effect. [2]

18. **2061 Q.No. 10** What is an ozone layer? [2]

19. **2061 Q.No.20** **2059 Q.No. 22** What is Wurtz reaction? Give an example. [2]

20. **2060 Q.No. 21** What happens when aluminium carbide is treated with cold water? [2]

21. **2058 Q.No.20** Show our acquaintance with Wurtz reaction. [2]

22. **2056 Q.No. 13** Name any one gas responsible for the depletion of ozone layer of upper part of our atmosphere. Why is it harmful to living beings, if ozone layer get depleted? [2]

23. **2056 Q.No. 22** What is green house effect? [2]

24. **2055 Q.No. 14** Why do you think depletion of ozone layer from the atmosphere will be harmful to plant and animal life? [2]

25. **2053 Q.No. 17** How does ozone protect plant and animal life on earth? [1.5]

SHORT ANSWER QUESTIONS

26. **2064 Q.No. 29** Describe the preparation of ethane in laboratory. [5]

WRITE SHORT NOTE ON:

27. **2065 Q.No. 33b** Laboratory preparation of ethane gas [5]

15.3. Alkenes

VERY SHORT ANSWER QUESTIONS

1. **2076 Set B Q.No. 21** An alkene Ⓐ undergoes ozonolysis to give ethanal and methanal as the major products identify Ⓐ and write its IUPAC name. [1+1]

2. **2075 GIE Q.No. 20** Identify the major products A and B and write their IUPAC name [1+1]

   $$CH_3 - CH_2 - CH_2 - Br \xrightarrow[\Delta]{alcKOH} A \xrightarrow[\Delta]{HBr} B$$

3. **2075 Set A Q.No. 20** Write an example of [1+1]
   i. Baeyer's test   ii. Wurtz reaction

4. **2075 Set B Q.No. 20** Write an example of each of the following. [1+1]
   i. Markovnikov's rule   ii. Wurtz's reaction

5. **2074 Supp Q.No. 20(i)** Write an example of each of the followings: Baeyer's test [1]

6. **2074 Set B Q.No. 20** Write an example of Peroxide effect [1]

7. **2073 Set D Q. No. 21** Identify the major products A and B in the following reaction sequence and give their IUPAC name. [1+1]

   $$H_3C - CH_2 - Br \xrightarrow[\Delta]{Alc.\ KOH} A \xrightarrow[\Delta]{Ozonolysis} B$$
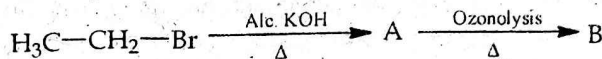
   Ans: A = Ethene, B = Methanal

8. **2072 Supp Q. No. 22** Write an example of each of: [1+1]
   i. Kolbe's reaction   ii. Dhydrohalogenation

9. **2072 Set C Q.No. 20 (ii)** **2069 (Set A) Q. No. 22b** Write an example of each of the following: Markovnikov's rule [1]

10. **2072 Set D Q.No. 20** Identify the major products A and B giving their IUPAC names. [1+1]

    $$CH_3 - CH_2 - Br \xrightarrow[\Delta]{alc.\ KOH} A \xrightarrow[Zn/H_2O]{O_3} B$$

    Ans: A = Ethene, B = Methanal

11. **2071 (Set C) Q.No. 20** Give a suitable reaction for each: [1+1]
    a. Baeyer's test   b. Dehydrohalogenation

12. **2071 (Set D) Q.No. 20** Identify the major product A and B of the following and write their IUPAC name. [2]
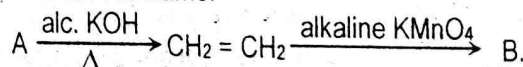
    $$CH_3 - CH_2 - CH_2 - Br \xrightarrow[\Delta]{alc\ KOH} A \xrightarrow{HBr} B$$
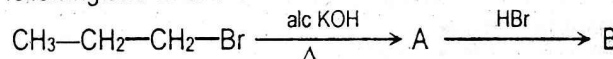
    Ans: A = $CH_3 - CH = CH_2$ (Propene); $CH_3 - \overset{\overset{Br}{|}}{CH} - CH_3$ (2-bromopropane)

13. **2069 (Set A) Q. No. 20** Identify A and B In the following reaction and give IUPAC name: [1+1]

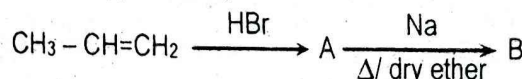 $$A \xrightarrow[\Delta]{alc.\ KOH} CH_2 = CH_2 \xrightarrow{alkaline\ KMnO_4} B.$$
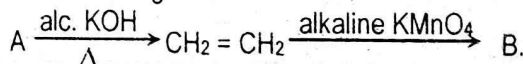
    Ans: A = $CH_3 - CH_2 - Cl$; B = $\overset{\overset{OH}{|}}{CH_2} - \overset{\overset{OH}{|}}{CH_2}$

14. **2069 (Set B) Q. No. 22** Identify the compounds A and B. Give their IUPAC name. [1+1]

 $$A \xrightarrow[\Delta]{alc.\ KOH} CH_2 = CH_2 \xrightarrow{alkaline\ KMnO_4} B.$$

    Ans: A = Chloroethane; B = Ethane-1,2-diol

15. **2068 Q.No. 21** Identify the major product A and B and give their IUPAC name. [1+1=2]

    $$CH_3 - CH = CH_2 \xrightarrow{HBr} A \xrightarrow[\Delta/\ dry\ ether]{Na} B$$

    Ans: A = 2–bromopropane, B = 2,3-dimethylbutane

16. **2065 Q. No. 19** Write an example of each of the following reaction: [2]
    a. Wurtz reation   b. Markovnikov's rule

17. **2063 Q.No. 21** State Markovnikov's rule. Give an example of it. [2]

18. **2060 Q.No. 22** Identify the unknown organic compounds 'A' and 'B' in the following reaction: [2]

    $$CH_3CH_2Cl \xrightarrow[\Delta]{Alc,\ KOH} A \xrightarrow[2.\ H_2O/Zn]{1.\ O_3} B$$
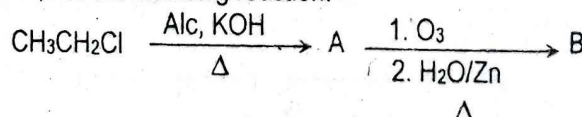
    Ans: A = $CH_2 = CH_2$; B = 2HCHO

19. 2058 Q.No. 19 Describe the Baeyer's test. What is observed and what does it identify? [2]

20. 2058 Q.No. 21 The ozonolysis of a compound gave acetone as the only product. Identify the compound. [2]

SHORT ANSWER QUESTIONS

21. 2076 Set B Q.No. 25 Describe laboratory method of preparation of ethene. Suggest a chemical test to distinguish ethene from ethane. [4+1]

22. 2073 Set C Q. No. 25 2073 Set D Q. No. 25 How is ethene prepared in the laboratory? What happens when ethene is passed through Baeyer's reagent? [4+1]

23. 2072 Supp Q. No. 29 How is ethene obtained in the laboratory? How does it react with bromine and alkaline potassium permanganate solution? [3+2]

24. 2071 Supp. Q. No. 29 Describe with a neat and labelled diagram for the preparation of ethylene in the laboratory. How does it react with aq. alkaline potassium permanganate solution? [4+1]

25. 2060 Q.No. 29(i) 2059 Q.No. 29(a) What happens when: [5]
   a. ethene is passed through alkaline potassium permanganate solution
   b. benzene is allowed to react with methyl chloride in presence of anhydrous aluminium chloride.

WRITE SHORT NOTES ON

26. 2070 Set D Q.No. 33a 2068 Q.No. 33 a Laboratory preparation of ethene. [5]

27. 2066 Q.No. 28 Ozonolysis [2.5]

28. 2066 Q.No. 28 2058 Q.No. 33c 2056 Q.No. 32 a Markovnikov's rule [2.5]

29. 2061 Q.No. 33(b) 2059 Q.No. 3(c) Write short notes on Polymerization [5]

30. 2064 Q.No. 33c Markovnikov's rule and peroxide effect. [2]

15.4. Alkynes

VERY SHORT ANSWER QUESTIONS

1. 2076 Set C Q.No. 22 Write down chemical reaction to prepare ethene from: [1+1]
   i. Ethyne
   ii. Chloroethane.

2. 2075 Set A Q.No. 21 2075 Set B Q.No. 22 2074 Supp Q.No. 21 2074 Set A Q.No. 21 2074 Set B Q.No. 21 Identify the major products Ⓐ and Ⓑ in the following. [2]

$$CaC_2 \xrightarrow{H_2O} Ⓐ \xrightarrow{\text{ammonical } AgNO_3} Ⓑ$$
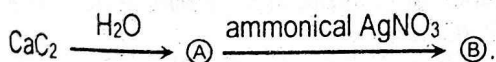
Ans: A: Acetylene; B: Silver acetylide

3. 2073 Supp Q.No. 21 Identify the major products Ⓐ and Ⓑ in the following reaction sequence and give their IUPAC name. [1+1]
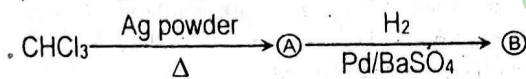
$$CaC_2 \xrightarrow{H_2O} Ⓐ \xrightarrow[60°C]{Conc.H_2SO_4/HgSO_4} Ⓑ$$
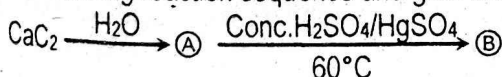
Ans: A = Ethyne, B = Ethanal

4. 2073 Set C Q. No. 21 2070 Supp.Q.No. 22 Identify the major products Ⓐ and Ⓑ in the following reaction sequence. And give their names. [1+1]

$$CaC_2 \xrightarrow{H_2O} Ⓐ \xrightarrow[\Delta]{Fe\text{-}tube} Ⓑ$$
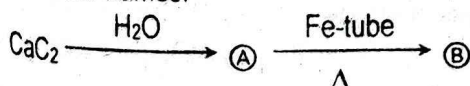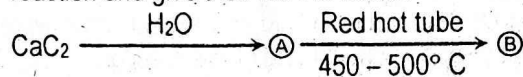
Ans: A = Ethyne, B = Benzene

5. 2072 Set C Q.No. 22 2072 Set E Q.No. 22 Identify the major product Ⓐ and Ⓑ in the following: [1+1]

$$CHCl_3 \xrightarrow[\Delta]{Ag\ powder} Ⓐ \xrightarrow[Pd/BaSO_4]{H_2} Ⓑ$$

Ans: A = H–C ≡C – H Ethyne, B = CH₃ – CH₃ Ethane

6. 2072 Set D Q.No. 22 (i) What happens when: ethyne is reacted with hydrogen in presence of Pd/BaSO₄? [1]

7. 2071 Supp. Q.No. 21 Identify Ⓐ and Ⓑ in the following reaction and give their IUPAC name: [1+1]

$$CaC_2 \xrightarrow{H_2O} Ⓐ \xrightarrow[450 - 500° C]{Red\ hot\ tube} Ⓑ$$

Ans: A = C₂H₂ (Ethyne), B = C₆H₆ (Benzene)

8. 2070 Supp. Q.No. 20 Write a chemical test to distinguish ethyne from ethene. [1]

9. 2067 Q.No. 20 How would you convert ethyne into:
   i. ethene   ii. benzene [1+1]

10. 2066 Q.No. 19 b Write the Chemical reactions when: Ethyne is catalytically hydrated. [1]

11. 2063 Q.No. 19 Identify the compounds A and B in the given reaction. [2]

$$A \xrightarrow{H_2O} C_2H_2 \xrightarrow{H_2O}_{HgSO_4/H^+} B$$
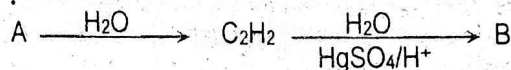
Ans: A = CaC₂; B = CH₃ CHO

12. 2058 Q.No. 22 What gas is obtained when calcium carbide is treated with water? Show equation for this reaction. [2]

13. 2057 Q.No.20 You are supplied two similar gas jars. One of the jar is filled with ethene while the other with ethyne. Suggest any one suitable chemical test to identify them. [2]

14. 2056 Q.No. 21 Give a chemical reaction to show acidic nature of ethyne. [2]

SHORT ANSWER QUESTIONS

15. 2076 Set C Q.No. 25 Describe laboratory method of preparation of ethyne. How is ethyne converted into ethanal? [4+1]

16. 2075 GIE Q.No. 26 How is ethyne gas prepared in the laboratory? [5]

17. 2073 Supp Q. No. 25 How is ethyne prepared in laboratory? Give a test reaction of ethyne. [4+1]

18. 2071 (Set C) Q.No. 26 How is acetylene gas prepared in the laboratory? What happens when acetylene is passed through HgSO₄ and H₂SO₄ at 60°C? [4 + 1]

19. 2071 (Set D) Q.No. 26 Give a suitable reaction for the preparation of each of: [1+1+1+1+1]
   a. ethene   b. ethyne
   How does ethyne react with (i) water and (ii) cuprous chloride? How would convert ethyne into ethane?

20. 2069 (Set A) Q. No. 29 How is ethyne prepared in the laboratory? What is Baeyer's test? [4+1]

21. 2069 (Set B) Q. No. 26 Write any two method of preparation of ethyne. What happens when ethyne is
   i. Catalytically hydrated.
   ii. Heated in a red hot iron tube
   iii. Treated with hydrogen in presence of Pd/BaSO₄ [2+3]

22. 2062 Q.No. 29 How is acetylene prepared in laboratory? What happens when acetylene gas is passed through ammoniacal solution of Silver nitrate? [4+1]

23. 2061 Q.No. 29b 2060 Q.No. 29ii 2059 Q.No. 29b What happens when: [2]
    a. ethyne is passed through ammoniacal solution of cuprous chloride.
    b. ethyne is hydrated catalytically.
    c. iodoform is heated with silver powder.

24. 2061 Q.No. 29(b) Conversion: Ethyne to ethanol [2.5]

25. 2058 Q.No. 33(c)/ 2056 Q.No. 32 b Write notes on Acidic nature of ethyne [5]

26. 2057 Q.No. 29
    a. What gaseous product would you expect when water is dropped over calcium carbide? Give reaction. [2]

b. What action takes place when the gas obtained from the above reaction is allowed to react with (i) HBr and (ii) dil. H_2SO_4 in presence of $HgSO_4$? [3]

27. 2056 Q.No. 29 How is acetylene prepared in the laboratory from calcium carbide? Give a reaction to detect unsaturation in acetylene. [5]

WRITE SHORT NOTES ON

28. 2075 Set A Q.No. 33iii 2075 Set B Q.No. 33ii 2074 Supp Q.No. 33ii 2074 Set A Q.No. 33ii 2074 Set B Q.No. 33iii 2072 Set E Q.No. 33 iv 2070 Supp. Q.No. 33 a Laboratory preparation of ethyne. [5]

29. 2072 Set C Q.No. 33c 2072 Set D Q.No. 33c 2067 Q.No. 33c 2065 Q. No. 33 b Laboratory preparation of acetylene. [5]

5 Sets Questions

Set 1

Group 'A'

Attempt any fifteen questions [15 × 2 = 30]

1. What Dipole moment? What is its unit?
2. What are radioisotopes? Give one important use.
3. What do you mean by malleability, ductility, metallic clink and metallic luster?
4. What happens when ethylene gas is passed through cold dilute alkaline $KMnO_4$ solution?
5. A gas has density 2.41 g/liter at 25°C and 770 mm Hg. Calculate its molecular mass. (R = 0.0821 L atm.mol⁻¹K⁻¹)

   Ans: 58.37 amu

6. How many molecules of H_2O and O_2 are present in 8.5 g of H_2O_2?

   Ans: 1.5 × 10²³ H_2O, 7.52 × 10²² O_2

7. Why is the ionization energy of nitrogen higher than oxygen?
8. Why are alkali metals kept in kerosene oil?
9. Write any two application of: (i) ¹⁴C (ii) ¹²³I
10. Predict the effect of temperature on the equilibrium of the reaction:

    $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$, H = -93.6 kJ

11. What happens when aqua regia is treated with gold?
12. Define the terms:
    i. dead burnt plaster   ii. available chlorine
13. Define electrophile and nucleophile giving one example of each.
14. What is partial pressure? What is the application of Dalton's law of partial pressure?
15. State Heisenberg's uncertainty principle.
16. Write the electronic configuration of Cr and Cu in terms of s, p, d orbitals.
17. How does an ammonia molecule differ from ammonium ion?
18. What are the control measures of air pollution?
19. Write the Lewis structure CCl_4 and NH_4Cl.
20. Calculate the O.N. of underlined atom of the
    i. (N̲H₄)₂SO₄   ii. Na₂S̲₂O₇
21. Identify the oxide
    i. NO   ii. Fe_3O_4
    iii. Al_2O_3 iv. H_2O
22. Give the structural formula of the following organic compounds:
    i. 3-chlorobutanal   ii. 3-methylbutanoic acid

Group 'B'

Attempt any five questions [5×5=25]

23. Write the chemical reaction for the laboratory preparation of H_2S gas. How does Kipp's apparatus work to supply H_2S gas in salt analysis?

24. A vessel of volume 100 mL contains 10% O_2 and 90% unknown gas. The gases diffuse in 86 sec through a small hole of the vessel. If pure oxygen under the same condition diffuse in 75 sec. Find the molecular mass of the unknown gas.

    Ans: 43.17 amu

25. 5 g of pure $CaCO_3$ if treated with 5 g of HCl to produce $CaCl_2$, CO_2 and H_2O
    i. Find which is limiting reactant and why?
    ii. Calculate mass of $CaCl_2$ formed.
    iii. How many number of water molecules are produced?
    iv. Calculate the volume of CO_2 produced at NTP.

    Ans: (i) $CaCO_3$ (ii) 5.55 g (iii) 3.011 × 10²² (iv) 1.12 L

26. State modern periodic law. What are the advantage of modern periodic table?

27. Define oxidation number. Balanced the redox reaction by oxidation number or ion electron method and indicate oxidizing and reducing agent.

    $KMnO_4 + KBr + H_2SO_4 \longrightarrow K_2SO_4 + MnSO_4 + H_2O + Br_2$

28. How is bromine manufacture from Carnalite? Give its action upon hot concentrated NaOH solution.

29. Describe the laboratory preparation of ethyne gas. What is the action of ethyne on:
    i. ammoniacal solution of Cu_2Cl_2
    ii. ozone

Group 'C'

Attempt any two questions [2×10=20]

30. a. State and explain the Graham's law of diffusion. Write its important application.
    b. When 2 g of a gas (P) is introduced into an evacuated flask kept at 25°C, the pressure is found to be one atmosphere. If 3 g of another gas (Q) is then added to the same flask, the total pressure becomes 1.5 atm. Assuming ideal behaviour of gas, calculate the ratio of molecular mass of $M_P:M_Q$.

    Ans: 1:1

31. Describe the principle and process for the manufacture of sulphuric acid with a labelled diagram by contact method. What happens when:
    i. copper turning is heated with conc. H_2SO_4
    ii. cane sugar is heated with con. H_2SO_4
    iii. red P is treated with conc. H_2SO_4
    Write down the test of sulphate ion in its aqueous solution.

32. Describe the manufacture of washing soda by Solvay ammonia process and write the reaction involves in it. What is the action of washing soda with:
    i. water   ii. lime water
    iii. SO_2

33. Write short notes on: (any two)   [2×5=10]
    i.   Smelting process
    ii. Le-Chatelier principle
    iii. Oxidant and Reductant
    iv. Functional group of organic compound

Set 2

Group 'A'

Attempt any fifteen questions   [15 × 2 = 30]

1. Define the terms:
   i. Viscosity   ii. Evaporation

2. Write one example of each:
   i.   Anisotropic solid   ii. Isotropic solid
   iii. Deliquesces solid   iv. Hygroscopy solid

3. Assign all the quantum number of 11th electron of Mg.

4. Distinguish between nascent hydrogen and atomic hydrogen.

5. State Law of multiple proportion.

6. Define aqueous tension. What is the application of Dalton's law of partial pressure?

7. What volume of air will be expelled from a vessel containing 400 cc. at 7°C when it is heated to 27°C at the same pressure?   **Ans: 28.57 cc**

8. How does natural radioactivity differ from artificial radioactivity?

9. Why are noble gases chemically inert?

10. Write the Lewis structure of: i. SO_4^{--} ii. CO_3^{--}

11. Assign the oxidation number to the underlined element in each of the following formulas:
    i. $Na_4[\underline{Fe}(CN)_6]$ ii. $NH_4\underline{N}O_3$

12. How many molecules of H_2O are present in a drop of pure water which weight 0.048 g?   **Ans: 1.60 × 10²¹**
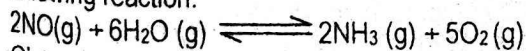
13. A metal is oxidized by heating in presence of oxygen to oxide. The mass of the residue was found to be increased by 34.78%. Calculate the equivalent mass of the metal.   **Ans: 23**

14. Write the expression for equilibrium constant (Kc) for the following reaction:
    $2NO(g) + 6H_2O(g) \rightleftharpoons 2NH_3(g) + 5O_2(g)$

15. Give any two differences between α-particle and β-particle.

16. Write any two differences between the bleaching action of Cl_2 and SO_2.

17. Which ion would you expect to have smaller size and why. Be^{++} or Li^+.

18. Write the IUPAC name of:
    i. HCHO   ii. $CH_3-CH_2-CONH_2$

19. What are oxides? Give an example of amphoteric oxide.

20. What is meant by acid rain? Give one major effect of acid rain.

21. Mention the biological importance of potassium and sodium metal.

22. Write down a functional isomer of CH_3-CH_2-OH and give its IUPAC name.

Group 'B'

Attempt any five questions   [5×5=25]

23. Describe Rutherford's α-ray scattering experiment. What are the conclusions drawn from this experiment about the structure of atom? Point out its limitations.

24. Give a brief account of:
    i. Alumino Thermite process   ii. Smelting process

25. A mixture of ozone and oxygen containing 20% by volume of ozone diffused through a porous plug in 172 seconds, while the same volume of pure oxygen took 164 seconds to diffuse through the same plug. Calculate the relative density of ozone.   **Ans: 23.95**

26. 4 gram of hydrogen combines with 100 gram of chlorine to produce hydrogen chloride gas (HCl).
   i.   Which is the limiting reactant?
    ii. Calculate the amount of reactant left unreacted.
    iii. Calculate the amount of HCl formed.
    iv. What volume of HCl gas is evolved at NTP?
    Ans: (i) Cl_2 (ii) 1.18 g (iii) 102.82g (iv) 63.1L

27. Give reasons with equations:
    i.   HI turns brown on standing.
    ii. HBr cannot be prepared by treated NaBr with conc. H_2SO_4.
    iii. CO_2 turns lime water milky but mikyness disappears when excess of CO_2 is passed through lime water.
    iv. When SO_2 is passed through red rose flowers then the colour of red flower discharged but an aerial oxidation the colourless flower gets black its original colour.

28. What is oxidation number? Balance the following equation by oxidation number or ion electron method.
    $K_2Cr_2O_7 + SnCl_2 + HCl \longrightarrow CrCl_3 + SnCl_4 + KCl + H_2O$
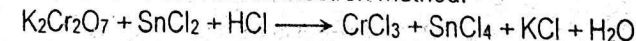
29. How is nitrogen detected in the organic compound by Lassaigne's method?

Group 'C'

Attempt any two questions   [2×10=20]

30. Derive the relation PV = nRT. Under what condition does a gas follow the above relation? How would you define universal gas constant 'R'? For 10 minutes, each at 27°C from two identical holes, N_2 gas and unknown gas are leaked into common vessel of three litre capacity. The resulting pressure is 4.18 atm and the mixture contains 0.4 mole of N_2 gas. What is the molecular mass of unknown gas?   **Ans: 448 amu**

31. Describe Haber's process for the manufacture of ammonia. Why is NH_3 not dried over conc. H_2SO_4 and anhydrous $CaCl_2$? What is the action of NH_3 with:
    i. CO_2 ii. $CuSO_4$
    iii. Chlorine in excess   iv. Na-metal
    v.   Nessler's reagent

32. How is sodium extracted by Down's process? Sketch a diagram for Down's cell and write reactions involved. What are the difficulties on obtaining sodium by this process and how are they removed? How does sodium react with:
    i. moist air
    ii. CO_2

33. Write short notes on: **(any two)** [2×5=10]
    i. Markovnikov's rule and ozonolysis
    ii. Kinetic theory of gas
    iii. Froth floatation and zone of refining
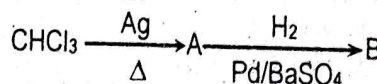   iv. Laboratory preparation of SO_2 gas

Set 3

Group 'A'
Attempt any fifteen questions [15 × 2 = 30]

1. What do you understand by water of crystallization? Give any two example of it.
2. Write any two physical properties o Oolf liquid caused by surface tenstion.
3. Mention an important use of:
    i. Deuterium
    ii. Heavy water
    iii. Nascent hydrogen
    iv. Tritium
4. What is ideal gas? Explain, why gases do not settle on the bottom of container.
5. Write a method of preparation of:
    i. Lime water from lime
    ii. Plaster of paris from gypsum salt
6. What happens when the gas obtained by heating oxalic acid and conc. H_2SO_4 is passed through: (a) NaOH solution (b) Finely divided Ni
7. 73 g of conc. HCl was diluted by adding 144 g of water. How many g atom of hydrogen are present in the dilute acid?
    Ans: 18 g
8. Write the IUPAC name of $CH_3-CH_2-CH = CH-CH_3$ and $CH_3-CH_2(OH) - CH_2-CH_3$
9. Calculate the equivalent weight of underlined element:
    i. $\underline{C}Cl_4$
    ii. $\underline{Mg}O$
    iii. $\underline{Fe}_2O_3$
    iv. $\underline{Al}Cl_3$
10. What is meant by thermonuclear reaction? Write an example.
11. Why is water not added to concentrated H_2SO_4 in order to dilute it?
12. Name the components that are responsible for:
    i. Acid rain
    ii. Photochemical smog
    iii. Ozone layer depletion
    iv. Green house effect
13. Compare the size of F^- and Na^+ with the atomic size of Ne.
14. One volume of H_2 reacts with one volume of Cl_2 to give two volume of hydrogen chloride. Which law of stoichiometry is illustrated? State the law.
15. State law of mass action and write Kc for the following reaction
    $$H_2 (g) + I_2 \rightleftharpoons 2HI (g)$$
16. 4s orbital starts filling before 3d, why?
17. Write the Lewis structure N_2O_5 and KNO_3.
18. Calculate the O.N. of underlined atom of:
    i. $\underline{N}H_4NO_3$
    ii. $H_2\underline{S}_2O_7$
19. Why Al_2O_3 is amphoteric but Na_2O is basic oxide but placed in the same period of periodic table?

20. Write the possible isomer of molecular formula C_3H_6O and write their IUPAC name.
21. Identify A and B in the following reaction and give their IUPAC name.
    $$CHCl_3 \xrightarrow[\Delta]{Ag} A \xrightarrow[Pd/BaSO_4]{H_2} B$$
22. Differentiate between nuclear fission and nuclear fusion.

Group 'B'
Attempt any five questions [5×5=25]

23. What do you mean by quantum number? What does it signify?
24. 17 g NH_3 is completely reacted with 45 g of oxygen to produce NO and H_2O
    i. Which is limiting reactant?
    ii. Calculate the number of moles of unreacted reactant left over.
    iii. What volume of NO are produced at NTP?
    iv. Calculate the mass of water produced.
    Ans: (i) NH_3 (ii) 0.156 mol (iii) 22.4L (iv) 27g
25. Draw a self explanatory sketch and discuss the principle involve for the manufacture of ammonia by Haber's process.
26. Balanced the redox reaction by oxidation number or ion electron method and indicate oxidizing and reducing agent.
    $K_2Cr_2O_7 + NaNO_2 + H_2SO_4 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + NaNO_3 + H_2O$
27. Give the chemistry of bleaching powder.
28. Compare and contrast the properties of HCl, HBr and HI.
29. Describe the detection of foreign element nitrogen and halogen organic compound.

Group 'C'
Attempt any two questions [2×10=20]

30. a. Draw the graph of Boyle's law and Charle's law and prove that $\dfrac{t_2}{t_1} = \sqrt{\dfrac{M_2}{M_1}}$
    b. In 2 metre long narrow tube, HCl is allowed to diffuse in the tube from one end and NH_3 from the other end. If diffusion starts at the same time, at what point from the NH_3 end do the white fumes of NH_4Cl form?
    Ans: 1.189 m
31. Write the principle involved along with a self-explanatory diagram for the manufacture of H_2SO_4 by contact process. How would you show that H_2SO_4 acts as:
    i. an acid
    ii. a dehydrating agent
    iii. oxidizing nature
    iv. precipitating nature.
32. How is washing soda manufactured by Solvay's ammonia process? Convert caustic soda into soda ash. Mention any two uses of washing soda.
33. Write short notes on: **(any two)** [2×5=10]
    i. s, p, d and f blocks in modern periodic table
    ii. Laboratory preparation of ethene.
    iii. Isomerism of organic compound.
    iv. Relation between Kp and Kc.

Set 4

Group 'A'

Attempt any fifteen questions   [15 × 2 = 30]

1. State Law of constant proportion.
2. Mention any two important characters of each of the following:
   i. Efflorescent solid
   ii. Deliquescent solid
3. Differentiate between boiling point from evaporation.
4. Write the IUPAC name of:
   i. $CH_3 - CH(CH_3) - CH(NH_2) - COOH$
   ii. $CH_3 - C(CH_3)_2 - C(NO_2)H - CH_3$
5. Calculate the weight of 100 mL of NH_3 gas at NTP.
   Ans: 0.0759 g
6. 74.5 g of a metallic chloride contains 35.5 g of chlorine. Calculate the equivalent mass of the metal.
   Ans: 39
7. Calculate the volume of 2 g of CO_2 gas at 23°C and 710 mm pressure.
   Ans: 1.182 L
8. Give any two differences between α-particles and β-particles.
9. Give the electronic configuration of copper and chromium in terms of s, p and d orbitals.
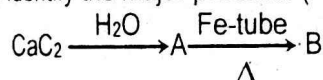10. Explain why:
    i. HCl has polar character though it has covalent bond
    ii. CO_2 is a linear molecular but H_2O is not
11. Write an example of each of the following:
    i. Wurtz's reaction
    ii. Markovnikov's rule
12. Define equilibrium constant (K_c). Why is backward reaction forward when $K_c > 1$?
13. Identify the major products (A) and (B) in the following:
    $$CaC_2 \xrightarrow{H_2O} A \xrightarrow[\Delta]{Fe\text{-}tube} B$$
14. Classify the following oxides with reasons: Fe_3O_4 and BaO_2
15. Differentiate between ortho and para hydrogen.
16. Write a chemical reaction for:
    i. Ring test   ii. Chloride test
17. What is the effect of heat on ortho phosphoric acid?
18. Name the chemical which are responsible for acid rain. What is the harmful effect of acid rain?
19. Distinguish between flux and slag with an example of each.
20. Write the Lewis structure of H_3PO_4 and $NaNO_3$
21. Which of the following pairs would have larger size and why?
    i. N^{3-} & O^{2-} ii. F^- & Na^+
22. Assign the oxidation number of the underlined element in each of the following:
    i. $K_4[\underline{Fe}(CN)_6]$ ii. $\underline{Fe}_2O_3$
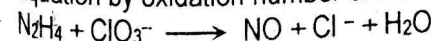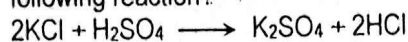
Group 'B'

Attempt any five questions   [5×5=25]

23. What are the differences between an atomic orbit and an atomic orbital? Draw the shapes of s and p orbital.
24. What is meant by redox reaction? Balance the following equation by oxidation number or ion-electron method:
    $$N_2H_4 + ClO_3^- \longrightarrow NO + Cl^- + H_2O$$

25. i. How much sulphuric acid containing 80 % H_2SO_4 by weight is needed for the production of 10 kg of hydrochloric acid containing 30 % HCl by weight in the following reaction?
    $$2KCl + H_2SO_4 \longrightarrow K_2SO_4 + 2HCl$$
    Ans: 5034.24 g
    ii. If the above reaction is carried out by mixing 32.75 g of pure KCl and 9.8 g pure H_2SO_4, find the limiting reactant.
    Ans: 21.54 g

26. How is nitric acid prepared from catalytic oxidation of ammonia?
27. Define homologous series. Write a homologous series containing –CHO as functional group. Mention any three important characteristics of homologous series.
28. Write down a balanced chemical reaction for the preparation of Cl_2 gas at laboratory. What is the action of Cl_2 on: (i)NH_3 (ii) conc. NaOH (iii) H_2S. How would you test the presence of Br^- in the aqueous solution?
29. Write down the chemistry of Epsom salt.

Group 'C'

Attempt any two questions   [2×10=20]

30. State and explain Dalton's law of partial pressure. What is its application? 50 cc of hydrogen are collected over mercury the level of which stands 20 cm above the level of mercury in the trough. If the atmospheric pressure be 760 mm, calculate the volume it will occupy when the level of mercury inside and outside the tube is made same.
    Ans: 34.84 cc
31. Describe laboratory method of preparation of hydrogen sulphide. What is the action of H_2S on: (i) acidified $K_2Cr_2O_7$ (ii) $FeCl_3$. Write the application of H_2S in salt analysis.
32. Sketch a neat and well labeled diagram for the manufacture of sodium carbonate by Solvay's ammonia process. Explain the chemical principle involved. What is the advantage of this process? Write down the molecular formula of: (i) soda ash (ii) baking soda (iii) washing soda.
33. Write short notes on: **(any two)**   [2×5=10]
    i. Demerits of Mendeleev's periodic table
    ii. Application of Le-Chatelier principle in chemical equilibrium
    iii. Laboratory method of ethyne
    iv. Lassaigne test of nitrogen.

Set 5

Group 'A'

Attempt any fifteen questions   [15 × 2 = 30]

1. State Law of reciprocal proportion.
2. Write down the three differences between crystalline and amorphous solid.
3. Give the value of all four quantum number of 11th electrons of Na.
4. Write the IUPAC name of:
   i. $CH_3 - CH(Br) - CH(NH_2) - COOH$
   ii. $CH_3 - C(CH_3)_2 - C(OH)H - CH_3$
5. What is the weight of 0.5 atom of oxygen?
6. Define equivalent weight of an element. A divalent metal has atomic weight 24. What is it's equivalent weight?
   **Ans: 12**

7. 200 g of 90 % pure calcium carbonate is completely reacted with excess of HCl to produce $CaCl_2$, H_2O and CO_2. What volume of CO_2 are produced if the reaction is carried out at 27°C temperature and 760 mm Hg pressure?

Ans: 44.33 L

8. An element has 2 electrons in K shell, 8 electrons in L shell and 9 electrons in M shell. Write its electronic configuration and calculate the total numbers of p-electrons.

9. The volume of carbon monoxide gas collected over water at 25°C is 680 cc with a total pressure of 752 mm Hg. The vapour pressure of water at 25°C is 23.8 mm Hg. Determine the partial pressure of CO in the container.

Ans: 728.20 mm Hg

10. How do increase in temperature and pressure affect the equilibrium of the following reaction:

$$2 SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) + heat$$
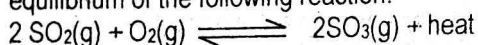
11. Write the molecular formula of:
    i. Borax
    ii. Orthophosphoric acid.

12. Classify the following oxides with reasons: Al_2O_3 and CO_2

13. What are the major components of photochemical smog? Write its effect.

14. Write the name of chemical compound which is formed in ring test of nitrate.

15. Distinguish between flux and slag with an example of each.

16. Write two reactions to show that H_2S is a reducing agent.

17. Why can't HI be prepared by the action of conc. H_2SO_4 on NaI?

18. Write the Lewis structure of H_2O_2 and HNO_3.

19. Which of the following pairs would have larger size and why?
    i. K & K^+
    ii. F & F^-

20. Assign the oxidation number of the underlined element in each of the following:
    i. $K_2\underline{S}_2O_3$
    ii. $\underline{S}O_2Cl_2$

21. How is natural radioactivity differed from artificial radioactivity?

22. Show your acquaintance with Wurtz reaction by giving example.

Group 'B'

Attempt any five questions [5×5=25]

23. Explain hydrogen spectra in the light of Bohr's theory. Why does hydrogen gas show large number of line spectra through H–atom contains one electron?

24. What is meant by redox reaction? Balance the following equation by oxidation number or ion-electron method:
    $$KMnO_4 + C_2H_2O_4 + H_2SO_4 \longrightarrow K_2SO_4 + MnSO_4 + CO_2 + H_2O$$
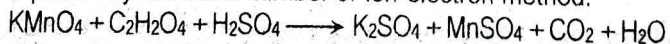
25. a. How much sulphuric acid containing 90 % H_2SO_4 by weight is needed for the production of 1000 kg of hydrochloric acid containing 42 % HCl by weight in the following reaction?
    $$2NaCl + H_2SO_4 \longrightarrow Na_2SO_4 + 2HCl$$
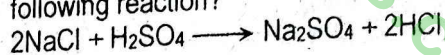
    Ans: 626.48 kg

    b. if the above reaction is carried out by mixing 11.7 g of pure NaCl and 10 g pure H_2SO_4, find the limiting reactant.

    Ans: 9.8 g

26. How are metals generally extracted from ores and purified?
27. Define homologous series. What are the characteristics of a homologous series?
28. Describe the laboratory preparation of H_2S gas.
29. How is bromine manufactured from Carnalite?

Group 'C'

Attempt any two questions [2×10=20]

30. State and explain Dalton's law of partial pressure. 0.50 g of a volatile liquid was introduced into a globe of 1000 mL capacity. The globe was heated to 91°C, so that all the liquid vaporized exerted a pressure of 190 mm Hg. Calculate the molecular mass of the liquid. (R = 0.0821 L atm. K^{-1} mol^{-1})

Ans: 59.76 amu

31. Write down the principle and sketch a labeled diagram for the manufacture of nitric acid by the oxidation of ammonia. What happens when:
    i. conc. Nitric acid is exposed to light for a long time
    ii. iron is treated with conc. Nitric acid
    iii. freshly prepared $FeSO_4$ solution is added to equal volume mixture of conc. H_2SO_4 and conc. HNO_3

32. Describe in brief the manufacture of sodium hydroxide by Castner-Kellner process. What happens when:
    i. sodium is treated with ammonia
    ii. washing soda is heated
    iii. sodium burns with CO_2
    iv. CO_2 gas is passed through NaOH solution
    Why is sodium fire not extinguished by adding water?

33. Write short notes on: **(any two)** [2×5=10]
    i. Laboratory preparation of ethyne gas
    ii. Law of mass action
    iii. Laboratory method of CO gas
    iv. Chemistry of Epsom salt