COMPREHENSIVE EXAMINATION 2019
XI – CHEMISTRY
PAPER – I (Science Pre-Engineering & Pre-Medical Groups)

Time Allowed: 2 Hours 40 mins. **Max. Marks: 68**

SECTION 'B'
(SHORT – ANSWER QUESTIONS)

(Marks: 40)

NOTE: Answer any **TEN** questions from this Section. All questions carry equal marks.

Q-2

i) Define the following:

*Activation energy	***Mole**	***Stoichiometry**	***Avogadro's Number**	***Internal energy**
***Limiting reactant**	***Surface Tension**	***Significant Figures**	*Unit cell	*Rounding off
***Threshold energy**	***Specific rate constant**	*Intensive Properties	***Molar Volume**	***Hydrogen Bonding**
***Latent heat of fusion**	***Order of reactiohn**	***Common ion effect**		***Significant figures**
***Enthalpy**	*Empirical formula	***Systematic Error**	*Bond Energy	***Atomic Mass**
*Colligative Properties	***System**	*Ionization Energy	***Sublimation**	***Molarity**
***Standard Heat of formation**	***Molar volume**	***Extensive Properties**	*Sublimation	

ii) **Differentiate between the following (ANY TWO):**

***Azimuthal Quantum Number and Principal Quantum Number**
***Polar and Non-polar bond**
*V.B.T and M.O.T
***Isomorphism & Polymorphism**
***Extensive and Intensive Properties**
*Balmer and Lyman Series
***Hydration and Hydrolysis**
***Molar and Molal Concentrations**
***Orbit and Orbital**
*Solubility and Solubility Product
***Bonding Molecular Orbital and Anti-bonding Molecular Orbital**
***Continuous and Line Spectrum**
*E.N. & Electron affinity
***Exothermic and Endothermic reactions**
***Sigma and Pi Bond**
***Exponential Notation and Significant figures**
*Molecular and Empirical Formula
*Rate of Reaction and Velocity of Reaction
*Crystalline and Amorphous Solids
***Reversible and irreversible reactions**

iii) How is chemical equilibrium established? How is equilibrium constant used to predict the direction of a reversible reaction. OR 3.86 gram of NaOH is dissolved in 2.5 dm^3 of solution. Find its molarity. **OR Define the term Concentration? Discuss the various units of concentration.**

iv) Give reasons for *ANY FOUR* of the following:

***Glycerine is distilled at reduced pressure.**
*Ionic compounds have higher melting points.
***Chemical equilibrium is dynamic in nature.**
***Pressure of a gas collected over water is not the true pressure.**
***No liquid ionic compounds are known but many of the known covalent compounds are liquids & gases.**
***Aqueous solution of NH_4Cl is acidic and whereas Na_2CO_3 is basic.**
*A positive catalyst increases the rate of reaction.
***Ice is a solid but it floats on water.**
*Spilled water evaporate more quickly than a water on a surface.
***The rates of diffusion of CO_2 and C_3H_8 gases are the same.**
***p-p sigma bond is stronger than s-p sigma bond.**
***Powdered zinc reacts more rapidly.**
*A pressure cooker is used for rapid cooking.
***H_2S is a gas while H_2O is a water at room temperature**
***Water forms concave meniscus but mercury forms convex meniscus.**

***Food is preserved in refrigerator.**

*Evaporation is a cooling Process.

*I.P. value of Nitrogen is greater than I.P. Value of Oxygen.

***Honey is more viscous than water.**

***The ability of an ion to form hydrate depends on its charge density**.

v) Balance any ONE of the following Chemical equation by Ion-electron Method?

***$MnO_4^{-1} + Fe^{+2} \rightarrow Mn^{+2} + Fe^{+3}$**

* $HI + HNO_3 \rightarrow I_2 + NO + H_2O$

***$Cr_2O_7^{-2} + I + H \rightarrow Cr^{+3} + IO_3^- + H_2O$**

* $Cr_2O_4^{-2} + I^- \rightarrow Cr^{+3} + IO_3^-$ (Basic Medium)

*** $Cr(OH)_3 + SO_4^{-2} \rightarrow CrO_4^{-2} + SO_3^{-2}$**

OR

Discuss the ionic character of Covalent bond? OR Name ANY FOUR series in the Hydrogen Spectrum?

vi) a) Find the pH of 1.0 x 10^{-3} M NaOH Solution? **OR Write the rate expressions for the following: (i) $PCl_5 \longrightarrow PCl_3 + Cl_2$ (ii) $2NO + O_2 \longrightarrow 2NO_2$**

b) Derive the value of 'R' in TWO different Unit Systems? *OR* How is Buffer Solution prepared? *OR* Derive both forms of Equation of state/Ideal Gas Equation from Gas Laws? *OR* Compare the rates of diffusion of He and SO_2? *or* CH_4 and SO_2? **OR State Hess's Law of constant heat of summation. Give its verification and applications?**

vii) Write the Postulates of Kinetic Molecular Theory of Gases? Calculate the volume of 14g of Nitrogen at 20^0 C and 740 torr pressure. OR Write down the postulates of Arrhenius Theory of Ionisation? OR State and Explain Activation Energy? OR Define Heat of formation. Calculate the Heat of Formation of Acetic acid from the following data:

***$2C + 3H_2 \rightarrow C_2H_6$** $\Delta H_{f=}$ **?**

***$C + O_2 \rightarrow CO_2$** $\Delta H_{f=}$ **-394 KJ/mol**

***$H_2 + \frac{1}{2}O_2 \rightarrow H_2O$** $\Delta H_{f=}$ **-286 KJ/mol**

***$C_2H_6 + \frac{7}{2}O_2 \rightarrow 2CO_2 + 3H_2O$** $\Delta H_{f=}$ **-1560.632 KJ/mol**

OR

$2NO_{2\,(g)} \rightarrow N_2O_{4\,(g)}$ $\Delta H_{f=}$ **?**

Given: (i) $N_2 + 2O_2 \rightarrow 2NO_2$ $\Delta H_{f=}$ **67.9 KJ/mol**

(ii) $N_2 + 2O_2 \rightarrow N_2O_4$ $\Delta H_{f=}$ **9.3 KJ/mol**

viii) Describe the Chadwick experiment for the discovery of Sub-atomic Particle? **OR**

What is Dipole moment with its unit? Explain it in CO_2 and H_2O molecules. OR Helium takes 5 seconds to effuse from a hole of 10 dm^3 container. How long would it take for oxygen to effuse from the same container at the same pressures and temperatures.

ix) What do you mean by Exothermic and Endothermic Reactions. Illustrate it with the help of diagram and give one example of each. **OR What are the Postulates of Electron pair repulsion theory? Explain the Shape of NH_3, BF_3 and H_2O (or C_2H_4) on the basis of this theory. OR**

What do you understand by the term Ionisation Potential, Electron Affinity and Electronegativity? How E.N. can be used to predict the nature of bonds between the atoms.

x) State the rule which is violated in the following electronic configurations:

*** N = $1s^2$, $2s^2$, $2p_x^2$, $2p_y^1$, $2p_z^0$**

*** Na = $1s^2$, $2s^2$, $2p^7$**

OR What are the applications of Law of equilibrium? Explain with examples. **OR**

Do as directed: (*ANY FOUR*)

***Arrange 4s, 3p, 3d, 2p, 1s and 7p by *n* + *l* rule.**

***Arrange 4 Quantum Numbers to 2 electrons in 3p orbitals or He atom.**

***State Hund's Rule? Also write the stable electronic configuration of Z = 24, 29, 42, Br^- (Z=35) or Ga^{+3} (Z=31)**

***Which rule or principle is violated in $1s^2$, $2s^3$, $2p^5$ *or* $1s^2$, $2s^2$, $2p_x^2$**

***Solve by using exponential notation: 43100 + 3900 + 2100**

***Which law is related to given statement ''we can easily identify that a person just entered in the room is wearing perfume''.** *Association of water molecules through hydrogen bond (Draw the Diagram only)

***Draw the shape of orbital for which *l* = 0 and *l* = 1? *Draw dot & cross structures of $CHCl_3$ and C_2H_4**

OR

A Voltaic cell (Emf = 0.34 V) is made up of Standard Hydrogen Electrode and Copper electrode is represented by:

Pt H_2 / $2H^+$ aq. (1M) || Cu^{+2} aq. (1M) / Cu

- Draw the Complete diagram of this cell, showing the direction of electron flow in the circuit.
- Write the Half Cell reactions and overall cell reaction.
- Determine the Reduction Potential of Copper mentioning its sign.

xi) What is an Ionic Bond and Lattice Energy? Write the formation of NaCl from sodium atom and Chlorine atom along with the energy changes involved. Also discuss its Stability.

OR

State and Explain Dalton's Law of Partial Pressures with application.

OR 60 cm^3 of hydrogen gas were collected over water at 15^0 C and 767 torr pressure. What volume will the dry gas occupy at S.T.P? (Vapor pressure of water at 15^0 C is 15.7 torr) *OR* 50 cm^3 of hydrogen gas was collected at 27^0 C at a pressure of 800 torr pressure. Calculate its volume at S.T.P?

OR For the gaseous equilibrium.

$2NO_{(g)} + O_{2(g)} \leftrightarrow NO_{2(g)}$ ΔH = -ve

Predict only the directions in which the reaction will proceed after the following changes are brought about an equilibrium.**

(i) increasing the concentration of NO **(ii) decreasing the concentration of NO_2**

(iii) increasing the temperature **(iv) increasing the pressure**

xii) Define Oxidising and Reducing Agent? In this reaction which substance is a reducing agent?

$2Fe + 3Cl_2 \longrightarrow 2FeCl_3$. Also find the oxidation number of the following:

***Mn in MnO_4^-** *N in NCl_3 *Fe in $Fe_2(SO_4)_3$ ***P in H_3PO_4** ***C in C_2H_6O**

***S in $Na_2S_2O_3$** ***Cr in $K_2Cr_2O_7$** ***O in OF_2** *O in KO_2

OR Define Solubility Product. Will *AgCl* precipitate from a solution prepared by mixing 400 ml of 0.1 M NaCl and 600 ml of 0.03 M $AgNO_3$? ($K_{sp} = 1.6 \times 10^{-10}$).

OR On what factors does the solubility of substance depends? K_{sp} for PbI_2 is 1.2×10^{-9} mol^3/dm^9. Find its:

***Solubility in mol/dm^3** ***Solubility in g/dm^3**

xiii) What weight of *NaCl* will be obtained when 100 gram of Na_2CO_3 is treated with the 100 grams of *HCl*.

OR

For the reaction: $3Mg + N_2 \longrightarrow Mg_3N_2$

1.5gm of each reactant i.e. Mg and N_2 are used; what is the amount of Mg_3N_2 formed and which element is the limiting reactant?

OR

Calculate the wave number of spectral lines of hydrogen gas when an electron jumps from n = 4 to n = 2. (R_H = 109, 678 cm^{-1}) OR

2.273 g of a gas at 27^0 C and 900 torr pressure occupies a volume of 1.4 dm^3. Calculate the molecular mass of the gas.

xiv) When 4000 joule of heat is added to a gaseous system at a constant pressure of 101300 N/m^2 ; its internal energy increases by 500 J. Calculate the change in the volume of the system.

OR

Calculate the no. of molecules of CO_2 at S.T.P when 6.1 gm marble is reacted with 2.8 g hydrochloric acid,

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$

OR If 250 ml of 1M HCl solution is diluted to 1000 ml. What would be the molarity of diluted solution and also calculate its pH. OR

a) Calculate the no. of atoms of Na in 9.2 grams of Sodium? **OR** A container holds 9gm of H_2O. How many water molecules are present? Also calculate the total no. of atoms.

b) A 600 dm^3 vessel contains 2g of H_2 and 8g of CH_4. Calculate the total pressure of mixture of gas at 30^0C. **OR Calculate the no. of atoms presentin 7.2gm of Calcium?** *OR* Calculate the mass and no. of molecules in 18000 cm^3 of H_2S at S.T.P?

xv) Using the significant figure rules, simplify: $\frac{92 \times 751 \times 173}{760 \times 297}$ *OR* $\frac{2.417 \times 8.123}{4.956}$ *OR* **Give the significant figures of the following: *46.75 *0.00067 *506.40 *76000**

OR An organic compound producing air pollution contains 8.73% carbon. 77.45% chlorine and 13.82% fluorine; find the molecular formula of the compound if its molecular mass is 137.5 (Atomic mass: C = 12, Cl = 35.5, F = 19)

OR 1.8gm of an organic compound on combustion gave 3.21gm CO_2 and 1.322gm H_2O. Calculate the empirical formula. OR What is Natural and Artificial radioactivity? How were the α – rays used in the discovery of the nucleus.

SECTION 'C'
(DETAILED-ANSWER QUESTIONS)

(Marks: 28)

NOTE: Attempt any **TWO** question from this Section. Draw diagram where necessary.

Q-3

a) State Le-chatelier's Principle. Describe suitable conditions for the high yield of SO_3 in Contact process. *OR* NH_3 by Haber process.

OR What are Ideal and Non-ideal gases? Explain the causes of non-ideal behavior of gases especially at high pressures and low temperatures. OR

State the postulates of Bohr's Atomic Model. Derive an expression for the *Total Energy* *OR* ***Radius*** **of the electron in the nth orbit** *OR* **Wave Number of the radiation emitted by H-atom? Also calculate the radius of 3rd orbit? (a_0 = 0.529A).**

b) Define Electrolyte, Electrode, Electrode Potential and Standard Electrode Potential? What is the electrode potential of Copper and How it is determined experimentally.

OR

When the equilibrium was attained for the reaction A + B ≡ 2C, the concentration of [A] = [B] = 4 mol/dm^3 and that of [C] = 6 mol/dm^3 , Calculate K_c and initial concentration of A and B. **OR Find the pH and pOH of 0.3M $Mg(OH)_2$ solution which is 60% ionized? OR What is the H^+ and OH^- ion concentration of a solution having pH equal to 7.86? OR The equilibrium constant for the reaction $H_2 + I_2 \rightarrow 2HI$ at 700^0 C is 55.**
Calculate the equilibrium concentration of reactants and products when the initial concentrations of H and I are 2.55 moles/dm^3 each.

c) Write Short Notes on Any TWO of the following:

*Heisenberg's Uncertainity Principle ***Surface Tension** *Viscosity
***Indicators** ***Crystal Systems** ***Quantum Number** *Planck's Quantum Theory
***Covalent bond and its types**

Q-4

a) Consider the following experimental data:

S.No.	[X] mol.dm^{-3}	[Y] mol.dm^{-3}	Rate mol.dm^{-3}sec^{+1}
1.	0.10	0.10	2.0×10^{-3}
2.	0.20	0.10	8.0×10^{-3}
3.	0.10	0.20	4.0×10^{-3}

*Write rate expression.
*Determine the order of reaction.
*Calculate the rate constant of the reaction.

OR

State and Explain first law of thermodynamics. Prove that $q_p = \Delta E + P\Delta V = \Delta H$ and W = P ΔV OR

If the initial rate for the decomposition of NO_2 (Nitrogen dioxide) $2NO_2 \longrightarrow 2NO + O_2$ is 4.5×10^{-9} mole per liter per second.
i) Write the rate equation. ii) Calculate the rate constant
iii) Calculate the rate constant when the concentration of NO_2 is doubled.

b) Define rate of reaction. List the factors affecting rate of chemical reaction and explain any TWO of them.
OR Discuss the effect of light and catalyst on the rate of reaction? Also Explain how the rate of the following reaction is determined by the chemical method. $CH_3COOC_2H_5 + H_2O \longrightarrow CH_3COOH + C_2H_5OH$ OR
Name the crystal system which has the following axes and angles:

- **a = b = c ; α = β = γ = 90^0**
- **a = b ≠ c ; α = β = γ = 90^0**
- **a ≠ b ≠ c ; α = β = γ = 90^0**
- **a = b ≠ c ; α = β = 90^0, γ = 120^0**

c) **What do you understand by the term Common ion effect? Explain its application in Qualitative salt analysis.**
OR
What are Cathode rays? How were Cathode rays discovered by Discharge Tube Experiment. Did they depend upon the nature of gas filled inside the tube.

Q-5

a) **Define Orbital Hybridisation and write its types. Draw and explain following the molecules on the basis of HOT/Hybridisation:**
***H_2O *C_2H_2 *NH_3** *$BeCl_2$ ***C_2H_4**
OR
State and Explain the Law of Mass Action. Derive an expression for the equilibrium constant K_c for the reaction. $n_1A + n_2B \equiv n_3C + n_4D$. **Also give the relationship between K_p and K_c.*****
OR
9.2gm of ethyl alcohol, 3.6gm of acetic acid, 1.1gm of ethyl acetate and 9.0gm of water were mixed and allowed to attain equilibrium. If $K_c = 4$, what was the concentration of the resulting mixture?
OR What is meant by electrolysis? Discuss the electrolysis of $CuCl_2$ with necessary electrode reactions? **OR For the reaction $N_2 + O_2 = 2NO$ Kc is 0.110 at 2000^0 C. Calculate the equilibrium concentration of N_2 , O_2 and NO when the initial concentrations of N_2 and O_2 are 0.1M each and the volume of the vessel is $5dm^3$.**

b) **What are Roentgen-rays? Discuss their origin and also describe their relationship with the atomic number.**
OR
What is Dative bond? Illustrate it with the formation of: (i) $POCl_3$ (ii) CH_3NO_2 (iii) NH_4^+

c) State and Explain Graham's Law of Diffusion?
OR
Describe Gold foil Experiment with its Conclusion for the discovery of nucleus in an atom. Also mention its drawbacks. OR
State the following Laws in terms of K.M.T:
***Boyle's Law *Charle's Law *Dalton's Law of Partial Pressures**
OR Two gases A and B having the same volume effuse from a container in 20 seconds and 10 seconds respectively. If the molecular mass of gas A is 49 a.m.u. Find the molecular mass of gas B.

---------- **BEST OF LUCK** ----------

Marked with '**RED BOLD**' are the '**MOST IMPORTANT**' Questions.