



## 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 reaction	*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
- \*Crystalline and Amorphous Solids
- \*Rate of Reaction and Velocity of Reaction
- \*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<sup>3</sup> 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<sub>4</sub>Cl is acidic and whereas Na<sub>2</sub>CO<sub>3</sub> 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<sub>2</sub> and C<sub>3</sub>H<sub>8</sub> 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<sub>2</sub>S is a gas while H<sub>2</sub>O is a water at room temperature
- \*Water forms concave meniscus but mercury forms convex meniscus.

\*Food is preserved in refrigerator.

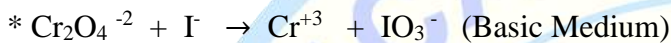
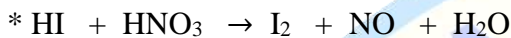
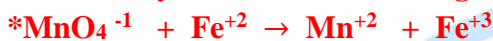
\*Evaporation is a cooling Process.

\*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?

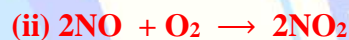
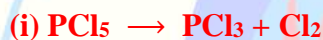


OR

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

vi) a) Find the pH of  $1.0 \times 10^{-3}$  M NaOH Solution? OR Write the rate expressions

for the following:



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  $\text{SO}_2$ ? OR  $\text{CH}_4$  and  $\text{SO}_2$ ? OR State Hess's Law of constant heat of summation. Give its verification and applications?

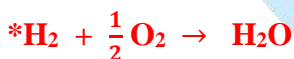
vii) Write the Postulates of Kinetic Molecular Theory of Gases? Calculate the volume of 14g of Nitrogen at  $20^\circ\text{C}$  and 740 torr pressure. OR Write down the postulates of Arrhenius Theory of Ionisation? OR State and Explain Activation Energy? OR Define Heat of formation. Calculate the Heat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



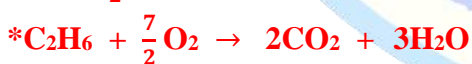
$\Delta H_f = ?$



$\Delta H_f = -394 \text{ KJ/mol}$

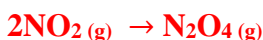


$\Delta H_f = -286 \text{ KJ/mol}$

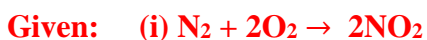


$\Delta H_f = -1560.632 \text{ KJ/mol}$

OR



$\Delta H_f = ?$



$\Delta H_f = 67.9 \text{ KJ/mol}$



$\Delta H_f = 9.3 \text{ KJ/mol}$

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

What is Dipole moment with its unit? Explain it in  $\text{CO}_2$  and  $\text{H}_2\text{O}$  molecules. OR

Helium takes 5 seconds to effuse from a hole of  $10 \text{ dm}^3$  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  $\text{NH}_3$ ,  $\text{BF}_3$  and  $\text{H}_2\text{O}$  (or  $\text{C}_2\text{H}_4$ ) 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:



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  $Z = 24, 29, 42, \text{Br}^- (Z=35)$  or  $\text{Ga}^{+3} (Z=31)$

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

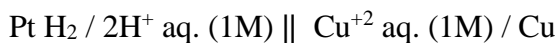
\*Solve by using exponential notation:  $43100 + 3900 + 2100$

\*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  $\text{CHCl}_3$  and  $\text{C}_2\text{H}_4$

OR

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



- 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.

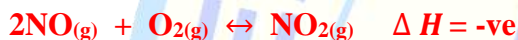
x) **What is an Ionic Bond and Lattice Energy? Write the formation of NaCl from sodium atom and Chlorine atom along with the energy changes involved. Also discuss its Stability.**

**OR**

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

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

**OR** For the gaseous equilibrium.



**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<sub>2</sub>

(iii) increasing the temperature

(iv) increasing the pressure

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



\*Mn in MnO<sub>4</sub><sup>-</sup>

\*N in NCl<sub>3</sub>

\*Fe in Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>

\*P in H<sub>3</sub>PO<sub>4</sub>

\*C in C<sub>2</sub>H<sub>6</sub>O

\*S in Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>

\*Cr in K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>

\*O in OF<sub>2</sub>

\*O in KO<sub>2</sub>

**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<sub>3</sub>? (K<sub>sp</sub> = 1.6 x 10<sup>-10</sup>).

**OR** On what factors does the solubility of substance depends? K<sub>sp</sub> for PbI<sub>2</sub> is 1.2 x 10<sup>-9</sup> mol<sup>3</sup>/dm<sup>9</sup>. Find its:

\*Solubility in mol/dm<sup>3</sup>

\*Solubility in g/dm<sup>3</sup>

xiii) **What weight of NaCl will be obtained when 100 gram of Na<sub>2</sub>CO<sub>3</sub> is treated with the 100 grams of HCl.**

**OR**



1.5gm of each reactant i.e. Mg and N<sub>2</sub> are used; what is the amount of Mg<sub>3</sub>N<sub>2</sub> 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<sub>H</sub> = 109, 678 cm<sup>-1</sup>) **OR**

2.273 g of a gas at 27<sup>0</sup> C and 900 torr pressure occupies a volume of 1.4 dm<sup>3</sup>. 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<sup>2</sup>; its internal energy increases by 500 J. Calculate the change in the volume of the system.

**OR**

Calculate the no. of molecules of CO<sub>2</sub> at S.T.P when 6.1 gm marble is reacted with 2.8 g hydrochloric acid,



**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<sub>2</sub>O. How many water molecules are present? Also calculate the total no. of atoms.

b) A 600 dm<sup>3</sup> vessel contains 2g of H<sub>2</sub> and 8g of CH<sub>4</sub>. Calculate the total pressure of mixture of gas at 30<sup>0</sup>C. **OR**

Calculate the no. of atoms present in 7.2gm of Calcium? **OR** Calculate the mass and no. of molecules in 18000 cm<sup>3</sup> of H<sub>2</sub>S 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<sub>2</sub> and 1.322gm H<sub>2</sub>O. 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<sub>3</sub> in Contact process. OR NH<sub>3</sub> 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 3<sup>rd</sup> orbit? (a<sub>0</sub> = 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  $A + B \rightleftharpoons 2C$ , the concentration of  $[A] = [B] = 4 \text{ mol/dm}^3$  and that of  $[C] = 6 \text{ mol/dm}^3$ , Calculate  $K_c$  and initial concentration of A and B. **OR Find the pH and pOH of 0.3M Mg(OH)<sub>2</sub> solution which is 60% ionized? OR What is the H<sup>+</sup> and OH<sup>-</sup> 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<sup>o</sup> C is 55. Calculate the equilibrium concentration of reactants and products when the initial concentrations of H and I are 2.55 moles/dm<sup>3</sup> each.**

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

\*Heisenberg's Uncertainty 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 <sup>-3</sup>	[Y] mol.dm <sup>-3</sup>	Rate mol.dm <sup>-3</sup> sec <sup>-1</sup>
1.	0.10	0.10	2.0 x 10 <sup>-3</sup>
2.	0.20	0.10	8.0 x 10 <sup>-3</sup>
3.	0.10	0.20	4.0 x 10 <sup>-3</sup>

\*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  $W = P \Delta V$  OR**

**If the initial rate for the decomposition of NO<sub>2</sub> (Nitrogen dioxide)  $2NO_2 \rightarrow 2NO + O_2$  is 4.5 x 10<sup>-9</sup> 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<sub>2</sub> 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 the rate of the following reaction is determined by the chemical method.  $CH_3COOC_2H_5 + H_2O \rightarrow CH_3COOH + C_2H_5OH$  OR**

**Name the crystal system which has the following axes and angles:**

- $a = b = c ; \alpha = \beta = \gamma = 90^\circ$
- $a = b \neq c ; \alpha = \beta = \gamma = 90^\circ$
- $a \neq b \neq c ; \alpha = \beta = \gamma = 90^\circ$
- $a = b \neq c ; \alpha = \beta = 90^\circ, \gamma = 120^\circ$

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<sub>2</sub>O

\*C<sub>2</sub>H<sub>2</sub>

\*NH<sub>3</sub>

\*BeCl<sub>2</sub>

\*C<sub>2</sub>H<sub>4</sub>

**OR**

State and Explain the Law of Mass Action. Derive an expression for the equilibrium constant K<sub>c</sub> for the reaction.

n<sub>1</sub>A + n<sub>2</sub>B ⇌ n<sub>3</sub>C + n<sub>4</sub>D. **Also give the relationship between K<sub>p</sub> and K<sub>c</sub>.\*\*\***

**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<sub>c</sub> = 4, what was the concentration of the resulting mixture?

**OR** What is meant by electrolysis? Discuss the electrolysis of CuCl<sub>2</sub> with necessary electrode reactions? **OR** For the reaction N<sub>2</sub> + O<sub>2</sub> = 2NO K<sub>c</sub> is 0.110 at 2000<sup>0</sup> C. Calculate the equilibrium concentration of N<sub>2</sub>, O<sub>2</sub> and NO when the initial concentrations of N<sub>2</sub> and O<sub>2</sub> are 0.1M each and the volume of the vessel is 5dm<sup>3</sup>.

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<sub>3</sub> (ii) CH<sub>3</sub>NO<sub>2</sub> (iii) NH<sub>4</sub><sup>+</sup>

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.

✚ **PEC REGISTERED ENGINEER - BE (NED UET) -  
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