Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	The pH of mixture of CH_3COONa and CH_3COOH is :				
	(A) 7	(B) > 7		(C) < 7	(D) 1
2	Balmer series in hydrogen spectrum lies in the region :				
	(A) Ultraviolet	(B) Visible		(C) Infrared	(D) Microwave
3	Density of an ideal gas can be calculated by the formula :				
	(A) $d = nRT$	(B) $d = \dfrac{PM}{RT}$		(C) $d = \dfrac{m}{M} RT$	(D) $d = \dfrac{PV}{M}$
4	In endothermic reactions, the heat content of the :				
	(A) Products is more than that of reactants		(B) Reactants is more than that of products		
	(C) Surrounding increases		(D) Reactants and products are equal		
5	Which of the following species has unpaired electrons in antibonding molecular orbitals :				
	(A) O_2^{2+}	(B) N_2^{2-}		(C) B_2	(D) F_2
6	1 gram formula of $NaCl$ is equal to :				
	(A) 58.5 g	(B) 23 g		(C) 35.5 g	(D) 12 g
7	The unit of rate constant is the same as that of rate of reaction in :				
	(A) First order reaction	(B) Second order reaction				
	(C) Zero order reaction	(D) Third order reaction				
8	When water freezes at 0 °C, its density decreases due to :				
	(A) Cubic structure of ice		(B) Empty spaces present in structure of ice		
	(C) Change of bond lengths		(D) Change of bond angles		
9	An excess of silver nitrate in aqueous form is added to aqueous barium chloride and precipitate is removed by filtration. What are main ions in the filtrate :				
	(A) Ag^+ and NO_3^- only		(B) Ag^+ and Ba^{2+} and NO_3^-		
	(C) Ba^{2+} and NO_3^- only		(D) Ba^{2+} and NO_3^- and Cl^-		
10	Many elements have fractional atomic masses, this is because :				
	(A) The mass of an atom is itself fractional		(B) Atomic masses are average masses of isobars		
	(C) Atomic masses are average masses of isotopes				
	(D) Atomic masses are average masses of isotopes proportional to their relative abundance				
11	According to VSEPR theory, the shape of PH_3 molecule is :				
	(A) Trigonal pyramidal	(B) Tetragonal		(C) Linear	(D) Trigonal planer
12	Which of the following compounds do not show process of sublimation :				
	(A) Ammonium chloride	(B) Iodine	(C) Naphthalene	(D) Carbon tetra chloride	
13	A thermometer used in Landsberger's method can read upto :				
	(A) 0.1 K	(B) 0.01 F		(C) 0.01 K	(D) 0.01 °C
14	In the monoclinic crystal system, bond axes are :				
	(A) a = b = c	(B) a = b ≠ c		(C) a ≠ b = c	(D) a ≠ b ≠ c
15	If a salt bridge is not used between two half cells, then the voltage :				
	(A) Decreases rapidly	(B) Decreases slowly	(C) Does not change	(D) Drops to zero	
16	Orbitals having same energy are called :				
	(A) Hybrid orbitals	(B) Valence orbitals	(C) Degenerate orbitals	(D) d-orbitals	
17	If absolute temperature of a gas is doubled and the pressure is reduced to one half, the volume of the gas will :				
	(A) Remain unchanged	(B) Increase four times	(C) Reduce to $\dfrac{1}{4}$	(D) Be doubled	

CHEMISTRY   221-(INTER PART – I)   Time Allowed : 2.40 hours

PAPER – I (Essay Type)   GROUP – I   Maximum Marks : 68

SECTION – I   LHR-4L2I

2. Write short answers to any EIGHT (8) questions :   **16**

(i) How is the law of conservation of mass obeyed during stoichiometeric calculations?

(ii) Why N_2 and CO have same number of electrons, protons and neutrons? Justify.

(iii) Define mole. Calculate the gram atoms (moles) in 0.1 g of sodium.

(iv) Draw the beautiful diagram of sublimation process.

(v) Write down the uses of chromatography.

(vi) What is the physical meaning of R?

(vii) Prove Boyle's law in the light of K.M.T.

(viii) What are the two characteristics of plasma?

(ix) Write down the quantitative statement of Charles's law.

(x) Define heat of solution.

(xi) How will you justify that the lowering of vapour pressure is a colligative property?

(xii) Differentiate between ideal and non-ideal solutions.

3. Write short answers to any EIGHT (8) questions :   **16**

(i) Ethyl alcohol is soluble in water. Why?

(ii) Explain H-bonding in deoxyribonucleic acid (DNA).

(iii) What do you know about anisotropy, explain with example?

(iv) What is allotropy, give one example?

(v) Write two nuclear reactions for production of gamma (γ) radiations and β-particle.

(vi) Write defect of Rutherford Atomic Model.

(vii) Define Heisenberg's uncertainty principle and write its mathematical equation.

(viii) Write name of different quantum numbers.

(ix) Write Henderson's equation for acidic and basic buffer.

(x) Why do we need buffer solution?

(xi) Explain specific rate constant briefly.

(xii) What is zero order reaction, give one example?

4. Write short answers to any SIX (6) questions :   **12**

(i) Define bond order and give one example.

(ii) Draw diagram for formation of bonding and antibonding molecular orbitals for H_2 molecule.

(iii) Define sigma bond and pi-bond.

(iv) Define atomic orbital hybridization.

(v) What is first law of thermodynamics, give its mathematical equation?

(vi) Define enthalpy of combustion ΔH_c^o.

(vii) How anodized aluminium is prepared in an electrolytic cell?

(viii) Draw a diagram of standard hydrogen electrode (SHE)

(ix) Define electrochemical series.

(Turn Over)

SECTION – II

Note :   Attempt any THREE questions.   LHR-GL21

5. (a) NH_3 gas can be produced by heating together NH_4Cl and $Ca(OH)_2$. If a mixture
containing 100g of each solid is heated then calculate the number of grams of NH$_3$ produced.
$$2NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + 2NH_3 + 2H_2O$$ 4

   (b)   Explain isomorphism with examples. 4

6. (a)   Give postulates of kinetic molecular theory. 4

   (b)   Derive an expression to determine radius of an orbit using Bohr's model. 4

7. (a)   What is sp^2 hybridization, how it explains structure of ethene? 4

   (b)   What is Hess's law? Explain by giving two examples. 4

8. (a)   Calculate the pH of a buffer solution in which 0.11 molar CH_3COONa and 0.09 molar
acetic acid solutions are present. K_a for the CH_3COOH is 1.85×10^5. 4

   (b)   Define half life period. How order of reaction can be determined by knowing half life
of a reaction? 4

9. (a)   What are colligative properties of solutions? Explain elevation of boiling points. 4

   (b)   Describe the construction and working of standard hydrogen electrode. 4

42-221-I-(Essay Type) – 46000

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	The pH of 10^{-3} mol dm^{-3} of an aqueous solution of H_2SO_4 is :
	(A) 3 (B) 2.7 (C) 2.0 (D) 1.5
2	Bond angles $\alpha = \gamma = 90°$; $\beta \neq 90°$ and axes $a \neq b \neq c$ is for crystal system :
	(A) Tetragonal (B) Hexagonal (C) Monoclinic (D) Triclinic
3	If the rate equation of a reaction $2A + B \rightarrow$ Products is , rate = $K[A]^2[B]$ and A is present in large excess, then order is :
	(A) 1 (B) 2 (C) 3 (D) Zero
4	Nickel has number of isotopes :
	(A) 3 (B) 5 (C) 7 (D) 2
5	pH of human blood is :
	(A) 7.35 (B) 6.35 (C) 5.35 (D) 4.35
6	The number of bonds in nitrogen molecule is :
	(A) One σ and one π (B) One σ and two π (C) Three sigma only (D) Two σ and one π
7	Pressure remaining constant, at which temperature the volume of the gas will become twice of what it is at 0 °C :
	(A) 546 °C (B) 200 °C (C) 546 K (D) 273 K
8	1 gram formula of $NaCl$ is equal to :
	(A) 58.5 g (B) 23 g (C) 35.5 g (D) 12 g
9	18 g glucose is dissolved in 90 g of water, the relative lowering of vapour pressure is :
	(A) $\frac{1}{5}$ (B) 5.1 (C) $\frac{1}{51}$ (D) 6
10	dc-Broglie equation is represented as :
	(A) $\lambda = \frac{h}{mv}$ (B) $m = \frac{h}{\lambda}$ (C) $m = \frac{h}{v}$ (D) $\lambda = \frac{2h}{mv}$
11	1-calorie is equivalent to :
	(A) 0.4184 J (B) 41.84 J (C) 418.4 J (D) 4.184 J
12	The temperature of a natural plasma is about :
	(A) 20000 °C (B) 1000 °C (C) 5000 °C (D) 10000 °C
13	Ionization energy for $Mg \rightarrow Mg^+ + 1e^-$ has $\Delta H = ---$:
	(A) 738 $KJ\,mol^-$ (B) 238 $KJ\,mol^-$ (C) 448 $KJ\,mol^-$ (D) 138 $KJ\,mol^-$
14	The velocity of photon is :
	(A) Independent of wavelength (B) Depends on wavelength
	(C) Equal to square of its amplitude (D) Depends on its source
15	Solvent extraction is an equilibrium process and it is controlled by :
	(A) Law of mass action (B) The amount of solvent used
	(C) Distribution law (D) The amount of solute
16	Stronger the oxidizing agent, greater is the :
	(A) Oxidation potential (B) Reduction potential
	(C) Redox potential (D) E.M.F of cell
17	Which of the following is a pseudo solid :
	(A) CaF_2 (B) Glass (C) $NaCl$ (D) All of these

16

2. **Write short answers to any EIGHT (8) questions :**

   (i) Define stoichiometry. Give two assumptions for stoichiometeric calculations. Justify it.

   (ii) How percentage yield is calculated?

   (iii) Define Avogadro's number. Give one example.

   (iv) Differentiate between stationary phase and mobile phase in chromatographic technique?

   (v) What is ether extraction?

   (vi) Derive Avogadro's law from KMT.

   (vii) Why the graph plotted between pressure and volume moves away from pressure axis at higher temperature?

   (viii) Calculate SI unit of ' R ' gas constant.

   (ix) Why does pilots feel uncomfortable breathing at high altitude?

   (x) State Raoult's law. Give one mathematical expression.

   (xi) Relative lowering of vapour pressure is independent of temperature. Justify this statement.

   (xii) Give two applications of colligative properties.

16

3. **Write short answers to any EIGHT (8) questions :**

   (i) What are dipole dipole forces? Give one example.

   (ii) Name the factors which affect the London forces.

   (iii) Cleavage of the crystals is itself anisotropic behaviour, explain.

   (iv) Define transition temperature with two examples.

   (v) Why cathode rays are also called as electron?

   (vi) Write down any four properties of positive rays.

   (vii) Define spectrum and name any two types of spectrum.

   (viii) For Azimuthal quantum number, $\ell = 2$ and $\ell = 3$, calculate the total values of magnetic quantum number (m).

   (ix) How equilibrium constant (K_c) predicts direction of a reaction?

   (x) Define pH and write how it is helpful to know nature of solutions.

   (xi) What do you mean by order of reaction? Give two examples.

   (xii) What is the effect of temperature on rate of chemical reaction? Also write Arrhenius equation.

12

4. **Write short answers to any SIX (6) questions :**

   (i) Bond distance is the compromise distance between two atoms. Justify.

   (ii) Write down the two postulates of VSEPR theory.

   (iii) Differentiate between covalent and co-ordinate covalent bond.

   (iv) Draw the hypothetical orbital picture of He_2 molecule according to M.O.T.

   (v) Define enthalpy of formation with an example.

   (vi) Prove $q_v = \Delta E$.

   (vii) Calculate the oxidation numbers of the elements underlined : (a) $Na_2\underline{P}O_4$ (b) $H\underline{N}O_3$

   (viii) How salt bridge maintains the electrical neutrality in the cell? Justify.

   (ix) What is standard hydrogen electrode (SHE)?

(Turn Over)

SECTION – II LHR-G2-21

Note : Attempt any THREE questions.

5. (a) Calculate the number of grams of K_2SO_4 and H_2O produced when 14 gram of KOH reacts with excess of H_2SO_4 under the following equation :

$$2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$$ 4

(b) Explain the structure of ice on the basis of hydrogen bonding.   4

6. (a) State Charles's law. Explain its experimental verification.   4

(b) Write down experiment that how neutrons were discovered?   4

7. (a) Define ionization energy, write factors affecting ionization energy and explain its trend along group.   4

(b) Prove that $\Delta H = q_p$ 4

8. (a) A buffer solution is prepared by mixing 0.2 M CH_3COONa and 0.5 M CH_3COOH in $1\,dm^3$ of solution. Calculate pH of solution. pK_a of acid is 4.74.   4

(b) Explain energy of activation.   4

9. (a) Define solubility curve. Explain different types of solubility curves with the help of graphs.   4

(b) Describe electrochemical series. Give its three applications.   4

132-221-II-(Essay Type) – 41000