Roll No _____ (To be filled in by the candidate) **(Academic Sessions 2018 – 2020 to 2021 – 2023)**

CHEMISTRY 222-(INTER PART – I) Time Allowed : 20 Minutes

Q.PAPER – I (Objective Type) GROUP – I Maximum Marks : 17

PAPER CODE = 6487

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. LHR-41-22

1-1	For which system does the equilibrium constant, K_c has the units of (concentration)$^{-1}$: (A) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (B) $H_2 + I_2 \rightleftharpoons 2HI$ (C) $2NO_2 \rightleftharpoons N_2O_4$ (D) $2HF \rightleftharpoons H_2 + F_2$
2	NH_3 shows maximum boiling point among the hydrides of group V-A elements due to : (A) Very small size of nitrogen (B) Lone pair of electrons present on nitrogen (C) Enhanced electronegative character of nitrogen (D) Pyramidal structure of NH_3
3	The molar volume of CO_2 is maximum at : (A) S.T.P (B) 127 °C and 1 atm. (C) 0 °C and 2 atm. (D) 273 °C and 2 atm.
4	Which one has a regular tetrahedral shape : (A) $SnCl_2$ (B) CH_4 (C) SO_3 (D) BF_3
5	Splitting of spectral lines when atoms are subjected to strong electric field is called : (A) Zeeman effect (B) Stark effect (C) Photoelectric effect (D) Compton effect
6	One mole of SO_2 contains : (A) 6.02×10^{23} *atoms of oxygen* (B) 18.1×10^{23} *molecules of* SO_2 (C) 6.02×10^{23} *atoms of sulphur* (D) 4 *gram atoms of* SO_2
7	With increase of 10 °C temperature , the rate of reaction doubles, this increase in rate of reaction is due to : (A) Decrease in activation energy of reaction (B) Decrease in the number of collisions between reactant molecules (C) Increase in activation energy of reactants (D) Increase in number of effective collisions
8	Which of the following will have the same number of molecules at S.T.P : (A) 280 cm^3 of CO_2 and 280 cm^3 of N_2O (B) 11.2 dm^3 of O_2 and 32 g of O_2 (C) 44 g of CO_2 and 11.2 dm^3 of CO (D) 28 g of N_2 and 5.6 dm^3 of oxygen
9	The change in heat energy of a chemical reaction at constant temperature and pressure is called : (A) Enthalpy change (B) Bond energy (C) Heat of sublimation (D) Internal energy change
10	The mass of one mole of electrons is : (A) 1.008 mg (B) 0.55 mg (C) 0.184 mg (D) 1.673 mg
11	The wave number of the light emitted by a certain source is 2×10^6 m^{-1}. The wavelength of this light will be : (A) 500 nm (B) 500 m (C) 200 nm (D) 5×10^7 m
12	Solvent extraction method is particularly useful technique for separation, when the product to be separated is : (A) Non-volatile or thermally unstable (B) Volatile or thermally stable (C) Non-volatile or thermally stable (D) Volatile or thermally unstable

(Turn Over)

13	Molarity of pure water is : (A) 1 (B) 18 (C) 55.5 (D) 6
14	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
15	Which of the following statements is not correct about galvanic cell : (A) Anode is negatively charged (B) Reduction occurs at anode (C) Cathode is positively charged (D) Reduction occurs at cathode
16	Which of the following is a pseudosolid : (A) CaF_2 (B) Glass (C) NaCℓ (D) All
17	Which one does not undergo sublimation : (A) Ammonium chloride (B) Naphthalene (C) Iodine (D) Mercury

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

SECTION – I

LHR-GI-22

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

(i) Why we use the term relative atomic mass?

(ii) Many chemical reactions take place in our surroundings involve limiting reactant. Give reason.

(iii) How can you justify with example that molecular formula = n × empirical formula

(iv) In solvent extraction why repeated extraction using small portion of solvent is more efficient than single extraction using large volume of solvent.

(v) How the decolorization of crude crystal can takes place?

(vi) What is the purpose of Gooch Crucible?

(vii) Give characteristics of plasma.

(viii) What are the faulty points of kinetic molecular theory of gas?

(ix) Water vapours do not behave ideally at 273 K. Give reason.

(x) Give applications of common ion effect (any two).

(xi) How do the buffer acts?

(xii) Solubility of glucose in water is increased by increasing temperature. Give reason.

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

(i) What is polarizability? Give its relation with London dispersion forces.

(ii) Why H_2O is liquid but NH_3 is gas at room temperature?

(iii) Why graphite conduct electricity in one direction only not in other?

(iv) What is habit of crystal? How it is changed?

(v) Why positive rays are called canal rays?

(vi) How neutrons were discovered?

(vii) Give difference between continuous spectrum and line spectrum.

(viii) What are slow and fast neutrons?

(ix) What is continuous solubility curve? Which solution give this type of curve?

(x) Why 1 molal solution of NaOH is dilute as compared to its 1 molar solution?

(xi) What is order of reaction? Give examples.

(xii) What do you mean by rate determining step? Give example.

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

(i) Why the size of a cation is smaller as compared to its parent atom?

(ii) What is octet rule? Give one example.

4. (iii) Define co-ordinate covalent bond, give one example.

(iv) Dipole moment of CO_2 is zero but SO_2 is 1.61 D. Why?

(v) Define thermochemistry.

(vi) Define enthalpy of formation. Give example.

(vii) Describe enthalpy of neutralization by taking example of HCl and NaOH.

(viii) Describe Nickle Cadmium Cell.

(ix) Define anode and cathode.

SECTION – II

Note : Attempt any THREE questions.

5. (a) How can the percentage of carbon, hydrogen and oxygen in the given organic compound be estimated by combustion analysis? 4

(b) Derive an expression to calculate the radius of revolving electron in the nth orbit of hydrogen atom. 4

6. (a) A sample of nitrogen gas is enclosed in a vessel of volume 380 cm^3 at 120 °C and pressure of 101325 Nm^{-2}. This gas is transferred to a 10 dm^3 flask and cooled to 27 °C. Calculate the pressure in Nm^{-2} exerted by a gas at 27 °C. 1,1,1,1

(b) Explain the structure and function of voltaic or galvanic cell. 1,3

7. (a) Explain type of hybridization in H_2O and NH_3. 2,2

(b) State first law of thermodynamics. Also prove that $\Delta E = q_2$. 1,3

8. (a) Write four properties of covalent solids. 1,1,1,1

(b) The solubility of CaF_2 in water at 25 °C is found to be $2.05 \times 10^{-4}\ mol\ dm^{-3}$. What is the value of K_{sp} at this temperature? 4

9. (a) Describe a method to determine the boiling point elevation of a solution. 3,1

(b) Define order of reaction. Describe it with three examples. 1,3

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Q.PAPER – I (Objective Type) GROUP – II Maximum Marks : 17

PAPER CODE = 6484

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. LHR-G2-22

1-1	Which of the following will have the same number of molecules at S.T.P : (A) 280 cm^3 of CO_2 and 280 cm^3 of N_2O (B) 11.2 dm^3 of O_2 and 32 g of O_2 (C) 44 g of CO_2 and 11.2 dm^3 of CO (D) 28 g of N_2 and 5.6 dm^3 of oxygen
2	Quantum number values for 2p orbitals are : (A) $n = 2, \ell = 1$ (B) $n = 1, \ell = 2$ (C) $n = 1, \ell = 0$ (D) $n = 2, \ell = 0$
3	For which system does the equilibrium constant, K_c has units of (concentration)$^{-1}$: (A) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ (B) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ (C) $2NO_2(g) \rightleftharpoons N_2O_4(g)$ (D) $2HF(g) \rightleftharpoons H_2(g) + F_2(g)$
4	The unit of the rate constant is the same as that of the rate of reaction in : (A) First order reaction (B) Second order reaction (C) Zero order reaction (D) Third order reaction
5	Isotopes differ in : (A) Properties which depend upon mass (B) Arrangement of electrons in orbitals (C) Chemical properties (D) The extent to which they may be affected in electromagnetic field
6	The bond angle in NH_3 molecule is : (A) 109.5° (B) 107.5° (C) 104.5° (D) 108°
7	The comparative rates at which the solutes move in paper chromatography depends on : (A) The size of the paper (B) R_f values of solutes (C) Temperature of the experiment (D) Size of the chromatographic tank used
8	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
9	If a strip of Cu metal is placed in a solution of $FeSO_4$: (A) Cu will be deposited (B) Fe is precipitated out (C) Cu and Fe both dissolve (D) No reaction takes place
10	London dispersion forces are the only forces present among the : (A) Molecules of water in liquid state (B) Atoms of helium in gaseous state at high temperature (C) Molecules of solid iodine (D) Molecules of hydrogen chloride gas

(Turn Over)

11	The mass of one mole of electron is : (A) 1.008 mg (B) 0.55 mg (C) 0.184 mg (D) 1.673 mg
12	Diamond is a bad conductor because : (A) It has a tight structure (B) It has a high density (C) There are no free electron present in the crystal of diamond to conduct electricity (D) Is transparent to light
13	How should the conditions be changed to prevent the volume of a given gas from expanding when its mass is increased : (A) Temperature is lowered and pressure is increased (B) Temperature is increased and pressure is lowered (C) Temperature and pressure both are lowered (D) Temperature and pressure both are increased
14	Bohr's model of atom is contradicted by : (A) Plank's quantum theory (B) Dual nature of matter (C) Heisenberg's uncertainty principle (D) All of these
15	Chromatography in which the stationary phase is a solid classified as : (A) Partition chromatography (B) Gas chromatography (C) Adsorption chromatography (D) Thin layer chromatography
16	The net heat change in a chemical reaction is same, whether it is brought about in two or more different ways in one or several steps. It is known as : (A) Henry's law (B) Joule's principle (C) Hess's law (D) Law of conservation of energy
17	Molarity of pure water is : (A) 1 (B) 18 (C) 55.5 (D) 6

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SECTION – I

LHR-92-22

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

(i) N_2 and CO have the same number of electrons, protons and neutrons, justify.

(ii) Law of conservation of mass have to be obeyed during stoichiometric calculations, explain.

(iii) Why actual yield is always less than theoretical yield?

(iv) Write down any two uses of chromatography.

(v) In solvent extraction technique, why repeated extractions using small portions of solvent are more efficient than using a single extraction but larger volume of solvent?

(vi) How undesirable colours in crystallization process can be removed?

(vii) Write formulas to interconvert various scales of temperature.

(viii) How density of an ideal gas can be calculated from ideal gas equation?

(ix) Derive Charles's law by kinetic equation of gases.

(x) What is Henderson equation and for which purpose it is used?

(xi) What are applications of buffer in daily life?

(xii) Derive ionic product of water and what is its value at 25 °C?

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

(i) Define anisotropy, with example.

(ii) What is symmetry of a crystal?

(iii) Define isomorphism with example.

(iv) Define unit cell, give its crystallographic elements.

(v) What is Moseley's law?

(vi) Define Hund's rule.

(vii) Discuss briefly principal quantum number.

(viii) What is Aufbau's principle?

(ix) What are discontinuous solubility curves?

(x) Define colligative properties , give two examples.

(xi) What is meant by homogeneous catalysis, give one example.

(xii) How surface area of reactants affect rate of reaction?

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

(i) π bonds are more diffused than σ bonds. Why?

(ii) What is bond order? Give an example.

4. (iii) Define covalent bond. Draw the Lewis structure of water.

(iv) The radius of an atom can not be determined precisely. Why?

(v) What is enthalpy of combustion? Give an example.

(vi) Define system and surrounding.

(vii) What are exothermic reactions? Give an example with equation.

(viii) Calculate the oxidation number (O.N) of "Mn" in $KMnO_4$.

(ix) Write two functions of salt bridge.

SECTION – II

Note : Attempt any THREE questions.

5. (a) Explain construction and working of mass spectrometer. 4

(b) Give properties of neutron in detail (any four). 4

6. (a) Calculate the mass of 1 dm^3 of NH_3 gas at 30 °C and 1000 mm Hg. 1,2,1

(b) How electrochemical series is helpful in the prediction of feasibility of chemical reaction and relative chemical reactivity of metals? 2,2

7. (a) Explain sp^3 hybridization by taking example of methane (CH_4). 4

(b) Explain bomb calorimetric method for the measurement of enthalpy of reaction. Also draw diagram. 3,1

8. (a) What are molecular solids? Give their important characteristics. 4

(b) The solubility product of Ag_2CrO_4 is 2.6×10^{-2} at 25 °C. Calculate the solubility of the compound. 4

9. (a) State solubility curves and explain continuous and discontinuous solubility curves. 1, 1½ , 1½

(b) What are the characteristics of a catalyst. (Any four)? 1,1,1,1