Roll No. ☐☐☐☐☐☐

Sig. of Candidate._____

Answer Sheet No._____

Sig. of Invigilator._____

CHEMISTRY HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes

NOTE: Section–A is compulsory and comprises pages 1-2. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) Mass of 6.02×10^{23} electrons is _____

    A. 1.008 mg   B. 0.55 mg   C. 0.184 mg   D. 1.673 mg

(ii) The largest number of molecules is present in _____

    A. 3.6 g of H_2O B. $4.8\,g\,of\,C_2H_5OH$

    C. $2.8\,g\,of\,CO$ D. $5.4\,g\,of\,N_2O_5$

(iii) The comparative rates at which the solutes move in paper chromatography depends on _____

    A. Size of paper   B. Rf values

    C. Temperature of the experiment   D. Size of chromatographic tank

(iv) Acetone and chloroform are soluble in each other due to _____

    A. Intermolecular Hydrogen Bonding   B. Ion-dipole interactions

    C. Instantaneous dipoles   D. All of these

(v) Ionic solids are characterized by _____

    A. Low melting points   B. Good conductivity in solid state

    C. High vapour pressure   D. Solubility in polar solvents

(vi) Number of molecules in one dm^3 of water is close to _____

    A. $\dfrac{6.02}{22.4} \times 10^{23}$ B. $\dfrac{12.04}{22.4} \times 10^{23}$

    C. $\dfrac{18}{22.4} \times 10^{23}$ D. $55.6 \times 6.02 \times 10^{23}$

(vii) Quantum number values for 3d orbitals are _____

    A $n = 3, l = 2$ B. $n = 3, l = 3$

    C. $n = 2, l = 3$ D. $n = 2\ l = 3$

(viii) Bohr Model of Atom is contradicted by _____

    A Planck's Quantum theory   B. Dual nature of matter

    C. Heisenberg's un-certainty principle   D. All of these

(ix) Enthalpy of Neutralization of all the strong Acids and strong Bases have the same value because_____

    A. Neutralization leads to the formation of salt and water

    B. Strong Acids and Bases are ionic substances

    C. Acids always give rise to H^+ and Bases give rise to $O\overline{H}$ ions

    D. The net chemical change involve the combination of H^+ and $O\overline{H}$ to form water

....

(x) Which of the following Hydrogen Halides has the highest percentage of ionic character?

A.	HCl	B.	HBr
C.	HF	D.	HI

(xi) The pH of 10^{-3} moles dm^{-3} of an aqueous solution of H_2SO_4 is _____

A.	3.0	B.	2.7
C.	2.0	D.	1.5

(xii) Which of the following solutions has the highest boiling-point?

A.	5.85% NaCl solution	B.	18.0% glucose solution
C.	6.0% urea solution	D.	All have the same Boiling-points

(xiii) The product obtained at Anode by the electrolysis of an aqueous solution of H_2SO_4 using an inert electrode is _____

A.	O_2	B.	H_2
C.	SO_2	D.	S

(xiv) If salt bridge is **NOT** used between two half cells then the voltage of a cell _____

A.	Decreases rapidly	B.	Decreases slowly
C.	Does not change	D.	Drops to zero

(xv) Which order of reaction obeys the expression, $t_{\frac{1}{2}} = \dfrac{1}{Ka}$?

A.	First order	B.	Second order
C.	Third order	D.	Zero order

(xvi) According to Molecular orbital theory, electrons in the molecular orbitals are filled according to _____

A.	Aufbau's Principle	B.	Pauli's exclusion principle
C.	Hund's rule	D.	All of these

(xvii) The equation for determination of heat of neutralization by using Glass Calorimeter is _____

A.	$q = m \times S \times \Delta T$	B.	$E = m \times S \times \Delta T$
C.	$q = m \times c \times \Delta T$	D.	$\Delta E = qv$

For Examiner's use only:

Total Marks:	17
Marks Obtained:	

CHEMISTRY HSSC–I

Time allowed: 2:35 Hours   **Total Marks Sections B and C: 68**

NOTE: Sections 'B' and 'C' comprise pages 1–2 and questions therein are to be answered on the separately provided answer book. Answer any fourteen parts from Section 'B' and attempt any two questions from Section 'C'. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q. 2 **Attempt any FOURTEEN parts. The answer to each part should not exceed 5 to 6 lines. (14 x 3 = 42)**

(i) A compound contains the Elements of C, H and Cl in the molar ratios C:H: Cl, 3:2:1. What is the empirical formula of this compound? Also find the molecular formula of this compound if its molecular mass is 147 g / mol.   **03**

(ii) What is a limiting reactant? How does it control the quantity of the product formed. Give one example.   **03**

(iii) a. Define chromatography.

     b. How distribution coefficient (k) helps in the distribution of the components of a mixture in chromatography?   **(1+2=3)**

(iv) $250 \, cm^3$ of the sample of Hydrogen effuses four times as rapidly as $250 \, cm^3$ of an unknown gas. Calculate the molar mas of unknown gas.   **03**

(v) What type of intermolecular forces are present in the following: **(0.5x6=3)**

     a. Ammonia NH_3 b. Octane (C_8H_{18}) c. Argon (Ar)

     d. Propanone   e Methanol   f. HF

(vi) Why is diamond an Electrical insulator while Graphite is a good conductor of Electricity?   **03**

(vii) Define the following with examples: **(1.5x2=3)**

     a. Isomorphism   b. Transition Temperature

(viii) Calculate the energy, frequency and wave length of radiations emitted when an electron drops from n=4 to n=2 of Hydrogen Atom.   **03**

(ix) Discuss Chadwick's experiment for the discovery of Neutron in an Atom.   **03**

(x) Define Ionization energy by giving an example. Also name the factors affecting it.   **03**

(xi) Differentiate between Sigma (σ) and Pi (π) Bond. Why are π bonds more diffused than σ bond?   **03**

(xii) Explain the molecular orbital structure of N_2 molecule.   **03**

(xiii) Draw a fully labelled Born-Haber cycle for the formation of potassium Bromide (K Br).   **03**

(xiv) What is Lowry Bronsted idea of Acids and Bases? Explain conjugate Acids and Base.   **03**

(xv) Why do the rates of forward reactions slow down when a reversible reaction approaches the equilibrium stage?   **03**

(xvi) What is critical solution temperature? Explain by giving the example of Phenol-water system.   **03**

(xvii) Define Galvanic cell. Draw a labelled diagram of a cell consisting of Zu-Cu Electrodes.   **03**

(xviii) The sum of the exponents in the rate equation may or may not be the same as in a balanced chemical equation. Justify this statement by giving any two examples.   **03**

(xix) What is Energy of activation? How can energy of activation be calculated from Arrhenius equation?   **03**

Note: **Attempt any TWO questions. All questions carry equal marks.**   **(2 x 13 = 26)**

Q. 3   **a.**   Calculate the number of grams of Al_2S_3 which can be prepared by reacting 20 g of Al with 30 g of S. How much of the non-limiting reactant is in excess? The reaction between Al and S is given as: **(04)**

$$2Al + 3S \rightarrow Al_2S_3$$ (At masses: S=32, Al=27)

     b.   Derive Boyle's Law and Grahm's law of diffusion of Gases on the basis of Kinetic molecular theory of Gases.   **(3+3=6)**

     c.   Write any three uses of plasma.   **(03)**

Q. 4   **a.**   Keeping in mind the postulates of Bohr's model of an Atom, derive an expression for energy of revolving electron in nth orbit of Hydrogen Atom.   **(06)**

     b.   What is (n+l) rule of distribution of electrons in sub-shells of an Atom? Give examples.   **(03)**

     c.   Explain the shape of Ethyne on the basis of Atomic orbital Hybridization.   **(04)**

Q. 5   **a.**   Give a graphical explanation of Elevation of Boiling-point of a solution. How molar mass of a non volatile and non Electrolyte solute can be determined with the help of it?   **(06)**

     b.   Differentiate between Zeotropic and Azeotropic mixtures with the help of examples.   **(04)**

     c.   Write Redox reactions taking place at Anode and cathode during discharging and recharging of Lead Accumulator (car battery).   **(03)**

CHEMISTRY HSSC–I

SECTION – A (Marks 17)

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Q. 1 **Circle the correct option i.e. A / B / C / D. Each part carries one mark.**

(i) The volume occupied by 1 gram of H_2 at STP is_____

    A. $22.4\,dm^3$ B. $24\,dm^3$

    C. $11.2\,dm^3$ D. $22.4\,cm^3$

(ii) Isotopes differ in_____

    A.   Properties which depend on mass

    B.   Arrangement of electrons in orbitals

    C.   Chemical properties

    D.   The extent to which they may be affected in electromagnetic field

(iii) Paper chromatography is a type of _____

    A.   Partition chromatography   B.   Thin layer chromatography

    C.   Adsorption chromatography   D.   Gas chromatography

(iv) Which of the following substances is used as a decolorizing agent?

    A.   Animal charcoal   B. P_2O_5

    C.   Silica gel   D.   None of these

(v) A real gas obeying Vander waal's equation will resemble ideal gas if _____

    A.   Both 'a' and 'b' are large   B.   Both 'a' and 'b' are small

    C.   'a' is small and 'b' is large   D.   'a' is large and 'b' is small

(vi) NH_3 shows the maximum boiling point among the hydrides of V A group elements due to _____

    A.   Very small size of Nitrogen   B.   Lone pair of electrons present on Nitrogen

    C.   Pyramidal structure of NH_3 D.   Enhanced electronegative nature of Nitrogen

(vii) The molecules of CO_2 in dry ice form the _____

    A.   Ionic crystals   B.   Covalent crystals

    C.   Molecular crystals   D.   Any type of crystals

(viii) The wave number of the light emitted by a certain source is $2\times10^6\,m^{-1}$. The wave length of this light will be _____

    A   500 nm   B.   500 m

    C.   200 nm   D. $5\times10^7\,m$

(ix) In the ground state of an Atom, the electron is present _____

    A.   In the Nucleus   B.   In the second shell

    C.   Nearest to the Nucleus   D.   Farthest from the Nucleus

....

(x)   In Methane molecule, carbon atom undergoes_____

   A. d^2SP^3 Hybridization   B. SP^2 Hybridization

   C. SP^3 Hybridization   D.   SP Hybridization

(xi) The change in heat energy of a chemical reaction at constant temperature and pressure

   is called _____

   A.   Enthalpy change   B.   Heat of sublimation

   C.   Bond energy   D.   Internal energy

(xii) Which of the following is the mathematical expression of the Hess's Law of constant heat summation?

   A. $\Sigma\Delta H(cycle) = 0$ B. $\Sigma\Delta H = 0$

   C. $\Delta H = 0$ D. $\Delta E = 0$

(xiii) The solubility product of AgCl is $2.0\times10^{-10}\ mol^2\ dm^{-6}$. The maximum concentration of

   Ag^+ ions in the solution is _____

   A. $2.0\times^{-10}\ mol\ dm^{-3}$ B. $1.41\times10^{-5}\ mol\ dm^{-3}$

   C. $1.0\times10^{-10}\ mol\ dm^{-3}$ D. $4.0\times10^{-20}\ mol\ dm^{-3}$

(xiv) 18g of glucose is dissolved in 90 g of water. The relative lowering of vapor pressure is

   equal to_____

   A. $\dfrac{1}{5}$ B.   5.1

   C. $\dfrac{1}{51}$ D.   6

(xv) During the electrolysis of fused NaCl, which reaction occurs at Anode?

   A. Cl^- ions are oxidized   B. Na^+ ions are oxidized

   C. Cl^- ions are reduced   D. Na^+ ions are reduced

(xvi) Stronger the oxidizing agent, greater is the _____

   A.   Oxidation Potential   B.   Reduction Potential

   C.   Redox Potential   D.   E.M.F. of a cell

(xvii) The rate of reaction _____ as the reaction proceeds.

   A.   Increases   B.   Decreases

   C.   Remains the same   D.   May decrease or increase

   _____

For Examiner's use only:

                                    Total Marks: | 17 |

                                    Marks Obtained: | |

CHEMISTRY HSSC–I

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SECTION – B (Marks 42)

Q. 2   **Answer any FOURTEEN parts. The answer to each part should not exceed 5 to 6 lines.**   **(14 x 3 = 42)**

(i)   A sample of 0.600 moles of a metal M reacts completely with excess of Fluorine to form 46.8 g of MF_2.   **(1.5x2=3)**

     a.   How many moles of F are present in the sample of MF_2 ?

     b.   Which element is represented by the symbol M ?   (At. mass of F =19)

(ii)   What are the features of an ideal solvent used for crystallization?   **03**

(iii)   What is the pressure exerted by a mixture of 2.00 g of H_2 and 8.00 g of N_2 at 273 K in a $10\,dm^3$ vessel?   **03**

(iv)   Gases show non-ideal behavior at low temperature and high pressure. Explain this with the help of a graph.   **03**

(v)   Explain the following with reason: **(1.5x2=3)**

     a.   Water and Ethanol can mix easily and in all proportions.

     b.   Boiling point of HF is lower than that of H_2O.

(vi)   Why is the heat of sublimation greater than heat of vaporization of a substance?   **03**

(vii)   What is the coordination number of the cation in: **03**

     a. $NaCl$ structure

     b. $CsCl$ structure.   Explain the reason for this difference.

(viii)   Write the postulates of Planck's Quantum theory of radiations.   **03**

(ix)   Discuss the significance of magnetic quantum number.   **03**

(x)   Bond angles in $\overline{N}H_2, NH_3$ and NH_4^+ are $105^0, 107.5^0$ and 109.5^0, respectively. Justify these values by drawing their structures.   **03**

(xi)   Define Dipole Moment. How does it help to predict the geometry of a tri-atomic and Tetra-atomic molecule?   **03**

(xii)   How does the molecular orbital theory explain the paramagnetic nature of O_2 molecule. Explain by drawing the molecular orbital diagram of this molecule.   **03**

(xiii)   What are Spontaneous and Non-spontaneous processes? Give examples.   **03**

(xiv)   How will you differentiate between ΔE and ΔH ? Is it true that ΔH and ΔE have the same values for the reactions taking place in the solution state?   **03**

(xv)   How can the extent of a reversible reaction be determined with the help of Equilibrium Constant? Give examples.   **03**

(xvi)   What is Raoult's law. Give its two statements.   **03**

(xvii)   Balance the following equation by oxidation number method:

$$Br_2 + NaOH \rightarrow NaBr + NaBrO_3 + H_2O$$ **03**

(xviii) SHE acts as Anode when connected with Cu electrode but as cathode with Zn electrode. Why? **03**

(xix) Define the following and give examples:

    a. Activation of a catalyst   **1.5**

    b. Catalytic poisoning   **1.5**

SECTION – C (Marks 26)

Note: **Attempt any TWO questions. All questions carry equal marks.**   **(2 x 13 = 26)**

Q. 3   **a.**   Derive van der Waal's equation for real gases with reference to volume correction and pressure correction in ideal gas equation.   **(3+3=6)**

      b.   How do you differentiate between Diffusion and Effusion of gases? Explain Grahm's law of diffusion and effusion of gases.   **(04)**

      c.   A mixture of two liquids, Hydrazine N_2H_4 and N_2O_4 are used in rockets. They produce N_2 and water vapours. How many grams of N_2 gas will be formed by reacting 100 g N_2H_4 and 200 g of N_2O_4 **(03)**

$$2N_2H_4 + N_2O_4 \rightarrow 3N_2 + 4H_2O$$

(At. Masses $H = 1$, $N = 14$, $O = 16$)

Q. 4   **a.**   Derive an equation for the radius of nth orbit of electron in H.atom by using Bohr's model.   **(05)**

      b.   What are the defects of Bohr's Atomic Model?   **(04)**

      c.   Explain Atomic orbital Hybridization with reference to SP Hybridization in Ethyne. $(CH \equiv CH)$ **(04)**

Q. 5   **a.**   Describe the construction of standard Hydrogen Electrode. How can it be used to measure the Electrode Potential of Copper?   **(05)**

      b.   How will you distinguish between Ideal and Non-deal solutions?   **(04)**

      c.   Define Buffer solutions. Derive Hendersen's equation for calculation of pH of an Acidic Buffer?   **(04)**

----- 1HA 1409 (ON) -----