Roll No. | | | | | | | Answer Sheet No._____

Sig. of Candidate._____ 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) Which of the following has least mass?

A. $1 mol\ of\ O_2$ B. 7 gram of Ag

C. $3.01\times10^{23}\ atoms\ of\ C$ D. 2 gram atoms of N

(ii) The Partial pressure of H_2 in a flask containing 2 grams of H_2 and 16 grams of O_2 is _____

A. $\frac{1}{4}$ B. $\frac{2}{3}$

C. $\frac{1}{6}$ D. $\frac{1}{8}$

(iii) Boiling point of solution is independent of_____

A. Nature of solvent B. Amount of solution

C. Pressure D. Concentration of solution

(iv) $n+l$ value for an orbital 'A' is 2+1=3 while for 'B' is 3+0=3. The energy order is_____

A. A>B B. B>A

C. A=B D. Can not be predicted

(v) For the reaction $N_2+3H_2 \rightleftharpoons 2NH_3\ \ \Delta H=-92kJ\ mol^{-1}$, which of the following gives the greatest yield of NH_3?

A. Adding a catalyst

B. Decreasing the temperature and pressure

C. Decreasing the temperature and increasing the pressure

D. Increasing the temperature and decreasing the pressure

(vi) Joule Thomson expansion of an Ideal gas produces_____

A. Heating B. Cooling

C. Gas liquefies D. No change in temperature

(vii) The frequency of X-rays having wavelength of $4A^{\circ}$ (Angstrom) is_____

A $1.33\times10^{18}\ Hz$ B. $2\times10^{18}\ Hz$

C. $7.5\times10^{17}\ Hz$ D. $2.6\times10^{10}\ Hz$

(viii) A solution of glucose is 10% w/v. The volume in which one mol of it is dissolved will be_____

A $1\ dm^3$ B. $1.8\ dm^3$

C. $10\ dm^3$ D. $18\ dm^3$

DO NOT WRITE ANYTHING HERE

(ix) If the energy of activated complex lies close to the energy of reactants, it means that the reaction is_____

A. Slow B. Fast

C. Reaction does not take place D. Endothermic

(x) After three half lives of a reaction, the % fraction of the amount left is_____

A. 75% B. 50%

C. 12.5% D. 25%

(xi) For the reaction $H_2 + I_2 \rightleftharpoons 2HI$ the value of Kc=64. If the volume of the container is reduced to one half of its original volume, the value of Kc is_____

A. 48 B. 16

C. 64 D. 32

(xii) Which of the following solutes will depress the freezing point of water the least, if one mole of each is added?

A. $NaCl$ B. $CaCl_2$

C. $C_6H_{12}O_6$ D. $AlCl_3$

(xiii) How many moles of oxygen atoms are there in 0.5 moles of $Ca(ClO_3)_2$?

A. 3 moles B. 6 moles

C. 0.5 moles D. 1 mole

(xiv) Which metal will dissolve in galvanic cell containing copper and silver electrodes?

$(Cu^{++} / Cu = +0.34V \;\; Ag / Ag^{+} = -0.80V)$

A. Copper B. Silver

C. Both A and B D. None of these

(xv) What is the unit cell with crystallographic dimensions $a = b \neq c \;\; and \;\; \alpha = \beta = \gamma = 90^0$?

A. Cubic B. Tetragonal

C. Monoclinic D. Rhombic

(xvi) For a chemical reaction $CH_3COOH \rightleftharpoons CH_3COO^{-} + H^{+}$ _____

A. $\Delta H < zero$ B. $\Delta H = O$

C. $\Delta H > zero$ D. $\Delta H = Negative$

(xvii) During the electrolysis of aqueous solution of $NaCl$ using inert electrodes_____

A. H_2 liberates at cathode B. Cl_2 liberates at cathode

C. Na deposits at anode D. O_2 evolves at anode

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 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 sample of $AlCl_3$ contains 5.4×10^{24} Cl^- ions. Calculate:

a. Number of Formula units of $AlCl_3$ **01**

b. Number of Al^{+3} ions in the sample **01**

c. Mass of the sample **01**

$(Al = 27 \; ; \; Cl = 35.5)$

(ii) a. The rate of filtration can be increased by using Fluted Filter Paper. Why? **1.5**

b. During crystallization process, why do some crystals appear coloured? How will the undesirable colours of crystals be removed? **1.5**

(iii) a. State Avogadro's Law. **01**

b. Calculate the number of molecules in $1050cm^3$ of CO_2 at $25\ ^0C$ and 800 mm Hg pressure. **02**

(iv) a. Define **Molar heat of Vaporization** and **Molar heat of Sublimation**. **02**

b. Explain why heat of sublimation of a substance is greater than heat of vaporization. **01**

(v) Why is it impossible to determine both the position as well as momentum of an electron in an atom simultaneously? **03**

(vi) a. What is lionization energy? Why is the 1st I.E <2nd I.E and so on? **02**

b. Why does the I.E increase along the period? **01**

(vii) For the processes taking place at constant pressure, prove $\Delta H = q_p$ **03**

(viii) Calculate the value of Kp for the synthesis of NH_3 according to the equation : **03**

$N_2 + 3H_2 \rightleftharpoons 2NH_3 \quad Kc = 6\times10^{-2}\ at\ 500\ ^0C$.

(ix) a. Define Molality. **01**

b. What is the Molality of 10% w/w $NaCl$ solution? **02**

(x) a. What is Electrode Potential? **01**

b. Standard electrode potential values are given: **02**

$Zn/Zn^{+2} = +0.76V \quad ; \quad Cu^{+2}/Cu = +0.34V$

Calculate emf of the cell. Also write the complete cell equation.

(xi) a. What is the Order of Reaction? **01**

b. A study of kinetics of a reaction $A + B \rightarrow$ Product, gave the following data: **02**

Exp#	$[A]$	$[B]$	Initial rate
I	1.00	0.15	4.2×10^{-6}
II	2.00	0.15	8.4×10^{-6}
III	1.00	0.20	5.6×10^{-6}

Calculate the order of reaction.

(xii) a. Define Salt Hydrolysis. **01**

b. Why is the aqueous solution of $NaCl$ neutral and that of NH_4Cl acidic? **02**

(xiii) Balance the Redox Equation by Ion Electron method in acidic medium: **03**

$Cr_2O_7^{-2} + Cl^- \rightarrow Cr^{+3} + Cl_2$

(xiv) The solubility of MgF_2 is $7.6\times10^{-2}\ g\,dm^{-3}$ at $25\ ^0C$. Calculate its solubility product

(Mg=24 ; F=19) **03**

(xv) a. What is Enthalpy? **01**

b. Under what conditions $\Delta H = \Delta E$ **02**

(xvi) Give reasons:

a. The dipole moment of CO_2 and CS_2 is zero , but that of SO_2 is 1.62 D. **1.5**

b. Pi bonds are more diffused than sigma bonds. **1.5**

(xvii) Calculate the Energy, Frequency and Wavelength of radiations emitted when electron jumps from n=4 to n=2 of hydrogen atom. **03**

(xviii) a. Why do the boiling points of noble gases increase down the group? **1.5**

b. Freshly cut surface of the metal is shiny. Why? **1.5**

(xix) Verify Graham's Law of diffusion from kinetic gas equation. **03**

SECTION – C (Marks 26)

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

Q. 3 **a.** (i) Define Stoichiometry. What assumptions are made while performing Stoichiometric calculations? **03**

(ii) 50 g each of NH_4Cl and $Ca(OH)_2$ reacted together according to the equation:

$2NH_4Cl + Ca(OH)_2 \rightarrow 2NH_3 + CaCl_2 + 2H_2O$. Calculate the mass of NH_3 formed.

$(N = 14\ ;\ Cl = 35.5\ ;\ Ca = 40)$ **04**

b. (i) Using kinetic gas equation $PV = \frac{1}{3}mN\bar{c}^2$, workout an expression which relates the average kinetic energy of the gas molecules to the absolute temperature. **04**

(ii) Why is the volume of a gas generally expressed in $g\,dm^{-3}$ rather than $g\,cm^{-3}$? **02**

Q. 4 **a.** (i) Give the main postulates of VSEPR theory. **04**

(ii) Explain the structure and geometry of $BeCl_2$ and $SnCl_2$ on the basis of VSEPR theory. **04**

b. What is Atomic Orbital Hybridization? Explain hybridization in **Ethene** and **Water.** **05**

Q. 5 **a.** (i) What are Buffers? How do the buffers act? **04**

(ii) What is the pH of a solution containing 7.2 g of sodium benzoate C_6H_5COONa in one dm^3 of 0.02 M benzoic acid $C_6H_5COOH.(Ka = 6.4\times10^{-5})$. **04**

b. How does the Arrhenius equation help to determine the energy of activation? **05**

Roll No. | | | | | | |

Answer Sheet No._____

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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) The volume occupied by a sample of CO_2 at STP which contains 8 gram of oxygen is _____

A. $11.20\,dm^3$ B. $5.60\,dm^3$

C. $56.0\,cm^3$ D. $112\,cm^3$

(ii) For drying crystals, which drying agent is **NOT** used in disiccator?

A. $Conc.\,H_2SO_4$ B. Silica gel

C. $CaCl_2$ D. P_2O_5

(iii) Eight grams each of Oxygen and Neon at 27^oC will have total K.E. in the ratio of_____

A. 5 : 8 B. 8 : 5

C. 3 : 4 D. 5 : 4

(iv) The permissible set of four quantum numbers for the electron in 3d orbital of Fe is_____

A. $n=3,\ l=1,\ m=0,\ S=\frac{+1}{2}$ B. $n=3,\ l=2,\ m=3,\ S=\frac{-1}{2}$

C. $n=3,\ l=2,\ m=-1,\ S=\frac{-1}{2}$ D. $n=3,\ l=3,\ m=-3,\ S=\frac{+1}{2}$

(v) Which of the following unit cell dimensions describes a trigonal (Rhombohedral) system?

A. $a=b=c,\ \alpha=\beta=\gamma=90^0$ B. $a\neq b\neq c,\ \alpha=\beta=\gamma=90^0$

C. $a=b=c,\ \alpha=\beta=\gamma\neq 90^0$ D. $a\neq b\neq c,\ \alpha\neq\beta\neq\gamma\neq 90^0$

(vi) The ratio between wave numbers of first line and limiting line in Lyman series is_____

A. 1:2 B. 4:3

C. 20:27 D. 3:4

(vii) Which of the following molecules is paramagnetic in nature?

A. Li_2 B. Be_2

C. B_2 D. C_2

(viii) The enthalpy of neutralization for $H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$ *is* $-57.4\,kJ\,mol^{-1}$.

What is the enthalpy of neutralization when 0.1 M HCl is mixed with equal volume of 0.1 M NaOH?

A $-57.4\,kJ\,mol^{-1}$ B. $-0.574\,kJ\,mol^{-1}$

C. $-5.740\,kJ\,mol^{-1}$ D. None of these

(ix) The reaction for the synthesis of ammonia is $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$.

For this reaction _____

A. $K_c > K_p$ B. $K_c < K_p$

C. $K_c = K_p$ D. None of these

(x) The relative lowering of vapour pressure of a solution containing 30 gram Urea in 500g H_2O is _____

A. 0.0122 B. 0.177

C. 0.0250 D. 0.0177

(xi) Hydrolysis of which ion-pair gives alkaline solution?

A. Cl^-, SO_4^{-2} B. HS^{-1}, HCO_3^{-1}

C. NO_3^{-1}, ClO_3^{-1} D. None of these

(xii) The standard reduction potentials of some substances are given below:

$E^o_{X^+/X} = -2.87\ V,\ E^o_{W^+/W} = 0.521\ V,\ E^o_{Z^+/Z} = 2.87\ V,\ E^o_{Y^+/Y} = -0.76\ V$

Which of the above elements is the strongest oxidizing agent?

A. X B. Y

C. Z D. W

(xiii) The half life of HI is 253 sec at 508^0C. If initial concentration of HI is 0.05M, then what fraction of initial concentration of HI is left behind after 1012 sec?

A. $\frac{1}{4}$ B. $\frac{1}{8}$

C. $\frac{1}{12}$ D. $\frac{1}{16}$

(xiv) dm^3 atm is the unit of energy. $1dm^3atm$ is equal to _____

A. 22.216 cals B. 101.325 cals

C. 133.3 cals D. 382.45 cals

(xv) The maximum number of unpaired electrons is present in _____

A. O_2^{+2} B. O_2^{-2} C. O_2 D. O_2^+

(xvi) K_b for water is $0.52\ ^0C.m^{-1}$. The boiling point of 2m $AlCl_3$ solution is _____

A. 102.08^0C B. 101.04^0C C. 100.52^0C D. 104.16^0C

(xvii) In Hexagonal close packing the coordination number of central atom is_____

A. 4 B. 8 C. 12 D. 6

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CHEMISTRY HSSC–I

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

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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 sample of MCl_2 contains 63.964% of chlorine. Calculate: **02, 01**

a. Molar mass of M b. Mass of 2.45 moles of the sample

(ii) Consider the distribution of I_2 between two immiscible layers (CCl_4 / H_2O). State Partition law. Give expression of distribution coefficient and suggest reason that I_2 dissolves in water in the presence of KI. **01,01,01**

(iii) How does quantitative statement of Charles's law help in the derivation of Absolute Zero? **03**

(iv) a. Table given below shows the boiling points of some compounds:

Name	Ethane	Hexane	Isodecane
$b.p\ ^0C$	-88.6^0C	68.7^0C	327.0^0C

Suggest reasons for the difference in their boiling points. **02**

b. Define the term Polarizability. **01**

(v) Derive expression for the potential energy of bounded electron. **03**

(vi) a. In periodic table, the ionization energies increase from left to right but actually it drops from beryllium to boron. Give the reason. **02**

b. Calculate the electron affinity for the process $X_{(g)} + 2\bar{e} \rightarrow X^{-2}_{(g)}$

First electron affinity $= -141\ kJ\ mol^{-1}$. Second electron affinity $= 798\ kJ\ mol^{-1}$. **01**

(vii) The enthalpy of formation of one mole of gaseous water is $-242.2\,kJ\ mol^{-1}\ at\ 100^0C$.

Calculate ΔE for the formation of one mole $H_2O\ at\ 100^0C$. **03**

(viii) Predict the effect of the following on the equilibrium position of $PCl_{5(g)}, \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$

a. Concentration of products becomes doubled . **1.5**

b. The volume of the system is reduced to one half . **1.5**

(ix) a. Derive the expression for ionization constant of a base. **02**

b. K_b value of aniline is $4.7\times10^{-7}\ \ mol\,dm^{-3}$. Calculate its pK_b value. **01**

(x) Define **Ebullioscopic** and **Cryoscopic constants**. **03**

(xi) Balance the following equation by Ion-electron method: **03**

$Cr(OH)_3 + SO_4^{-2} \longrightarrow CrO_4^{-2} + SO_3^{-2}$ (basic media).

(xii) Using standard reduction potentials of $E^{O}\,Cr^{3+}/Cr = -0.74V, E^0\ Ag^+ / Ag = 0.80V$

a. Calculate emf of the cell. b. Which cell will be positive pole? **01,01**

c. Give equation for the overall chemical reaction. **01**

(xiii) Justify the statement that collision frequency and orientation of molecules are necessary conditions for determining the proper rate of reaction. **03**

(xiv) For a general reaction, $A + 5B \rightarrow \text{Product}$, the rate law has been found to be:

$$\frac{-d[A]}{dt} = K[A][B]^2$$

a. Define Order of reaction. Justify with reason that $\frac{+d[A]}{dt}$ is negative. **01,01**

b. What would happen to the rate if we double the concentration of A and B? **01**

(xv) Sketch the shapes of NCl_3 and BF_3 using VSEPR theory. Explain the origin of differing in shape. **03**

(xvi) Explain with reasons that:

a $\Delta H_{sub} > \Delta H_{vap} > \Delta H_{fusion}$ **1.5**

b. Evaporation of a liquid occurs at the surface of the liquid. **1.5**

(xvii) Calculate the ionization energy value in $kJ\ mol^{-1}\ for\ He^{+}ion$. Give the units of $\in_0$ and $\bar{v}$. **03**

(xviii) van der Waals constant for some gases is given below:

Gas	O_2	NH_3	CO_2	H_2
'a'	1.360	4.170	3.590	0.245

a. What is the significance of "a"? Derive its SI units. **02**

b. Which gas has the highest critical temperature? Explain with reasons. **01**

(xix) About 99% of the universe consists of plasma. What is **Plasma** and **Metastable** state? **03**

SECTION – C (Marks 26)

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

Q. 3 **a.** Calculate the mass of Cl_2 gas evolved when 61.3 grams, 90% by mass of sample of $KMnO_4$ is allowed to react with $275\,cm^3$ HCl solution (27% by mass with density $1.14\,g\,cm^{-3}$)

$$2KMnO_{4(aq)} + 16\,HCl_{(aq)} \rightarrow 2\,KCl_{(aq)} + 2MnCl_{(aq)} + 5\,Cl_{2(g)} + 8H_2O_{(l)}$$ **06**

b. Describe Kinetic interpretation of absolute temperature by applying kinetic gas equation. **04**

c. Define Azeotropic mixture. Why does HCl / H_2O system exhibit negative deviation? **01,02**

Q. 4 **a.** What is Metallic bond? Explain its formation by both **Electron gas theory** and **Molecular Orbital theory.** **01+2.5+2.5**

b. VSEPR theory demands that lone pair occupies more space than bond pair. Explain with reasons. Also write the limitations of VSEPR theory? **02,02**

c. When Cu is immersed in $1M$ of $CuSO_4$ solution, an equilibrium is set up between the metal atoms and ions in the solution.Moreover, the electrode gets positive charge. Explain with reasons. **03**

Q. 5 **a.** Moseley studied X-rays spectrum of various elements.

(i) What are the conclusions drawn by Moseley from a detailed analysis of the spectra. **03**

(ii) What is the origin of X-rays? **02**

b. (i) What is Lattice energy? Explain the factors affecting Lattice energy. **01,02**

(ii) Draw fully labelled Born-Haber cycle for the formation of KBr. **02**

c. How does catalyst affect the rate of reaction? Also describe by means of graph. **02,01**