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Version No.			
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ROLL NUMBER					

Answer Sheet No. _____

Sign. of Candidate _____

Sign. of Invigilator _____

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

CHEMISTRY HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes

حصہ اوّل لازمی ہے۔ اس کے جوابات اسی صفحہ پر دے کر ناظم مرکز کے حوالے کریں۔ کاٹ کر دوبارہ لکھنے کی اجازت نہیں ہے۔ لیڈ پنسل کا استعمال ممنوع ہے۔

Fill the relevant bubble against each question:

ہر سوال کے سامنے دیے گئے درست دائرہ کو پُر کریں۔

1. The number of Hydrogen molecules required to form $36g$ of water (H_2O): $2H_2 + O_2 \longrightarrow 2H_2O$
   ○ 2.408×10^{24} ○ 24.08×10^{24} ● 1.204×10^{24} ○ 6.02×10^{23}

2. The values of Balmer series wave number lines lie in:
   ○ U.V ○ I.R ● Visible ○ Microwaves

3. Which of the following sets of quantum numbers is **incorrect** for an electron?
   ○ $n=2,\ l=0,\ m=0$ ○ $n=3,\ l=1,\ m=1$ ○ $n=3,\ l=2,\ m=1$ ● $n=4,\ l=1,\ m=2$

4. Hybridization of Beryllium in $BeCl_2$ will be:
   ○ SP^3 ○ SP^2 ● SP ○ dSP^2

5. Which one of the following gas molecules will only show translational motion?
   ○ H_2 ○ NH_3 ● He ○ CO_2

6. According to Kinetic Molecular Theory:
   ○ $v \propto \sqrt{m}$ ○ $v \propto m$ ● $v \propto \sqrt{\frac{1}{m}}$ ○ $v \propto \frac{1}{m}$

7. Osmotic pressure (π) does **NOT** depend on:
   ○ Molarity ○ Universal gas constant ○ Temperature ● Radius

8. Equilibrium constants $K_c = K_p$, when Δn is:
   ○ 1 ○ –1 ● Zero ○ –2

9. K_a is acid association constant, large PK_a value for an acid indicates that acid is:
   ○ Strong ● Weak ○ Moderate ○ Water soluble

10. Which of the following is an **acidic** salt? ○ $NaHCO_3$ ● NH_4Cl ○ CH_3COONa ○ K_2SO_4

11. Rate of reaction independent to concentration of reactants in: ● Zero order reactions ○ First order reactions ○ 2nd order reactions ○ 3rd order reactions

12. Which of the following gases will be **most non-ideal** at $-10°C$? ○ CO_2 ○ H_2 ○ N_2 ● NH_3

13. $\Delta H = \Delta E + P\Delta V$ is formula of: ● Enthalpy ○ Work ○ Surrounding ○ Internal energy

14. Which of the following relationship is **incorrect?** ○ $\Delta H_v > \Delta H_f$ ● $\Delta H_f > \Delta H_v$ ○ $\Delta H_s > \Delta H_f$ ○ $\Delta H_s > \Delta H_v$

15. Oxidation state of 'O' in KO_2 is: ○ -1 ○ -2 ○ -4 ● $-\frac{1}{2}$

16. Which of the following has **strongest** intermolecular forces of attraction? ○ $H_{2(g)}$ ○ $Cl_{2(g)}$ ● $I_{2(s)}$ ○ $CH_{4(g)}$

17. Lattice energy may also be called: ○ Affinity energy ● Crystal energy ○ Bond energy ○ Ionization energy

SUPPLEMENTARY TABLE

Atomic No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Symbol	H	He	Li	Be	B	C	N	O	F	Ne	Na	Mg	Al	Si	P	S	Cl	Ar	K	Ca
Mass No	1	4	7	9	11	12	14	16	19	20	23	24	27	28	31	32	35.5	40	39	40

ROLL NUMBER					

CHEMISTRY HSSC–I

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

NOTE: Answer any FOURTEEN parts from Section 'B' and attempts any TWO questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q. 2 Answer any FOURTEEN parts from the following. All parts carry equal marks. **(14 x 3 = 42)**

(i) The liquid $CHBr_3$ has a density of $2.89\,g/cm^3$. What volume of this liquid should be measured to contain a total of 4.8×10^{24} molecules of $CHBr_3$ (M.Wt, C=12, H=1, Br=80)

(ii) Point out the three defects of Bohr's model.

(iii) How dipole moment help to determine the polarity of molecules? Apply this concept to determine the nature of CO_2 and Cis-1, 2-dichloro ethene.

(iv) Predict and draw the shape and bond angles of following molecules on the basis of VSEPR theory:
(i) H_2S (ii) $SnCl_2$ (ii) PCl_3

(v) Briefly explain azimuthal quantum number. How it helps to determine number of e^- in a subshell?

(vi) Prove that absolute temperature of a gas is the measure of average kinetic energy of its molecules. $K\cdot E\propto T$

(vii) How the molar mass and density of a gas can be determined with the help of general gas equation?

(viii) Why butane is gas at room temperature while hexane is liquid?

(ix) Differentiate between Isomorphism and polymorphism with suitable examples.

(x) Describe electron sea theory. How it explains the properties of metals?

(xi) $N_2+3H_2 \rightleftharpoons 2NH_3$ $K_c=6\times10^{-1}$ at $500°C$ Predict the direction in which the system will shift to attain equilibrium when concentrations of H_2, N_2 and NH_3 are $1.0\times10^{-2}\,M$, $1.0\times10^{-3}\,M$, $1.0\times10^{-3}\,M$ respectively.

(xii) Calculate the pH of a buffer when molar concentrations of NH_4OH and NH_4Cl are $1.0M$ and $0.1M$ respectively. PK_b of NH_4OH is 4.75.

(xiii) Explain with chemical equation why aqueous solution of:
(i) NH_4Cl is acidic (ii) K_2CO_3 is basic (iii) Na_2SO_4 is neutral

(xiv) Consider the following reaction $2H_2+2NO\longrightarrow N_2+2H_2O$ $R=K[H_2][NO]^2$ if this reaction occurs in two steps then write its mechanism and predict the reaction intermediate.

(xv) What is diffusion? Also state Graham's law of effusion and diffusion with mathematical expression.

(xvi) Calculate the molality of 30% $\frac{w}{w}$ solution of fructose ($C_6H_{12}O_6$).

(xvii) Define system, surroundings and boundary with a suitable example.

(xviii) Predict the feasibility of the following reaction $Sn+Mg^{2+}\longrightarrow Sn^{+2}+Mg$ $E°_{Sn}=-0.14V$, $E°_{Mg}=-2.38V$

(xix) Distillation under reduced pressure is often used for purification of sensitive liquids. Describe the process giving reason.

(xx) Apply $n+l$ rule and pick the orbital with the lower energy from each of the given pairs:
(i) $3d,4s$ (ii) $2p,3s$ (iii) $6p,4s$

SECTION – C (Marks 26)

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

Q. 3 a. Consider the following reaction $CH_4+H_2O\longrightarrow CO+3H_2$ **(06)**

(i) What is the amount of CO produced if $30g$ of CH_4 and $50g$ of H_2O is used

(ii) In an experiment $22g$ of CO were produced, what is percentage yield?

b. Describe construction of lead storage battery and reactions taking place during charging and discharging. **(07)**

Q. 4 a. What is orbital hybridization? Explain the structure of $HC\equiv CH$, BF_3 and CH_4 on the basis of hybridization. **(06)**

b. State Le-Chatelier's principle. Briefly discuss the effect of increase in pressure, increase in concentration of SO_2, increase in temperature and increase in NO_2 catalyst when following reaction is at equilibrium. $2SO_2+O_2 \overset{NO_{2(g)}}{\rightleftharpoons} 2SO_{3(g)}$ $\Delta H=-256\,kJ/mol$ **(07)**

Q. 5 a. Draw complete Born Haber cycle for the formation of MgO from the following data. **(06)**
ΔH^0_f of $MgO=-602\,kJ/mol$, ΔH^0_s of $Mg=150\,kJ/mol$, $\Delta H^0_{I.E}$ of $Mg^{2+}=2180\,kJ/mol$, ΔH^0_{at} of O_2 = $24\,kJ/mol$, $\Delta H^0_{E.A}$ of $O^{-1}=-141\,kJ/mol$, $\Delta H^0_{E.A}$ of O^{-2} = $878\,kJ/mol$

b. Why addition of solute increases the boiling point of solution? Explain quantitative aspects of elevation of boiling point and prove that ΔT_b is inversely proportional to molar mass of solute. **(07)**

SUPPLEMENTARY TABLE

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