25

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 پر کریں۔

1.	No. of atoms of oxygen present in $500g$ of $KClO_3$ is (M.Wt, K=39, Cl=35.5, O=16)	○ 7.3×10^{24}	○ 3.61×10^{24}	○ 2.45×10^{24}	○ 36.8×10^{23}
2.	Magnesium reacts with Sulphur to produce MgS. How many grams of MgS can be made from $24g$ of Mg with excess of Sulphur by the reaction $Mg+S\rightarrow MgS$ (M.Wt, Mg=24, S=32)	○ $35g$	○ $56g$	○ $58.3g$	○ $12g$
3.	Which of the following is **NOT** a state function?	○ Pressure	○ Volume	○ Temperature	○ Work
4.	If frequency of Photon is $4\times10^{15}\,Hz$, then its energy will be: $(h=6.626\times10^{-34}\,Js)$	○ $26.5\times10^{-18}\,J$	○ $26.5\times10^{-19}\,J$	○ $26.5\times10^{19}\,J$	○ $26.5\times10^{18}\,J$
5.	According to Moseley's law, when metals having large atomic number will be used as an anode then it will produce X-rays of:	○ Longer wavelength	○ Low wave number	○ Shorter wavelength	○ Low energy
6.	Total No. of Sigma and Pi bonds in Ethyne $CH\equiv CH$ are:	○ 2 Sigma and 3 Pi bonds	○ 3 Sigma and 2 Pi bonds	○ 5 Sigma and 3 Pi bonds	○ 3 Sigma and 5 Pi bonds
7.	Identify the species with **maximum** bond angle:	○ CH_4	○ NH_3	○ H_2O	○ H_2S
8.	In lead storage battery electrolyte is:	○ $30\%HCl$	○ $30\%HNO_3$	○ $30\%H_2SO_4$	○ $30\%HBr$
9.	According to Le-chatelier's Principle, in an exothermic reaction, what should be done to temperature of system to obtain maximum product at equilibrium?	○ Kept Low	○ Kept High	○ Kept Same	○ Temperature has no effect
10.	According to Graham's law which one has highest rate of diffusion? (M. Wt, S=32, O=16, H=1)	○ SO_2	○ SO_3	○ H_2S	○ SCl_2

11.	Electric current can pass through graphite in one direction but not through other direction of crystal, such a property is called:	◯ Allotropy	◯ Anisotropy	◯ Isotropy	◯ An isomorphism
12.	Which one is conductor but **not mallable**?	◯ Iron	◯ Graphite	◯ Silver	◯ Copper
13.	Which of the following Concentration Units does **NOT** depends on Temperature?	◯ Molarity	◯ Molality	◯ $\%\frac{v}{v}$	◯ $\%\frac{m}{v}$
14.	Which of the following will contain **lowest** vapor pressure at $50°C$?	◯ CH_4	◯ HF	◯ NH_3	◯ H_2O
15.	A solution of HCl having $pH = 4$ will be:	◯ $0.4\,M$	◯ $4.0\,M$	◯ $0.0001\,M$	◯ $0.0004\,M$
16.	$K_c = 0.04$ at $723K$ for following reaction $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ K_p of the reaction will be: where ($R = 0.082\,atm\,dm^3\,mol^{-1}\,K^{-1}$)	◯ 0.04	◯ 2.37	◯ 0.64	◯ 0.40
17.	In a mixture containing $44g$ each of CO_2, SO_2, SO_3 and Cl_2 gases, which of the following will have **highest partial pressure** according to Dalton's Law? (where molar masses CO_2=44, SO_2=64, SO_3=80, Cl_2=71)	◯ CO_2	◯ SO_2	◯ SO_3	◯ Cl_2

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

26

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) Why actual yield is always less than theoretical yield? Write three arguments.

(ii) For $C + O_2 \longrightarrow CO_2$ $\Delta H = -393\,kJ/mol$

$H_2 + \frac{1}{2}O_2 \longrightarrow H_2O$ $\Delta H = -285.8\,kJ/mol$

$CH_3COOH + 2O_2 \longrightarrow 2CO_2 + 2H_2O$ $\Delta H = -875\,kJ/mol$

Deduce the value of standard enthalpy of formation of acetic acid.

(iii) How X-rays are produced? Discuss according to Moseley's law.

(iv) By using formula of radius derived by Bohr, how it can be proved that size of $^{4}_{2}He^{1+}$ is larger than that of $^{6}_{3}Li^{2+}$? $r = \frac{\varepsilon_o h^2 n^2}{z\pi me^2}$

(v) Write three defects of valence bond theory?

(vi) Give two causes for deviation of gases from ideality.

(vii) Write three differences between Sigma and Pi bond.

(viii) What is meant by molar heat of fusion and molar heat of vaporization? Why ΔH_v is always greater than ΔH_f ?

(ix) Boiling point increases continuously in hydrides of group IV from CH_4 to SnH_4 with the increase in atomic size of central atom. Which forces are responsible for this regular change and why?

(x) Describe briefly Lattice energy in two ways with suitable example.

(xi) Briefly explain with chemical equation, why:

(i) NH_4Cl is acidic (ii) $NaCl$ is neutral (iii) CH_3COONa is basic

(xii) Consider the following reaction $H_2 + Br_2 \rightleftharpoons 2HBr$ if concentrations of H_2 , Br_2 and HBr are $0.5M$, $0.3M$ and $0.1M$ respectively at equilibrium then calculate value of K_c .

(xiii) How relative lowring of vapour pressure helps to determine the molar mass of non-volatile and non-electrolyte solute in a dilute solution? Relationship of relative lowring of V.P is $\frac{\Delta P}{P^0} = X_2$

(xiv) What is freezing point of a solution containing $30g$ of Sucrose $C_{12}H_{22}O_{11}$ dissolved in $50g$ of water? ($K_{f\,of\,water} = 1.86$)

(xv) Differentiate between ΔE and ΔH . Under what conditions ΔH and ΔE will be equal?

(xvi) Briefly describe the construction and working of standard hydrogen electron (SHE).

(xvii) What is galvanizing? Why is it called sacrificial corrosion?

(xviii) Write thermochemical equation for the following:

(a) Standard enthalpy of formation of CH_3COCH_3 is $-248.1\,kJ/mol$

(b) Standard enthalpy of combustion of C_8H_{18} is $-5512\,kJ/mol$

(c) Standard enthalpy of atomization of Cl_2 is $+121\,kJ/mol$

(xix) What is bond energy? Why bond energy of HF is greater than that of H-I?

(xx) Enlist two factors that affect London Dispersion Forces. Why London Dispersion Forces are stronger in Radon (Rn) than Helium (He) in noble gases?

SECTION – C (Marks 26)

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

Q. 3 a. How catalyst increases the rate of reaction? Explain its action with suitable example along with the graph. Describe the types of Catalysis. **(07)**

b. Derive Vander Wall's equation for real gases and also derive the units of 'a' an 'b'. **(06)**

Q. 4 a. Balance the following redox equations with given methods: **(06)**

(i) $P + HNO_3 + H_2O \longrightarrow H_3PO_4 + NO$ Oxidation number method

(ii) $Cr_2O_7^{-2} + Cl^- \longrightarrow Cr^{+3} + Cl_2$ Ion electron method (in acidic media)

b. Explain buffer, its types and composition and buffer action with one suitable example. **(07)**

Q. 5 a. Explain the quantitative aspects of freezing point depression and prove that ΔT_f is inversely proportional to molar mass of solute. **(07)**

b. (i) A small piece of Al metal having a volume of $2.50cm^3$ is reacted with excess of HCl . What is the weight of H_2 liberated? The density of Al is $2.70\,g\,cm^{-3}$. $2Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2$ **(06)**

(ii) In a particular experiment $0.3g$ of H_2 gas was obtained. Calculate percentage yield of this reaction.

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

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Answer Sheet No. _____

Sign. of Candidate _____

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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

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ROLL NUMBER					

CHEMISTRY HSSC–I

24

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_f^0 of $MgO=-602\,kJ/mol$, ΔH_s^0 of $Mg=150\,kJ/mol$, $\Delta H_{I.E}^0$ of $Mg^{2+}=2180\,kJ/mol$, ΔH_{at}^0 of O_2 = $24\,kJ/mol$, $\Delta H_{E.A}^0$ of $O^{-1}=-141\,kJ/mol$, $\Delta H_{E.A}^0$ 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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Mass No.	1	4	7	9	11	12	14	16	19	20	23	24	27	28	31	32	35.5	40	39	40