CLASS: XI   TIME: 3 HRS
SUBJECT: CHEMISTRY   MM: 70

General Instructions:
1. All Questions Are Compulsory.
2. Question number 1 to 5 are very short- answer questions and carry 1 mark each.
3. Question number 6 to 12 are short- answer questions and carry 2 marks each.
4. Question number 13 to 24 are short- answer questions and carry 3 marks each.
5. Question number 25 to 27 are long- answer questions and carry 5 marks each.
6. Use log table if necessary. Use of calculator is not allowed

Q.1	What is the hybridization of Al in the reactant and product of the following reaction $AlCl_3 + Cl^- \rightarrow AlCl_4^-$	1M
Q.2	Give a neutral element isoelectronic with CH_3^+	1M
Q.3	Write the name and symbol of element having atomic no.105.	1M
Q.4	Under what conditions do real gases deviate from ideal gas behavior?	1M
Q.5	Give an example of an acidic buffer	1M
Q.6	What is the molality of a solution which contains 36 g of glucose in 250 g of water? (Molar mass of glucose $180g\ mol^{-1}$)	2M
Q.7	(a) How many electrons in an atom have the quantum numbers, $n=4$, $m_{s=\ -1/2}$? (b) Write the electronic configuration of zinc (Z= 30).	2M
Q.8	What is octet rule? Give its limitations with examples.	2M
Q.9	Critical temperature of 3 gases A,B,C is as follows 5.3K, 33.2K and 304.10K respectively. Which one of them will be liquefied easily and Which one will have the weakest intermolecular bonds?	2M
Q.10	Give reasons- a) Chlorine can be converted into Cl^- more easily as compared to F^- from fluorine. b) First ionization enthalpy of Be is more than B. Why?	2M
Q.11	State the law of multiple proportion and give one suitable example.	2M
Q.12	Starting from the thermodynamics relation $\Delta H= \Delta U + P\Delta V$, derive the relationship $\Delta H = \Delta U + \Delta n_gRT$	2M
Q.13	Write the postulates of Bohr's model of an atom.	3M
Q.14	(a) Predict the nature of the salt in aqueous solution: CH_3COONa, KNO_3. (b) When NaCl is added to the saturated solution of AgCl, what will happen to the concentration of Ag^+ ions? (c) Write the conjugate acid and conjugate base of HSO_4^- .	3M
Q.15	a. Define empirical formula. b. Determine the empirical formula of an oxide of iron which has 69.9% iron and 30.1% dioxygen by mass. (Fe- 55.85 , O- 16)	3M
Q.16	a) Write Vanderwaal's equation for 1 mole of a gas.. b) Calculate the volume occupied by 8.8 g of CO_2 at 31.1°C and 1 bar pressure. $R = 0.083\ bar\ L\ K^{-1}\ mol^{-1}$	3M
Q.17	(a) State Hund's rule of maximum multiplicity. . (b) Write the electronic configuration of Cu. (c) What do you mean by degenerate orbitals?	3M

Q.18	For the reaction $2 A(g) + B(g) \rightarrow 2D(g)$ $\Delta U^0 = -10.5$ KJ and $\Delta S^0 = -44.1$ JK^{-1}. Calculate ΔG^0 for the reaction, and predict whether the reaction may occur spontaneously	3M
Q.19	(a)A sample of KOH weighing 0.28g is dissolved in water and the solution is made to 50.0ml in volumetric flask. What is the molarity of the resulting solution? (b) Calculate the amount of water (g) produced by the combustion of 30 g of ethane.	3M

Q.20	Arrange the following elements as directed-
	   i) B, O , F, Mg, Na (increasing atomic size)
	   ii) Li, F, Mg, Cl (decreasing electronegativity)
	   iii) O^{2-}, Na $^+$, Be $^{2+}$, H$^+$ (decreasing size)
		3M

Q.21	a) State Heisenberg's uncertainty principle. b) An electron has speed of 40 ms-1 accurate upto 99. 99%. What is the uncertainty in locating its position?	3M
Q.22	a) Define Boyle's law? Draw V vs P graph at two different temperatures. b) Volume of a gas is decreased by four times at constant temperature, how much will be the change in pressure? **OR** Give reason (a)Mercury drops are spherical in shape (b)Liquids at high altitudes boils at lower temperature (c)Viscosity of liquids decreases with the rise in temperature	3M

Q.23	Describe the effect of
	   i) addition of H_2
	   ii) addition of CH_3OH
	   iii) removal of CO on the equilibrium state of the reaction $2H_{2(g)}+CO_{(g)} \rightarrow CH_3OH_{(g)}$
		3M

Q.24	Draw the Lewis dot structures and calculate formal charge of the underlined atoms: a) $\underline{N}H_3$ b. $\underline{C}O_3{}^{2-}$	3M

Q.25	(a) Explain the shape of SF_6 based on VBT model.
	(b) Explain-
	 i) The axial bonds are longer than equatorial bonds in PCl_5.
	ii) NH_3 has higher dipole moment than NF_3.
	iii) o-nitrophenol has lower boiling point than p-nitrophenol.
	 OR
	a) Draw the molecular orbital diagram and calculate bond order for N_2.
	b) Give reason
	   i. Although both CO_2 and H_2O are triatomic molecules but H_2O is bent while CO_2 is linear.
	   ii. H_2O is a liquid while H_2S is a gas at room temperature.
		5M

Q.26	a) If $\Delta U = 0$, how are q and w related to each other?
	b) b) Predict the change in entropy in the following
	   i. $H_{2\,(g)} \rightarrow 2H_{(g)}$
	   ii. $4Fe_{(s)}+3O_{2(g)} \rightarrow 2Fe_2O_{3(s)}$
	c) Calculate the heat of formation of Carbon-monoxide from the following data.
	i) $C(s) + O_2(g) \rightarrow CO_2(g)$; $\Delta_f H = -393.5$ kJ
	ii) $CO(g) + \frac{1}{2} O_2(g) \rightarrow CO_2(g)$; $\Delta_f H = -282.8$ kJ
	 OR
	(a) State Hess's law of constant heat summation.
	(b)Predict the sign of entropy change in the following reactions:
	(i)$2Cl(g) \rightarrow Cl_2(g)$
	(ii) $NH_4NO_3(s) \overset{\Delta}{\rightarrow} N_2O(g) + 2H_2O(g)$
		5M

	c) Calculate the enthalpy change for the process
	        $CCl_{4\,(g)} \rightarrow C_{(g)} + 4Cl_{(g)}$ and also calculate bond enthalpy of C-Cl in
	        $CCl_{4\,(g)}$?
	        $\Delta H^0_{vap}(CCl_4) = 30.5$ KJmol^{-1}
	        $\Delta H^0_{for}(CCl_{4\,(l)}) = -135.5$ KJmol^{-1}
	        $\Delta H^0_{a}(C) = 715.0$ KJmol^{-1}
	        $\Delta H^0_{a}(Cl_2) = 242$ KJmol^{-1}	

Q.27	a) The ionization constant of acetic acid is 1.74×10^{-5}. Calculate the degree of dissociation, conc. of acetate and pH in its 0.05M sol. b) Classify the following as acids or bases according to the theory of Bronsted –Lowry theory 1.NH_3 2.CH_3COO^- 3.H_3O^+ 4.H^- **Or** a) The degree of ionization of 0.1 M bromoacetic acid solution is 0.132. Calculate the K_a and pH of the solution. b) The solubility of $Mg(OH)_2$ is 8.352×10^{-3} g/L at 290 °C. Find the K_{sp} at this temperature c) Give relation between reaction quotient and equilibrium quotient for reaction to proceed in the backward direction.	5M