BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: IMSC **SEMESTER: V**
BRANCH: CHEMISTRY **SESSION : MO/2018**

SUBJECT : IMC5001 PHYSICAL CHEMISTRY-I

TIME: 1.5 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.

Q1 (a) Write down the activity expression for uni-bivalent electrolyte (K_2SO_4) in terms of mean ionic activity co-efficient and molality. [2]

(b) Consider the following redox reaction carried out in a voltaic cell. [3]
$Pb + 2Ag^+ \rightarrow Pb^{2+} + Ag$
If the reduction potential for Pb^{2+} is −0.13V and for Ag^+ it is +0.80V, what is the value of equilibrium constant (K) and ΔG^o for this reaction at a temperature of 298 K?

Q2 (a) How the solubility product constant (K_{sp}) of a sparingly soluble salt is determined by EMF measurement? [2]

(b) Calculate the liquid junction potential at 25^0C between two solutions of HCl having mean ionic activities of 0.01 and 0.001, respectively. The transference number of H^+ ion (t_+) in HCl may be taken as 0.83. [3]

Q3 (a) Explain why a glass electrode is preferred to quinhydrone electrode in measuring pH of a solution? [2]

(b) Determine the pH of a solution by using quinhydrone electrode in conjunction with a saturated calomel electrode, as represented below: [3]
Hg, Hg_2Cl_2 (s) ; KCl (sat. soln.) ‖ H^+ (unknown); Q, QH_2, Pt
The EMF of the cell was found to be 0.26 volt at 25^0C. Calculate the pH of the solution at this temperature. $E_{calomel}$ = + 0.24 volt at 25^0c and $E^0_{(H^+,\ Q,\ QH2)}$ = + 0.70 volt.

Q4 (a) The phase diagram of carbon dioxide in what way differs and resembles with that of water system. Write it without drawing water phase diagram. [2]

(b) Draw the complete phase diagram for the carbon dioxide system mentioning the regions. Why is fusion curve inclined away from the pressure axis? [3]

Q5 (a) Explain Acetone-Dry ice freezing mixture. [2]

(b) Explain the congruent melting point, incongruent melting point and peritectic emperature with examples. [3]

Q6 (a) What is Gibbs Helmholtz equation? What is 3rd low of thermodynamics? [2]

(b) What is Gibbs free energy? How do it depend on temperature and pressure? [3]

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