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SARDAR PATEL UNIVERSITY
B.Sc.(SEMESTER III) EXAMINATION
2013
TUESDAY, 19th NOVEMBER
2.30 to 5.30 pm
PHYSICAL CHEMISTRY: US03CCHE02

Maximum marks: 70

Q. 1 MULTIPLE CHOICE QUESTIONS**[10]**

1. A particular reaction will occur spontaneously or not is determined by which law of thermodynamics?
 - a) First law
 - b) Third law
 - c) Second law
 - d) None of these
2. _____ method is used to measure the elevation in boiling point.
 - a) Static
 - b) Landsberger
 - c) Dyanamic
 - d) Berkley Hartley
3. The Beckmann thermometer is used for measuring _____.
 - a) Boiling Point
 - b) Freezing point
 - c) Vapour Pressure
 - d) Osmotic Pressure
4. Arrangement of electrodes in the order of reduction potentials is known as _____.
 - a) Electrolytic series
 - b) Oxidation series
 - c) Electrochemical series
 - d) None of these
5. For the cell reaction to be spontaneous
 - a) E° is negative
 - b) E° is positive
 - c) ΔG is positive
 - d) E° and ΔG are positive
6. Which pairing of quantity and unit is incorrect?
 - a) Molar conductivity; $S\ m^2\ mol^{-1}$
 - b) Resistance; Ω
 - c) Conductance; $S\ m^{-1}$
 - d)
7. The activity of weak electrolyte in an aqueous solution can be obtained by _____.
 - a) $\gamma \cdot c$
 - b) $\gamma^2 \cdot c^2$
 - c) γ^2
 - d) c^2
8. During which of the following titrations will the conductivity reach a minimum value at the end point?
 - a) Aqueous NaOH ($0.50\ mol\ dm^{-3}$) titrated against aqueous CH_3CO_2H ($0.050\ mol\ dm^{-3}$)
 - b) Aqueous NH_4OH ($0.50\ mol\ dm^{-3}$) titrated against aqueous HCl ($0.050\ mol\ dm^{-3}$)
 - c) Aqueous NaOH ($0.50\ mol\ dm^{-3}$) titrated against aqueous HCl ($0.050\ mol\ dm^{-3}$)
 - d) Aqueous NH_4OH ($0.50\ mol\ dm^{-3}$) titrated against aqueous Cl_3CO_2H ($0.050\ mol\ dm^{-3}$)
9. Which of the following is always true for an isothermal process of an ideal gas
 - a) The internal energy does not change
 - b) No heat flows into or out of the system
 - c) The pressure does not change
 - d) The volume does not change
10. For a galvanic cell, the electrodes at which oxidation and reduction occurs are called
 - a) Anode and Anode
 - b) Anode and Cathode
 - c) Cathode and Anode.
 - d) None

[20]**Q. 2 ANSWER ANY TEN**

1. Give the statements for the second law of thermodynamics.
2. Define (a) cryoscopic constant and (b) boiling point
3. Define ohm's law. Give its mathematical equation.
4. What is the thermodynamic relationship between the free energy change, entropy and enthalpy of the cell.
5. Name the reference electrodes. To what type of electrodes do they belong.
6. Calculate the molal freezing point depression constant of water. The molar heat of fusion of ice at $0^\circ C$ is $6024.6\ J$.
7. Name the methods used for the measurement of
 - (a) Vapour pressure lowering
 - (b) Depression in freezing point
 - (c) Elevation in boiling point
 - (d) Osmotic pressure

Conti...

8. Give the systematic representation of the following cell
 $\text{Ca}^{+2} + 2\text{Na}_{(\text{Hg})} \leftrightarrow \text{Ca}_{(\text{s})} + 2\text{Na}^{+}_{(\text{aq})}$
9. Discuss about the Carnot theorem.
10. The EMF of $\text{Zn} / \text{Zn}^{+2} // \text{Cu}^{+2} / \text{Cu}$ cell is 1.1 volt. If the value of Faraday is 96500 Coulombs per mole. What is the change in free energy in J.
11. What is meant by efficiency of heat engines. what does it depend upon.
12. Define the terms (a) Molar Conductance and (b) Ionic mobility

Q. 3

1. Show that "The entropy change for the state of an ideal gas depends upon the initial and the final volume". [5]
2. Calculate the change in entropy accompanying the heating of 1 mole of He gas, assumed ideal from a temperature of 298 K to a temperature of 1000 K at constant pressure. Assume that $C_v = 3/2 R$. [5]

OR

Q. 3

1. Define the term Gibbs free energy and Helmholtz free energy. how is each of these terms related to maximum work that can be done by a system during a given change. [5]
2. Calculate ΔS when one mole of steam at 100°C is converted into ice at 0°C . Average specific heat of water is $4.184 \times 10^3 \text{ JK}^{-1}\text{Kg}^{-1}$, heat of vaporization is $2.4906 \times 10^3 \text{ JKg}^{-1}$ and heat of fusion is $333.555 \text{ J kg}^{-1}$. [5]

Q. 4

1. Discuss the following: [6]
- Dynamic method for the measurement of vapour pressure lowering.
 - Landsberger method to determine elevation in boiling point.
2. An aqueous solution of a non volatile solute boils at 100.17°C . At what temperature would it freeze? [4]
 For water $K_b = 0.52 \text{ KKgmole}^{-1}$; $K_f = 1.86 \text{ KKgmole}^{-1}$

OR

Q. 4

1. Define Osmosis. Derive an equation correlating osmotic pressure with solution concentration. [6]
2. 0.50 gm of a non volatile organic substance was dissolved in 100 ml of CCl_4 at 30°C . The V.P of the solution was found to be 140.9 torr. Calculate the molar mass of the substance. V.P of CCl_4 is 145.0 torr and its density is 1.58 gm/ml. [4]

Q. 5

1. Derive an expression relating EMF & mean activity coefficient. [5]
2. For a cell $\text{Pt} | \text{H}_2(1 \text{ bar}) | \text{HCl} | \text{AgCl} | \text{Ag}$ at a concentration of 0.005619 the cell voltage is 0.49257V. calculate the mean activity coefficient of HCl electrolyte at a given concentration. ($E^\circ = 0.2223 \text{ V}$). [5]

OR

Q. 5

1. What is concentration cell? derive an expression to calculate EMF of electrode concentration cell for (i) Amalgams of Pb in Hg and (ii) Hydrogen gas electrode. [6]
2. Write the cell reaction for [4]
- $\text{Pt} | \text{H}_2 | \text{HCl} | \text{AgCl} | \text{Ag}$
 - $\text{Pt} | \text{Ti}, \text{Ti}^{+3} || \text{Cu}^{+2} | \text{Cu}$
 - $\text{Zn}_{(\text{s})} | \text{ZnSO}_4 || \text{CuSO}_4 | \text{Cu}_{(\text{s})}$
 - $\text{Ag} | \text{AgBr} | \text{HBr} || \text{Pb}^{+2} | \text{Pb}$

Q. 6

1. What is electrolysis? Explain electrolysis of HCl solution by considering three compartments. [10]

OR

Q. 6

1. Define ionic mobility. Derive an expression for the determination ionic mobilities of ions in an aqueous solution at 'v' voltage through conductance measurements. [10]

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