

B.Sc. Semester - 5 (Remedial) (CBCS) Examination

February/March. -2020

PHYSICAL AND ANALYTICAL CHEMISTRY(CORE)

Time: 2:30 Hours

Marks: 70

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

- Q. 1 (a) Answer the following question.** (4)
- (1) Give limitations of first law of thermodynamics and different statements of second law of thermodynamics.
- Q. 1 (b) Answer any two questions out of three.** (10)
- (1) Explain in detail: Carnot Cycle.
- (2) Derive the equation for entropy of mixing for mixture of ideal gases.
- (3) (a) Calculate efficiency in percentage of a heat engine working with temperature 120 °C to 30 °C.
(b) Calculate the entropy change, when 3 mole of an ideal gas expand from volume 8 Lit. to 40 Lit. at 27 °C temperature ($R = 1.987 \text{ Cal/}^\circ\text{C}\cdot\text{mole}$).
- Q. 2 (a) Answer the following question.** (4)
- (1) Derive Clausius-Clayperon equation for a phase in equilibrium.
- Q. 2 (b) Answer any two questions out of three.** (10)
- (1) Derive the Gibbs-Helmholtz equation.
- (2) Discuss in brief the formation of one pair of partially miscible liquids in a ternary system.
- (3) (a) The equilibrium constant K_p for a reaction $A + B \rightleftharpoons C + D$ is 10^{-10} at 227 °C and 10^{-6} at 327 °C. Calculate the enthalpy of reaction. ($R = 1.987 \text{ Cal/}^\circ\text{C}\cdot\text{mole}$)
(b) Find out the value of the standard free energy change for given reaction at 25 °C. Reaction : $2\text{SO}_{2(g)} + \text{O}_{2(g)} \rightleftharpoons 2\text{SO}_{3(g)}$; The standard free energy of $\text{SO}_{3(g)}$ and $\text{SO}_{2(g)}$ are -88.52 and $-71.79 \text{ K.cal./Mole}$ respectively.
- Q. 3 (a) Answer the following question.** (4)
- (1) Write Cell reactions and Nernst equation at 298 K temperature and 1 bar pressure for following electrochemical cells.
(a) $\text{Mg}_{(s)} / \text{Mg}_{(aq)}^{+2} \parallel \text{Au}_{(aq)}^{+3} / \text{Au}_{(s)}$ (b) $\text{Sn}_{(s)} / \text{Sn}_{(aq)}^{+2} \parallel \text{H}_{(aq)}^{+} / \text{H}_{2(g)} / \text{Pt}$
- Q. 3 (b) Answer any two questions out of three.** (10)
- (1) What is reference electrode? Explain calomel electrode in detail.
- (2) Derive the mathematical expression of Lambert-Beer's law.
- (3) (a) Explain: Reversible and Irreversible cell with suitable example.
(b) A Pb rod is placed in 0.01M solution of PbSO_4 at 298 K. Calculate the reduction potential of Pb-electrode. ($E_{\text{Pb}^{+2}/\text{Pb}}^0 = -0.13 \text{ V}$)
- Q. 4 (a) Answer the following question.** (4)
- (1) Define: Conductance and discuss the conductometric curve for a mixture of strong acid and weak acid with strong base.
- Q. 4 (b) Answer any two questions out of three.** (10)
- (1) What is equivalent conductance? Describe the method to determine the degree of hydrolysis and hydrolysis constant by conductometry.
- (2) What is complexometry titration? Explain the titration of mixture of metal ions with EDTA by masking and demasking agents.
- (3) Discuss:
(a) Precipitation titration curve of NaCl by AgNO_3 .
(b) Replacement titration curve of NH_4Cl with NaOH .
- Q. 5 (a) Answer the following question.** (4)
- (1) What is an indicator? Explain the principle of Ostwald's law based on indicator.
- Q. 5 (b) Answer any two questions out of three.** (10)
- (1) Explain: Iodometry and Iodimetry titration in detail.
- (2) Explain: Mohr's method for precipitation titration.
- (3) Explain: Neutralisation titration curve of strong acid and weak base.
