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SEAT No._____

No. of pages: 04

SARDAR PATEL UNIVERSITY, VALLABH VIDYANAGAR
B.Sc. (SEMESTER - VI) EXAMINATION
PHYSICAL CHEMISTRY
US06CCHE23

Date: 06.04.2022, Wednesday

Time: 03:00 pm to 05:00 pm

Total marks: 70

Q- 1 Choose one most appropriate response out of four provided to you. (10)

(i) The relation between equilibrium constant and standard free energy change is given by ___ equation.
(a) $G = G^o + RT \ln P$　(b) $\Delta G^o = - RT \ln K_p$　(c) $\Delta G = \Delta H - T \Delta S$　(d) $G - G^o = RT \ln P$

(ii) The rotational thermal energy for linear molecule is _____ .
(a) RT　(b) 3/2 RT　(c) 2/3 RT　(d) none of these

(iii) For a cell reaction to be spontaneous _____ .
(a) E^0 is +ve　(b) E^0 is –ve　(c) ΔG is +ve　(d) Both ΔG and E^0 is +ve

(iv) To measure reduction potential of zinc electrode experimentally, the cell to be constructed is:
(a) $Zn_{(s)} | Zn^{+2}{}_{(aq)} \| H^+{}_{(aq)} | H_{2(g)}, Pt$　(b) $Pt(s) | H_{2(1\ atm)}, H^+{}_{(aq)} \| Zn^{+2}{}_{(aq)} | Zn_{(s)}$
(c) $Zn_{(s)} | Zn^{+2}{}_{(aq)} \| H^+{}_{(aq)} | Pt$　(d) $Zn(s) | Zn^{+2}(1M) \| H_{2(1atm)} | Pt_{(s)}$.

(v) EMF of a cell in terms of reduction potential of its left and right electrode is _____
(a) $E = E_{left} − E_{right}$　(b) $E = E_{left} + E_{right}$　(c) $E = E_{right} − E_{left}$　(d) $E = − (E_{right} + E_{left})$

(vi) In silver-lead system, the composition at the eutectic point is _____ .
(a) 4.4% Ag, 95.6% Pb　(b) 3.6% Ag, 96.4% Pb
(c) 2.6% Ag, 97.4% Pb　(d) 2.4% Ag, 97.6% Pb

(vii) The melting point of monoclinic sulphur is ___ °C .
(a) 100　(b) 110　(c) 120　(d) 130

(viii) The curve representing the equilibrium between liquid water and water vapor at different temperature is known as _____ curve.
(a) vapor pressure　(b) fusion　(c) sublimation　(d) transition

(ix) _____ the gold number of a hydrophilic colloid, the higher is its protective power.
(a) Higher　(b) Constant　(c) Lower　(d) None of these

(x) Fog is the example of _____ .
(a) emulsion　(b) aerosol of solid　(c) aerosol of liquid　(d) gel

Q- 2 True or False / fill in the blanks (08)

(i) Moment of inertia is a _____ property. (atomic or molecular)

(ii) The relation between entropy and the number of arrangements is given by _____ equation.
($S = W \ln k$ or $S = k \ln W$)

(iii) Instrument used to measure accurate cell potential is galvanometer. (True/False)

(iv) Electrochemical cell $Zn + Cu^{+2} \rightarrow Zn^{+2} + Cu$ may be represented as: $Zn | Cu^{+2} \| Zn^{+2} | Cu$. (True/False)

(v) The maximum number of phases in any equilibrium state of one component system having zero degree of freedom will be _____ (1 or 3)

(vi) A phase is always ____ . (homogeneous or heterogeneous)

(vii) The ions preferentially adsorbed on the surface of a particle of a colloidal system are called potential-determining ions. (True/False)

(viii) Albumen is a protective colloid. (True/False)

① (P.T.O.)

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Q- 3 Give answers of any ten questions out of twelve. (20)

(i) State the third law of thermodynamics and Trouton's rule.

(ii) What are the limitations of molecular basis of entropy?

(iii) What is free energy? Write the criteria for spontaneous process.

(iv) Define electrode concentration cell. Give one example.

(v) Write the cell reaction for: $Zn/Zn^{+2} // Fe^{+3}, Fe^{+2} / Pt$.

(vi) Write the electrode reaction and electrode representation for gas electrode and amalgam electrode.

(vii) Define the terms: component and degree of freedom.

(viii) What is thermal equilibrium? Prove that the temperatures of all the phases in equilibrium is the same.

(ix) Discuss the solubility method to determine transition point.

(x) Explain the formation of $AgI \mid I^-$ sol by selective adsorption of ions.

(xi) Define electro-osmosis and electro-phoresis.

(xii) State any four applications of colloids.

Q- 4 Give answers of any four questions out of eight. (32)

(i) Calculate the free energy function based on 298 K for NaCl at 1000 K.
If $S^0_{298} = 72.13$ J/K mol and value of a = 45.94, b = 16.32 x 10^{-3} T, c = 0.

(ii) Explain "Equilibrium constant can be treated as a particular type of molecular distribution".

(iii) Calculate E^0_{cell} and ΔG^0 for the reaction occurs in the following cell at 25^{0}C.
$Pt/Tl^{+1}(a=1), Tl^{+3}(a=1) // Cl^-(a=1) / Hg_2Cl_2 \text{(s)} / Hg$.
And explain that the ΔG^0 depends on the number of electrons transfer (i.e., n) during the cell reaction.
Given: Standard reduction potential of right electrode and left electrode are 0.2674V and 1.25V respectively. (F = 96485 Coulomb) .

(iv) Derive an expression for emf of electrolyte concentration cell without transference.

(v) Discuss Gibb's phase rule and give its advantages.

(vi) Draw and discuss the phase diagram of two components system which forms a compound with incongruent melting point.

(vii) Explain the methods of dialysis, electro-dialysis and ultrafiltration in the purification of colloidal solutions.

(viii) Write a short note on electrical double layer.

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