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Total Number of Pages: 02

B.TECH
15BS1103

2ND Semester Regular Examination 2015-16

CHEMISTRY

BRANCH: ALL

Time: 3 Hours

Max Marks: 100

Q.CODE: W630

Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

Q1 Answer the following questions: (2 x 10)

- A real crystal has more entropy than an ideal crystal. Why?
- The equilibrium constant for a reaction is 10. What will be the value of ∂G^0 ? $R = 8.314 \text{ J.K}^{-1} \text{ mol}^{-1}$, $T = 300 \text{ K}$.
- Which of two crystal CdCl_2 and NaCl will produce schottky defect when AgCl crystal is added to them?
- When ∂H is equal to ∂E ?
- What is the value of degree of freedom and phase of a substance at its critical point?
- Give the representation of (notation) of standard Hydrogen Electrode.
- The oxalic acid is oxidized by acidified KMnO_4 , where KMnO_4 acts as ..?
- 99% of hydrogen peroxide decomposes in 40 Min. How much time does it take to decompose 99.9% of it?
- A compound formed by the element X and Y crystallizes in cubic structure. Where X atoms are at the corner of cube and Y atoms are at face center .What is the formula of compound?
- When Lead –storage battery is charged it acts as which type of cell?

Q2 Answer the following questions: (2 x 10)

- Write down the advantages of glass electrode.
- The latent heat of fusion of ice is 5.99 kJ mol^{-1} at its melting point. Calculate ∂S for fusion of 900 gm ice.
- What do you mean by unit cell? How many atoms present in BCC and CCP unit cell?
- What do you mean by liquid junction potential?
- What is the maximum number of phase and degree of freedom for system having component C?
- Write down the Schrödinger wave equation for one dimensional system. Explain the significance of the terms used in this equation.
- In a process, 701J heat is absorbed and 394J work is done by system. Calculate the change in internal energy for this process.
- What do you understand by state function? Neither q nor w is a state function but $q + w$ is a state function? Explain.
- What is the difference between eutectic point and triple point?
- Calculate the uncertainty in velocity of a bullet weighing 10 g whose position is known with accuracy 0.01 mm.

Part – B (Answer any four questions)

- Q3 a)** Consider the reaction, **(5)**
$$\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2 \text{HCl}(\text{g})$$

How does the value of ∂G change when the pressures of the gases are altered as follows at 25°C ?
 $\text{H}_2 = 0.25 \text{ atm}$; $\text{Cl}_2 = 0.45 \text{ atm}$; , $\text{HCl} = 0.30 \text{ atm}$
Standard free energy of $\text{HCl} = -95.27 \text{ kJ/mol}$

b) How pH of a solution can be determined using quinhydrone electrode? Discuss its advantages and disadvantages. **(6)**

c) What is heterogeneous catalysis? Discuss its theory. **(4)**

Q4 a) What is a condensed system? Why in such case phase rule becomes $F = C - P + 1$? Construct the phase diagram of Bi-Cd system and describe its use in understanding the eutectic point and eutectic composition. **(5)**

b) Why O_2 is paramagnetic while F_2 is diamagnetic? Explain these with molecular orbital diagram. **(5)**

c) If $\partial U = T\partial S - P\partial V$, then prove that $(\partial T/\partial P)_S = (\partial V/\partial S)_P$ **(5)**

Q5 a) Sucrose decomposed in an acid solution into glucose according to a first order rate law with half-life of 3.33h at 25°C . What fraction of sample of sucrose remains after 9.00h? **(5)**

b) What do you mean by EMF? Derive the expression for determination of EMF of a cell using Gibb's Helmholtz equation. **(6)**

c) Prove that $\partial G = V\partial P - S\partial T$ **(4)**

Q6 a) Discuss about band theory for metallic bonding. How does it explain the categorization of metal into conductor, insulator and semiconductor? **(6)**

b) A substance exists in solid, liquid and vapor forms under 1 atm pressure. One form of this substance stable at low temperature and other at high temperature and transition of two forms accompanying by increase in volume. Draw the phase diagram of this substance. **(5)**

c) Derive the relationship for density of a cubic crystal. **(4)**

Q7 a) Calculate the equilibrium constant, K_P , for the following reaction at 25°C . **(5)**
$$2\text{HCl}(\text{g}) \rightarrow \text{H}_2(\text{g}) + \text{Cl}_2(\text{g})$$

 $\text{HCl}(\text{g})$ free energy = -95.27 KJ/MOL

b) Show that wave length of a moving particle is related to kinetic energy as **(4)**
$$\text{Wavelength} = h/(2mE)^{1/2}$$

c) Differentiate between order and molecularity of a reaction. Give two examples each (i) both are same (ii) both are not same. **(6)**

Q8 a) NH_4Cl crystallizes in a body centered cubic lattice, with a unit cell distance of 387 pm. Calculate (a) the distance between the oppositely charged ions in the lattice, and (b) the radius of the NH_4^+ ion if the radius of the Cl^- ion is 181 pm. **(6)**

b) Discuss Frenkel Defect with an example. **(5)**

c) Calculate the standard electrode potential of lead chloride if the electrode potential is -0.18025 V at 301K and a concentration of Pb^{+2} solution is 0.0096M. **(4)**

Q9 a) What do you mean by fuel cell? Discuss hydrogen-oxygen fuel cell (Design, working, advantages and limitations). **(8)**

b) Will the vaporization of liquid water be spontaneous at 27°C and 1 atm pressure? Given $\partial H = 9710 \text{ k cal mol}^{-1}$, and $\partial S = 26 \text{ cal K}^{-1}$. Find the temperature at which liquid and vapor will be in equilibrium with each other. **(3)**

c) How the order of a reaction can be determined? **(4)**