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Total Number of Pages : 02

B.Tech  
BS1103

1<sup>st</sup> Semester Back Examination 2018-19

CHEMISTRY-I

BRANCH : AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH, MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE

Time : 3 Hours

Max Marks : 70

Q.CODE : E849

Answer Question No.1 which is compulsory and any FIVE from the rest.  
The figures in the right hand margin indicate marks.

- Q1** Answer the following questions : (2 x 10)
- a) What information are conveyed by  $\psi$  and  $\psi^2$ ?
  - b) Determine is the de-Broglie wavelength of an electron travelling at 2% of the speed of light?
  - c) What are the Miller indices, if the plane intersects the crystal lattice at  $2a$ ,  $b$ ,  $2c$  ?
  - d) Differentiate between the triple point and critical point with one example from each.
  - e) The radii of  $\text{Cs}^+$  and  $\text{Br}^-$  are 169pm and 185 pm respectively. Predict the structure of  $\text{CsCl}$  and its coordination number in  $\text{Cs}^+$ .
  - f) The time for half-completion of a reaction is changed from 100 sec to 50 sec when the initial concentration is changed from 0.80 to 1.6 mol  $\text{lit}^{-1}$ . Determine the order of this reaction.
  - g) Write the chemical reaction for propane fuel cell.
  - h) Four moles of perfect gas are expanded from a pressure of  $20\text{Nm}^{-2}$  to  $1\text{Nm}^{-2}$  at 300K. What is the free energy associated with this process?
  - i) How will you represent the rate of the reaction:  $2\text{A} + 3\text{B} \rightarrow 4\text{C}$ ?
  - j) What percent of  $T_1/T_2$  gives heat engine an ideal efficiency of 20%?
- Q2**
- a) Discuss the salient features of wave function. (5)
  - b) Draw the molecular orbital configuration of  $\text{O}_2$ ,  $\text{O}_2^-$ ,  $\text{O}_2^+$ . Compare magnetic behavior and bond length among these species. (5)
- Q3**
- a) The emf of the cell:  $\text{Cd} | \text{CdCl}_2 (\text{saturated}) || \text{AgCl} | \text{Ag}$  is 0.80V and 0.812 V at  $27^\circ\text{C}$  and  $7^\circ\text{C}$  respectively. Calculate the change in free energy and enthalpy of this reaction. (5)
  - b) A face-centred cubic crystal possesses an atomic radius of 180pm. Calculate the spacing of (i) (200) and (ii) (111) planes. (5)
- Q4**
- a) The catalysed decomposition of hydrogen peroxide follows first-order reaction. This reaction is 50% completed in 1 hour at 400K. Determine the activation energy of this reaction if 50% of this reaction is completed at 500K in 20 minutes. (5)
  - b) Prove that  $(\delta V / \delta T)_P = (\delta S / \delta P)_T$  (5)

**Q5 a)** What is the emf of the following cell at 25°C? Write the cell reaction. **(5)**

Zn(s) | Zn<sup>2+</sup> (0.2M) || Ag<sup>+</sup> (0.002M) | Ag(s)  
The standard emf of the cell is 1.54V.

**b)** Derive the relationship for change in entropy for an ideal gas at constant pressure. **(5)**

**Q6** Combustion of diborane (B<sub>2</sub>H<sub>6</sub>) proceeds according to the equation: B<sub>2</sub>H<sub>6</sub>(g) + **(10)**

3 O<sub>2</sub> → B<sub>2</sub>O<sub>3</sub> (g) + 3 H<sub>2</sub>O (g) with liberation of 464 kcal of heat per mole of B<sub>2</sub>H<sub>6</sub>. Combustion of boron produces B<sub>2</sub>O<sub>3</sub>(g) and released 283 kcal per g atom. Standard heat of formation of H<sub>2</sub>O(g) is -57.79 kcal mole<sup>-1</sup>. Calculate the ΔH<sub>f</sub> of diborane.

Describe the law of thermodynamics which confirms to this relation.

**Q7** Define phase rule. With the help of this, draw and describe the phase diagram of Fe-C systems. How it is different phase diagram of Sulphur system? **(10)**

**Q8** **Write short answer on any TWO:** **(5 x 2)**

**a)** Phase diagram of Bi-Cd system

**b)** Determination of Lattice energy of NaCl using Born-Haber cycle.

**c)** Salient features of heterogeneous catalysis with two examples.

**d)** Functioning of lead storage cell with cell reactions.