

- (b) What do you mean by order and molecularity ? Explain with examples from.

2

- (c) An electron is moving with a kinetic energy of  $4.55 \times 10^{-25}$  J. Calculate wavelength and frequency of particle wave.

3

8. (a) How can you determine  $P^H$  of a solution using glass electrode ?

3

- (b) Show that for an one mole of ideal gas.

$$[\partial P / \partial V]_T \times [\partial V / \partial T]_P \times [\partial T / \partial P]_V = -1$$

3

Or

- (b) Calculate the 0.01M sodium acetate solution Hydrolysis constant of sodium acetate is  $5.6 \times 10^{-10}$ .

- (c) For one mole of an ideal gas, writing  $V$  as a function of temperature and pressure. Show that  $\partial V$  is an exact differential.

4

Or

How many moles of calcium hydroxide must be dissolved to produce 250 ml of an aqueous solution of  $P^H$  10.65.

Total number of printed pages – 8 B.Tech  
BS 1103 (New)/BSCC 2101 (Old)

## Second Semester Examination – 2010

### CHEMISTRY – I

Full Marks – 70

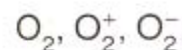
Time : 3 Hours

Answer Question No. 1 which is compulsory and any **five** from the rest.

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

- (a) Fusion curve of ice has negative slope explain ?  
(b) Which species given below have maximum bond strength ?



(c) Identify the crystal system in following cases.

(i)  $a = 4 \text{ nm}$ ,  $b = 6 \text{ nm}$ ,  $c = 10 \text{ nm}$ , and  $\alpha = \beta = \gamma = 90^\circ$

(ii)  $a = 4 \text{ nm}$ ,  $b = 4 \text{ nm}$ ,  $c = 4 \text{ nm}$ , and  $\alpha = \beta = \gamma = 90^\circ$

(d) The half life period ( $t_{1/2}$ ) of a reaction is halved as initial concentration of reactant is doubled. What is order of reaction ?

(e) What do you mean by extensive and intensive properties ? Explain with example.

(f) Define heat of neutralization.

Or

What is the molar concentration of  $\text{Ca}(\text{OH})_2$  if its solution has  $\text{pH}$  of 12 ?

(g) Two moles of ideal gas are allowed to expand reversibly and isothermally at  $300^\circ \text{K}$  from a pressure 1 atm to pressure 0.1 atm. What is the change in Gibb's free energy.

(h) Write down electrode reaction of calomel electrode and standard hydrogen electrode.

(i) What is the difference between pearlite and ledeburite ?

(j) What do you mean by zero order reaction ? Explain with one example.

2. (a) Calcium crystallises in a face centred cubic unit cell with  $a = 0.556 \text{ nm}$ . calculate the density, if  $2.5 \times 2$

(i) it contained 0.1% frenkel defects

(ii) it contained 0.1% schottky defects.

(b) What is the function of catalytic promoters and inhibitors in a chemical reaction ? Explain with example. 3

(c) Show that  $\partial G = V\partial P - S\partial T$  2

Or

$\text{N}_2$  and  $\text{H}_2$  were added to a 5.0 liter flask at 298 K. The equilibrium mixture contained 18.7 gm of  $\text{NH}_3$ , 0.16 gm  $\text{H}_2$  and 3.36 gm of  $\text{N}_2$ . Calculate  $K_c$  for reaction.

3. (a) On the basis of molecular orbital theory answer the following for  $N_2$  and  $O_2$ : 4
- Draw the molecular orbital diagram.
  - Write down molecular electronic configuration.
  - Find bond order and predict magnetic properties.
- (b) A hydrogenation reaction is carried out at  $500^\circ K$ . If same reaction is carried out in presence of Catalyst at same rate. The temperature required is  $400^\circ K$ . Calculate the activation energy of reaction if catalyst lower the activation energy barrier by 20 KJ/mol. 3
- (c) The heat liberated on complete combustion of 7.8 gm benzene is 327 KJ. This heat has been measured at constant volume and at  $27^\circ$ . Calculate heat of combustion of benzene at constant pressure at  $27^\circ$  ( $R = 8.3 J mol^{-1} K^{-1}$ ). 3

Or

Calculate the composition of an acidic buffer solution made up HA and NaA of total molarity 0.29 having  $P^H = 4.4$  and  $K_a = 1.8 \times 10^{-5}$ .

4. (a) What do you mean by invariant points ? Discuss invariant points in both water and sulphur system with diagram. (Mention T & P) 4
- (b) Calculate the standard electrode potential of  $Ni^{+2}/Ni$  electrode if the cell potential of cell  $Ni/Ni^{+2}(0.01M) // Cu^{+2}(0.1M)/Cu$  is 0.59V  
Given standard electrode potential  $E^0_{(Cu+2/Cu)} = 0.34 V$ . 3
- (c) When 2.94 moles of iodine and 8.1 moles of hydrogen are heated at  $444^\circ C$  until equilibrium is established 5.64 moles of HI are formed. Find the equilibrium constant ? 3

Or



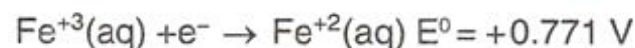
If  $\partial H = T\partial S + V\partial P$ ; then show that  $[\partial T/\partial P]_S = [\partial V/\partial S]_P$ .

5. (a) What is the difference between curie temperature, eutectic temperature and transition temperature explain with example.

3

- (b) You are given the following reduction reaction and  $E^0$  values :

3



Calculate  $E^0$  for half cell reaction  $\text{Fe}^{+3}(\text{aq}) + 3e^- \rightarrow \text{Fe}(\text{s})$ .

- (c) What do you mean by lattice energy ? Explain with suitable example how lattice energy calculate with help of born harber cycle.

4

Or

What do you mean by common ion effect ? Explain with example .Write down application of common ion effect (at least one).

6. (a) Write down the schrodinger wave equation for three dimensional form. Mention the conditions for acceptable wave function.

3

- (b) At 380°C the half life period for first order decomposition of  $\text{H}_2\text{O}_2$  is 360 min. The energy of activation of reaction is 200 kJ/mol. Calculate the time required for 75% decomposition at 450°C.

4

- (c) The heat of reaction for  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$  at 27°C is -91.94 KJ. What will be it value at 50°C ? The molar heat capacities at constant pressure and 27°C for  $\text{N}_2$ ,  $\text{H}_2$ , and  $\text{NH}_3$  are 28.45, 28.32, and 37.07 joules respectively.

3

Or

Calculate  $\text{P}^{\text{H}}$  of a solution obtained by mixing 50 ml of 0.01 M  $\text{Ba}(\text{OH}_2)$  with 50 ml of water.

7. (a) The galvanic cell  $\text{Ag}(\text{s})/\text{AgCl}(\text{s})/\text{KCl}(1.0\text{M})/\text{Hg}_2\text{Cl}_2(\text{s})/\text{Hg}(\text{l})$  is an example of cell without liquid junction potential. The E.M.F of cell is 0.058V at 298° K and 0.0614 V at 308° K.

5

- (i) Write down cell reaction of above cell ?  
(ii) Calculate  $\partial S^\circ$ ,  $\partial G^\circ$  and  $\partial H^\circ$  at 298° K.