

UG 4th Semester Examination 2020

CHEMISTRY

[HONOURS]

Course Code: CC8

(Physical Chemistry–III)

Full Marks: 10

Answer any five questions

[2×5=10]

1. A. The number of components in a system containing 1 mole of NH_4Cl , 0.5 mole of NH_3 and 0.5 mole of HCl are

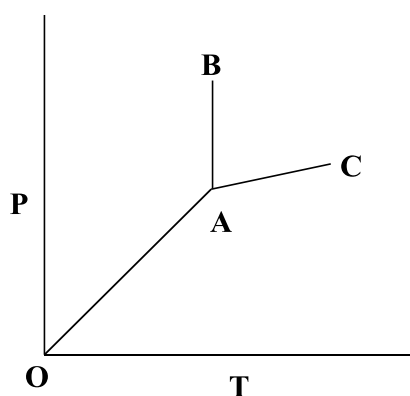
- (a) One (b) Two (c) Three (d) Four

B. The maximum number of triple points occurring in the one component sulphur system are

- (a) 1 (b) 2 (c) 3 (d) 4

[1+1]

2. Phase diagram of a compound is shown below



The slopes of the lines OA, AC and AB are $\tan \pi/4$, $\tan \pi/6$ and $\tan \pi/3$, respectively. If melting point and ΔH of melting are 300 K and 3 kJ mol^{-1} respectively, then calculate the change in the volume on melting?

[2]

3. A liquid has vapour pressure of $2.02 \times 10^3 \text{ Nm}^{-2}$ at 293 K and heat of vaporisation of 41 kJ mol^{-1} . Calculate the boiling point of the liquid (in Kelvin)?

[2]

4. Calculate the mean ionic activity coefficient of 0.001 molal ZnSO_4 (aq) at 298 K according to the Debye-Huckel limiting law? (Debye-Huckel constant is $0.509 \text{ mol}^{-1/2}$).

[2]

5. Express the activity of 'm' molal CuSO_4 solution in terms of its mean activity coefficient (γ_{\pm}).

(a) $m^2\gamma_{\pm}^2$ (b) $4m^3\gamma_{\pm}^3$ (c) $16m^4\gamma_{\pm}^4$ (d) $108m^5\gamma_{\pm}^5$

[2]

6. The Zn^{+2}/Zn half cell ($E^{\circ} = -0.762 \text{ V}$) is connected to a Cu^{+2}/Cu half cell ($E^{\circ} = 0.340 \text{ V}$). What is the value of E°_{cell} for spontaneous conversion of chemical energy to electrical energy? What is the value of $\log_{10}K$, where K is the equilibrium constant? Use $(2.303 \text{ RT/F}) = 0.06$

[2]

7. Determine whether or not the following operator will commute or not. Show it.

$$\hat{\mathbf{A}} = \mathbf{X}^3 \quad \hat{\mathbf{B}} = \frac{d}{dx}$$

[2]