



Answer the following Questions

Assume any missing data

Total Marks 50

(Na=23, H=1, S=32, C=12, N=14 and O=16)

Question No. (1):

(10 Marks)

- 3 (a) Show how you can obtain the values of the universal gas constant R in three different units of energy?
- 3 (b) Derive the relationship between partial pressure, total pressure and mole fraction of a component gas in a gas mixture?
- 4 (c) The vapor pressure of water vapor is 200 mm Hg in a mixture of air and water vapor. The total pressure is 740 mm Hg and temperature is 71.1°C. What is the density of the gaseous mixture in gm/lit (Assuming dry air has the following composition by volume $\text{CO}_2=0.03\%$, $\text{O}_2=20.69\%$, $\text{N}_2=78.02\%$ and $\text{H}_2\text{O}=1.26\%$)?

Question No. (2):

(10 Marks)

- 3 (a) Explain the three laws of thermodynamics?
- 2 (b) Derive the relationship between C_p and C_v for ideal and Real gases?
- 5 (c) Calculate the change in internal energy, (ΔE), when 64 gm of oxygen gas (O_2), are expanded isobarically at pressure 8.6 atm, by raising the temperature of the gas from 27 oC to 627 °C, consider oxygen behaves as an ideal gas during this process and Consider C_p varies with temperature. You are given that, O=16 and oxygen specific heat $C_p=8.3+0.003T$ cal /deg.mole)

Question No. (3):

(12 Marks)

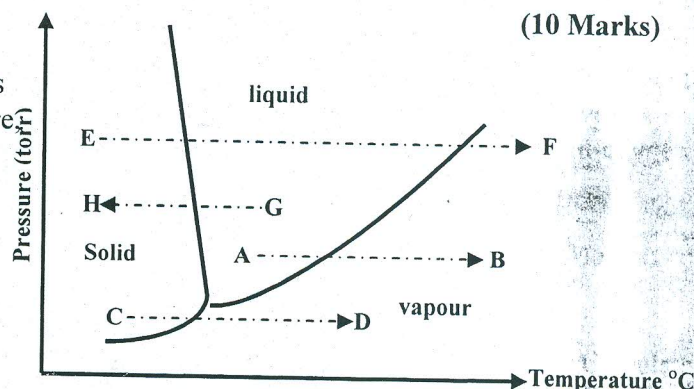
- 3 (a) Explain Raoult's law for ideal solutions and show how deviations from ideality could occur? Confirm your answer with drawing
- 3 (b) At 24°C, 0.00178 gm N_2 gas will dissolve in 100 gm of H_2O , if the nitrogen pressure is 737 torr. Calculate the Henry's law constant?
- 6 (c) 6 gm of NaHSO_4 dissolved in 500 gm of water lowers the freezing point of water by 0.5°C. Assuming that NaHSO_4 dissociates completely into (Na^+) and (HSO_4^-) and that the weak acid (HSO_4^-) dissociates partially to (H^+) and (SO_4^{2-}). Calculate from the observed freezing point lowering the molality of (SO_4^{2-}) and pH of this solution when molality equal molarity? (for water $\Delta H_{\text{fus.}}=1436$ cal/mol $T_f^0=273\text{K}$)

Question No. (4):

(10 Marks)

- 4 (a) The given figure represents the phase diagram of H_2O , draw the features of heating or cooling curves from the following isobaric paths given in the figure illustrating the main feature of each curve:

- 1- Path from A to B, (A → B)
 2- Path from C to D, (C → D)
 3- Path from E to F, (E → F)
 4- Path from G to H, (G → H)



- 6 (b) Calculate the **melting** and **boiling point** of water, at pressure of 31 atm, where the density of liquid water at 0°C is given as 0.9998 gm/cm³ and that for ice at 0°C is 0.9168 gm/cm³? Consider that ($\Delta H_{\text{fus.}}=1436$ and $\Delta H_{\text{vap.}}=9719.97$ cal/mol)

Question No. (5):

(10 Marks)

- 3 (a) In a simplified flow sheet diagram, explain the main steps of Portland cement manufacture?
- 3 (b) Explain the main features of the kiln used for burning the raw mix to produce Portland cement? and explain the main reactions occurring inside it?
- 4 (c) Explain the main stages of setting and hardening of Portland cement according to modern theory? and Explain (graphically) the development of compressive strength on the hydration of the main constituents of Portland cement?

انتهت الأسئلة - مع أطيب التمنيات بالتوفيق والنجاح
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