

Question Bank

Q.1) A-Define: 1-First law of thermodynamic. 2-Specific heat capacity. 3- Exothermic reaction. 4-Heat of formation.5- Viscosity of gase. 6- Heat of combustion.

B- The density of water vapor at 327.6 atm. and 776.4 K is 133.2 gm.dm^{-3} . a) determine the molar volume of water and the compression factor Z from these data attractive force or repulsive dominate , b) calculate Z from the van der Waals equation with $a= 5.536 \text{ L}^2.\text{atm.mol}^{-2}$. at low pressure?.

Q.2)A-Explain the condensation of CO_2 gases at the critical point according to Andrews work .

B-Prove for ideal gas $C_p-C_v=R$.

C- Why γ (Ar 1.66 while 1.26 for C_2H_2).

Q.3) A-Explain when 1 mole of NaCl dissolves in water 4Kj heat will be absorbed from the surrounding.

B- A sample of Argon Heat capacity at constant volume = $12.48\text{J.K}^{-1}.\text{mol}^{-1}$) at 1atm. Pressure expands reversibly & adiabatically from 0.5 dm^3 to 1 L . Initially its temperature is 25°C . What is its final temperature, how much work is done during the expansion & what is the change in internal energy.

Q.4)A- What is the heat of solution and dilution? then explain the types.

B-What is the Super critical fluid? Then write the properties.

C-A gas expands isothermally against a variable pressure given by $(P = 2+ 8/V)$ atm. , the volume increase from 4cm^3 to 30 L ;Calculate work.

Q.5) A-Define: 1-Viscosity of liquid. 2-Trouton's rule. 3-Lattice energy. 4-Hess law.

5-Heat of combustion.

B- A piece of zinc of 5gm mass is dropped in to a beaker of dilute hydrochloric acid. Calculate the work done by the system as a result of the reaction. The atmospheric pressure is 1.0 atm and the temperature 23°C .If atomic weight zinc= 65g/mol (10Marks).

Q.6) A- For adiabatic reversible expansion for ideal gas prove $[T_f = T_i * (V_i/V_f)^{1/\gamma}]$.

B-Prove E is a state function.

C-In thermo-chemical equations the heat associated with a process depends on what?

Q.7)A-Explain lattice energy by using Born – Haber cycle for NaCl.

B-Bond dissociations energies may be obtained by what?

C-The constant pressure heat capacities of gaseous hydrogen, oxygen and water are 28.84, 29.37 and 33.58 J. K⁻¹ mol⁻¹ respectively. The enthalpy of formation of gaseous H₂O at 25°C is (- 241.82 KJ.mol⁻¹) what is its value at 100°C.

Q.8)A-Calculate the entropy changes for the following processes :

a) Melting of 1.0 mol of Al at its melting point. (660°C) and $\Delta H^\circ_{\text{fusion}} = 1.91\text{Kcal mol}^{-1}$.

b) Evaporation of 2.0 mol of liquid O₂ at its Boiling Point(-182.9°C) and $\Delta H^\circ_{\text{vaporization}} = 1.63\text{ Kcal mol}^{-1}$.

c) Heating of 10 gm. Of H₂S from 50 to 100 °C at constant pressure and ($C_p = 7.15 + 0.00332T$) cal.mol⁻¹ K⁻¹.

B- ΔS_r cannot be calculated by the relation (q/T) why? While ΔS_r calculated by what?

C-Prove that $\mu_{JT} = 0$ for ideal gas using $\mu_{JT} = (-1/C_p)(\partial H/\partial P)_T$.

Q.9)A-Write the Comparison: among Solution, Colloid and Suspension.

B-What is the azeotrope? Then explain the types of azeotrope?

C-Write the reason when one mole of H₂O is added to a huge volume of water at 25°C, the volume increase by 18 cm³ and we can say that 18 cm³.mol⁻¹is the molar volume of pure water. However, when we add 1.0 mole of water to a huge volume of pure ethanol, the volume increases by only 14 cm³.

Q.10) A-Define: 1-First law of thermodynamic. 2- heat capacity. 3- Exothermic reaction.

4-Inversion point. 5- Viscosity of gase. 6- Thermochemistry.

B- A vessel of volume 22.4L contains 2.0 mole H₂ and 1.0 mole of N₂ at 273K initially. All the H₂ reacted with sufficient N₂ to form NH₃, calculate the partial pressure and the total pressure of the final mixture.

Q.11)A-Explain the condensation of CO₂ gases at the critical point according to Andrews work .

B-In adiabatic reversible expansion for ideal gas prove that $T_f = T_i * (V_i/V_f)^{1/c}$.

C- Why Only few reaction can be determined directly and accurately.

Q.12) A-Explain when 1 mole of NaCl dissolves in water 4Kj heat will be absorbed from the surrounding.

B- A sample of Argon Heat capacity at constant volume = 12.48J.K⁻¹.mol⁻¹) at 1atm. Pressure expands reversibly & adiabatically from 0.5 dm³ to 1 L . Initially its temperature is 25°C. What is its final temperature, how much work is done during the expansion & what is the change in internal energy.

Q.13)A- What is the heat of solution and dilution? then explain the types.

B-What is the Super critical fluid? Then write the properties.

C- 4.6 cm³ of methyl alcohol is dissolved in 25.2g of water calculate: 1-Percentage by mass of methyl alcohol .2- mole fraction of methyl alcohol and water. If the density of methyl alcohol= 0.7952 g/mL. ?.

Note:At.wt:[Na=23, Cl=35, H=1, O=16, H=1, C=12,N=14, K=39 , Ar=39.94,P=31, g/mol]

Q.14) A-Define: 1- 2nd law of thermodynamic. 2- Exothermic reaction. 3- Thermochemistry 4-Heat of formation. 5- 3rd law of thermodynamics.

B- For a solution of ethanol & H₂O at 25°C , which has a mole fraction of ethanol of 0.2 the partial molar volume of H₂O & ethanol are respectively 17.9 , 55 cm³. mol⁻¹ what volume of pure ethanol & water are required to make a liter of this solution , if the density of ethanol & water are 0.789 & 0.998 gm. cm⁻³ at 25°C.

Q.15)A-Explain the variation of the potential energy of two molecules on their separation.

B-Is the following reaction spontaneous under standard conditions?

$KClO_3(s) \longrightarrow KClO_4(s) + KCl(s)$		
	ΔH°_f (kJ/mol)	ΔS° (J/mol.K)
KClO ₃ (s)	-397.7	143.1
KClO ₄ (s)	-432.8	151.0
KCl (s)	-436.7	82.6

Q.16) A-Prove $C_p - C_v = R$ for ideal gas.

B- How many molecules are contained in 25g glucose?

Q.17)A-Why ΔS_r cannot be calculate by the relation (q/T) .

B-What is the Super critical fluid? Then write the properties.

Q.18) A- Consider an ideal gas in a piston chamber where the initial volume is (2L) and the initial pressure is 8atm. Assuming that the piston is moving up to a final volume of (5.5L) against constant external pressure of (1.75atm.) at constant temp. ,Find the work & the final pressure of the gas.

B-A football at 27°C has 0.5 mole of air molecules. Calculate the internal energy of air in the ball.

Note:At.wt:[Na=23, Cl=35, H=1, O=16, H=1, C=12,N=14, K=39 , Ar=39.94,P=31, g/mol]

Q.19) A-Define: 1- Heat of combustion. 2-Trouton's rule. 3-Lattice energy. 4- Gibbs-Duhem equation . 5- Viscosity of liquid.

B- A piece of zinc of 5gm mass is dropped in to a beaker of dilute hydrochloric acid. Calculate the work done by the system as a result of the reaction.The atmospheric pressure is 1.0 atm and the temperature 23°C.If atomic weight zinc=65g/mol.

Q.20) A- For adiabatic reversible expansion for ideal gas prove $[T_f = T_i * (V_i/V_f)^{1/c}]$.

B-Prove E is a state function.

C- The critical constants of ethane are $P_c = 48.2 \text{ atm.}$, $V_c = 148 \text{ cm}^3 \cdot \text{mol}^{-1}$ and $T_c = 305.4\text{K}$ calculate the Van der Waals parameters of the gas and estimate the radius of the molecules. Also calculate the reduce variable if $P = 0.5 \text{ atm.}$, $T = 25^\circ\text{C}$,and $V = 2.0\text{L}$.

Q.21)A-Bond dissociations energies may be obtained by what?

B- One mole of super cooled water at (-10°C & 1atm.) turns in to ice . Find the entropy change in the system , in the surrounding & the net entropy change , if C_p of ice & liq. water are 37.7 & $75.3 \text{ j} \cdot \text{K}^{-1} \cdot \text{mol}^{-1}$, ΔH fusion of ice at $0^\circ\text{C} = 6.02 \text{ Kj} \cdot \text{mol}^{-1}$.

Q.22)A-Calculate the entropy changes for the following processes :

a) Melting of 1.0 mol of Al at its melting point. (660°C) and $\Delta H^\circ_{\text{fusion}} = 1.91\text{Kcal mol}^{-1}$.

b) Evaporation of 2.0 mol of liquid O_2 at its Boiling Point(-182.9°C) and $\Delta H^\circ_{\text{vaporization}} = 1.63 \text{ Kcal mol}^{-1}$.

c) Heating of 10 gm. Of H_2S from 50 to 100 °C at constant pressure and ($C_p = 7.15 + 0.00332T$) $\text{cal.mol}^{-1} \text{K}^{-1}$.

B- ΔS_r cannot be calculated by the relation (q/T) why? While ΔS_r calculated by what?

C-Prove that $\mu_j T = 0$ for ideal gas using $\mu_j T = (-1/C_p)(\partial H/\partial P)_T$.

Q.23)

A-Write the reason when one mole of H_2O is added to a huge volume of water at 25°C, the volume increase by 18 cm^3 and we can say that 18 $\text{cm}^3.\text{mol}^{-1}$ is the molar volume of pure water. However, when we add 1.0 mole of water to a huge volume of pure ethanol, the volume increases by only 14 cm^3 .

B- Write the difference between Specific Heat and Heat Capacity.

C-What is the expression for the fugacity in term of Van der Waal.

D-Determine normal boiling point of chloroform if its heat of vaporization is 31.4 kJ/mol and it has a vapor pressure of 190.0 mmHg at 25.0°C

Q.24) A vessel of volume 22.4L contains 2.0 mole H_2 and 1.0 mole of N_2 at 273K initially .all the H_2 reacted with sufficient N_2 to form NH_3 , calculate the partial pressure and the total pressure of the final mixture .

Q.25) A-What is the thermo neutrality of salts solution then write principle and give example.

B- 4.6 cm^3 of methyl alcohol is dissolved in 25.2g of water calculate: 1-Percentage by mass of methyl alcohol .2- mole fraction of methyl alcohol and water. If the density of methyl alcohol= 0.7952 g/mL. ?.

Lecturer

Asst.Prof. Dr.Hemn A. Smail