



INDIAN SCHOOL MUSCAT

CLASS: XI

CHEMISTRY



THERMODYNAMICS

- Which one of the following thermodynamic quantities is not a state function?
 - Gibbs free energy
 - enthalpy
 - entropy
 - internal energy
 - work
- A system has an increase in internal energy of 80 J and at the same time has 50 J of work done on it. What is the heat change of the system?
 - +130 J
 - +30 J
 - 130 J
 - 30 J
 - 0 J
- The entropy will usually increase when
 - a molecule is broken into two or more smaller molecules.
 - a reaction occurs that results in an increase in the number of moles of gas.
 - a solid changes to a liquid.
 - a liquid changes to a gas.
 - I only
 - II only
 - III only
 - IV only
 - I, II, III, and IV
- For the following reaction at 25°C, $\Delta H^\circ = +115 \text{ kJ}$ and $\Delta S^\circ = +125 \text{ J/K}$. Calculate ΔG° for the reaction at 25°C.
 $\text{SBr}_4(\text{g}) \rightleftharpoons \text{S}(\text{g}) + 2\text{Br}_2(\text{l})$
 - +152 kJ
 - 56.7 kJ
 - +77.8 kJ
 - +37.1 kJ
 - 86.2 kJ

- 5 Which statement is false?
- The thermodynamic quantity most easily measured in a "coffee cup" calorimeter is ΔH .
 - No work is done in a reaction occurring in a bomb calorimeter.
 - ΔH is sometimes exactly equal to ΔE .
 - ΔH is often nearly equal to ΔE .
 - ΔH is equal to ΔE for the reaction:
- 6 What will be the sign of entropy change for the following changes?
- In an isolated system, two identical gases are allowed to mix under identical conditions.
 - $I_2(g) \rightarrow I_2(s)$
 - $H_2(g) + I_2(g) \rightarrow 2HI(g)$
 - Dissolution of sugar in water contained in a thermos flask.
- 7 Calculate the K_c at 298 K for the reaction $H_2 + I_2 \rightleftharpoons 2HI$, if $\Delta G_f^\circ (HI) = 1.3 \text{ kJ/mole}$.
- 8 For the equilibrium $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ at 25°C , $K = 1.8 \times 10^{-7}$. Calculate ΔG° of reaction.
- 9 For the reaction $2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$, calculate the ΔG at 600 K if enthalpy and entropy changes are -110 kJ/mole and 150 J/Kmole .
- 10 ΔH and ΔS for the reaction $Ag_2O \rightleftharpoons 2Ag + \frac{1}{2} O_2$ are 30.56 KJ/mole and 60 J/K respectively. Calculate the temperature at which the free energy change for this reaction will be zero. Predict whether the forward reaction will be favoured above/below this T.
- 11 For the synthesis of NH_3 , $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$, calculate K_p at 300K if ΔH_f° of NH_3 as -46.2 kJ/mole and ΔS° for the reaction is 198.3 J/Kmole .
- 12 Differentiate between a) closed system and an isolated system b) heat of formation and heat of reaction c) heat of hydration and heat of solution
- 13 The ΔH_{vap} of water at 100°C is 41 kJ/mole . Calculate the internal energy change.
- 14 Define C_v and C_p for an ideal gas. Derive a relationship between C_v and C_p .
- 15 Calculate the ΔH_f° of benzene if ΔH_{comb} of benzene, carbon and hydrogen are 3267 , 393 and 286 kJ/mole respectively.
- 16 The mean bond enthalpies of $N \equiv N$ and $H-H$ are 946 and 436 kJ/mole respectively. If heat of formation of ammonia is -46 kJ/mole , calculate the mean BE in ammonia.
- 17 Explain the formation of $NaBr$ using Born-Haber cycle.
- 18 Calculate heat change at constant pressure if heat change at constant volume for the reaction $NH_2CN(g) + \frac{3}{2} O_2(g) \rightarrow N_2(g) + CO_2(g) + H_2O(l)$ at 298K is -742 kJ/mole .
- 19 Calculate the entropy change in surroundings when 36 g of water is formed under standard conditions. ΔH_f° of water = -286 kJ/mole
- 20 What is the work done on a gas when 10 lt of the gas is compressed to 4.5 lt under

- a constant pressure of 10^3 kPa?
- 21 Calculate the work done when 2.5 moles of an ideal gas at 300K is isothermally and reversibly compressed from a volume of 5m^3 to a volume of 2m^3 .
 - 22 What would be the work done when the pressure of 2 moles of an ideal gas is changed from 2 bar to 5 bar isothermally and reversibly at 25°C ?
 - 23 When will heat change at constant volume and heat change at constant pressure be equal?
 - 24 Dissolution of ammonium chloride in water is endothermic yet it is a spontaneous process. Explain.
 - 25 Define
 - (i) Heat capacity
 - (ii) Molar heat capacity
 - (iii) Enthalpy of a reaction
 - (iv) Entropy
 - (v) Gibb's free energy
 - (vi) Residual entropy
 - 26 Derive the relationship between C_p and C_v
 - 27 State
 - i. Hess's law of constant heat summation
 - ii. Second law of thermodynamics
 - iii. Third law of thermodynamics
 - 28 Discuss the role of temperature in determining the spontaneity of a process
 - 29 Derive the relation $\Delta H = \Delta U + \Delta n_g RT$
 - 30 Comment on the following statements
 - (i) An exothermic reaction is always thermodynamically spontaneous.
 - (ii) The entropy of a substance increases when going from liquid state to vapour state at any temperature.
 - (iii) A reaction with $\Delta G^0 > 0$ always has an equilibrium constant greater than one