



DPP -4 (Gibbs Free Energy)[Numerical]

“Wo paper ke 3 ghante tabhi jeetega... jab tu is assignment ke 30 minute seriously lega.” — *Weird Chemist.*”

- Q1.** Standard enthalpy and standard entropy changes for the oxidation of ammonia at 298 K are $-382.64 \text{ kJ mol}^{-1}$ and $-145.6 \text{ J mol}^{-1} \text{ K}^{-1}$ respectively. Standard Gibbs energy change for the same reaction at 298 K is :
- (1) $-221.1 \text{ kJ mol}^{-1}$
 - (2) $-339.3 \text{ kJ mol}^{-1}$
 - (3) $-439.3 \text{ kJ mol}^{-1}$
 - (4) $-523.2 \text{ kJ mol}^{-1}$
- Q2.** The Gibbs free energy change of a reaction at 27°C is -26 kcal and its entropy change is -60 cal K^{-1} . ΔH for the reaction is :
- (1) -44 kcal
 - (2) -18 kcal
 - (3) 34 kcal
 - (4) -24 kcal
- Q3.** For a reaction at 25°C , enthalpy change (ΔH) and entropy change (ΔS) are $-11.7 \times 10^3 \text{ J mol}^{-1}$ and $-105 \text{ J mol}^{-1} \text{ K}^{-1}$ respectively. The reaction is :
- (1) Spontaneous
 - (2) Non-spontaneous
 - (3) At equilibrium
 - (4) Can't say anything
- Q4.** The enthalpy and entropy change for a chemical reaction are $-2.5 \times 10^3 \text{ cal}$ and 7.4 cal K^{-1} respectively. Predict the nature of reaction at 298 K :
- (1) Spontaneous
 - (2) Reversible
 - (3) Irreversible
 - (4) Non-spontaneous
- Q5.** Which reaction, with the following values of ΔH and ΔS , at 400 K is spontaneous and endothermic?
- (1) $\Delta H = -48 \text{ kJ}$; $\Delta S = +135 \text{ J/K}$
 - (2) $\Delta H = -48 \text{ kJ}$; $\Delta S = -135 \text{ J/K}$
 - (3) $\Delta H = +48 \text{ kJ}$; $\Delta S = +135 \text{ J/K}$
 - (4) $\Delta H = +48 \text{ kJ}$; $\Delta S = -135 \text{ J/K}$
- Q6.** The temperature at which the reaction $\text{Ag}_2\text{O}(\text{s}) \rightarrow 2\text{Ag}(\text{s}) + \frac{1}{2}\text{O}_2(\text{g})$ is at equilibrium is Given $\Delta H = 30.56 \text{ kJ mol}^{-1}$ and $\Delta S = 0.066 \text{ kJ K}^{-1} \text{ mol}^{-1}$:
- (1) 462.12 K
 - (2) 362.12 K
 - (3) 262.12 K
 - (4) 562.12 K

- Q7.** For the reaction $\text{Ag}_2\text{O}(\text{s}) \rightarrow 2\text{Ag}(\text{s}) + \frac{1}{2}\text{O}_2(\text{g})$, $\Delta H = 30.56 \text{ kJ mol}^{-1}$ and $\Delta S = 66 \text{ J K}^{-1} \text{ mol}^{-1}$. The temperature at which the free energy change for the reaction will be zero is :
- (1) 373 K
 - (2) 413 K
 - (3) 463 K
 - (4) 493 K
- Q8.** For a hypothetical reversible reaction $\frac{1}{2}\text{A}_2(\text{g}) + \frac{1}{2}\text{B}_2(\text{g}) \rightarrow \text{AB}_2(\text{g})$; $\Delta H = -20 \text{ kJ}$. If standard entropies of A_2 , B_2 , and AB_2 are 60, 40, and 50 $\text{J K}^{-1} \text{ mol}^{-1}$ respectively, the above reaction will be in equilibrium at :
- (1) 400 K
 - (2) 500 K
 - (3) 250 K
 - (4) 200 K
- Q9.** What is the free energy change ΔG , when 1.0 mole of water at 100°C and 1 atm pressure is converted into steam at 100°C and 1 atm pressure :
- (1) 540 Cal
 - (2) -9800 Cal
 - (3) 9800 Cal
 - (4) 0 Cal
- Q10.** The enthalpy and entropy change for reaction $\text{Br}_2(\text{l}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{BrCl}(\text{g})$ are 30 kJ mol^{-1} and 105 $\text{J K}^{-1} \text{ mol}^{-1}$ respectively. The temperature at which the reaction will be in equilibrium is :
- (1) 285.7 K
 - (2) 273 K
 - (3) 450 K
 - (4) 300 K
- Q11.** For vaporization of water at 1 atm pressure, the values of ΔH and ΔS are 40.63 kJ mol^{-1} and 108.8 $\text{J K}^{-1} \text{ mol}^{-1}$ respectively. The temperature when Gibbs energy change (ΔG) for this transformation will be zero is :
- (1) 393.4 K
 - (2) 373.4 K
 - (3) 343.4 K
 - (4) 273.4 K
- Q12.** Standard entropy of X_2 , Y_2 and XY_3 are 60, 40, and 50 $\text{J K}^{-1} \text{ mol}^{-1}$ respectively. For the reaction $\frac{1}{2}\text{X}_2 + \frac{3}{2}\text{Y}_2 \rightleftharpoons \text{XY}_3$, $\Delta H = -30 \text{ kJ}$. To be at equilibrium, the temperature will be :
- (1) 1250 K
 - (2) 500 K
 - (3) 750 K
 - (4) 1000 K
- Q13.** For a given reaction, $\Delta H = 35.5 \text{ kJ mol}^{-1}$ and $\Delta S = 83.6 \text{ J K}^{-1} \text{ mol}^{-1}$. The reaction is spontaneous at :
- (Assume that ΔH and ΔS do not vary with temperature.)

- (1) $T > 425 \text{ K}$
- (2) All temperatures
- (3) $T > 298 \text{ K}$
- (4) $T < 425 \text{ K}$

Q14. The values of ΔH and ΔS for the reaction $\text{C}_{(\text{graphite})} + \text{CO}_2(\text{g}) \rightarrow 2\text{CO}(\text{g})$ are 170 kJ and 170 J K^{-1} respectively. This reaction will be spontaneous at :

- (1) 510 K
- (2) 710 K
- (3) 910 K
- (4) 1110 K

Q15. In conversion of lime-stone to lime, $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ the values of ΔH° and ΔS° are $+179.1 \text{ kJ mol}^{-1}$ and $160.2 \text{ J K}^{-1} \text{ mol}^{-1}$ respectively at 298 K and 1 bar . Assuming that ΔH° and ΔS° do not change with temperature, the temperature above which conversion of limestone to lime will be spontaneous is :

- (1) 1008 K
- (2) 1200 K
- (3) 845 K
- (4) 1118 K

Q16. For the reaction : $\text{X}_2\text{O}_4(\text{l}) \rightarrow 2\text{XO}_2(\text{g})$, $\Delta U = 2.1 \text{ kcal}$, $\Delta S = 20 \text{ cal K}^{-1}$ at 300 K . Hence ΔG is :

- (1) 2.7 kcal
- (2) -2.7 Kcal
- (3) 9.3 kcal
- (4) -9.3 Kcal

Q17. For a given reaction at 298 K : $2\text{A}(\text{g}) + \text{B}(\text{g}) \rightarrow 2\text{C}(\text{g})$

If $\Delta U^\circ = -10 \text{ kJ mol}^{-1}$ and $\Delta S^\circ = -45 \text{ J K}^{-1} \text{ mol}^{-1}$, then what will be the value of ΔG° for the above reaction?

- (1) $+930 \text{ J mol}^{-1}$
- (2) $-25,890 \text{ J mol}^{-1}$
- (3) $+2000 \text{ J mol}^{-1}$
- (4) $+8500 \text{ J mol}^{-1}$

Q18. $\Delta S_{\text{Total}} = -40 \text{ kJ mol}^{-1} \text{ K}^{-1}$, $\Delta H_{\text{sys}} = 2000 \text{ kJ mol}^{-1}$, $T = 400 \text{ K}$. Calculate value of ΔS_{system} :

- (1) $-35 \text{ kJ mol}^{-1} \text{ K}^{-1}$
- (2) $-5 \text{ kJ mol}^{-1} \text{ K}^{-1}$
- (3) $-40 \text{ kJ mol}^{-1} \text{ K}^{-1}$
- (4) $+5 \text{ kJ mol}^{-1} \text{ K}^{-1}$

Q19. The enthalpy change for a given reaction at 298 K is $-x \text{ cal mol}^{-1}$. If the reaction occurs spontaneously at 298 K , the entropy change at that temperature :

- (1) Can be negative but numerically larger than $x/298 \text{ cal K}^{-1} \text{ mol}^{-1}$
- (2) Can be negative but numerically smaller than $x/298 \text{ cal K}^{-1} \text{ mol}^{-1}$
- (3) Cannot be negative
- (4) Cannot be positive