CHEMICAL THERMODYNAMICS
NEET PYQs (1988-2025)

"These are not just assignments. These are questions that once decided someone's rank. Solve them seriously... they might decide yours."

Topic–1 : First Law of Thermodynamics (F.L.O.T)

Subtopic 1.1 : Basic Definitions

1. **Which of the following are not state functions? [CBSE AIPMT 2008]**
   I. $q + W$ II. q III. W IV. $H - TS$
   (a) I and IV
   (b) II, III and IV
   (c) I, II and III
   (d) II and III

Subtopic 1.2 : First Law of Thermodynamics ($\Delta U = q + w$ based problems)

2. **The work done during the expansion of a gas from a volume of 4 dm^3 to 6 dm^3 against a constant external pressure of 3 atm, is [CBSE AIPMT 2004]**
   (a) -6 J
   (b) -608 J
   (c) $+304$ J
   (d) -304 J

3. **When 1 mole gas is heated at constant volume, temperature is raised from 298 to 308 K. Heat supplied to the gas is 500 J. Then, which statement is correct? [CBSE AIPMT 2001]**
   (a) $q = 500$ J, $W = 0$, $\Delta E = 0$
   (b) $q = \Delta E = 500$ J, $W = 0$
   (c) $q = W = -500$ J, $\Delta E = 0$
   (d) $\Delta E = 0$, $q = 500$, $W = -$ J

4. **In a closed insulated container a liquid is stirred with a paddle to increase the temperature, which of the following is true? [CBSE AIPMT 2002]**
   (a) $\Delta E = W \neq 0$, $q = 0$
   (b) $\Delta E = 0$, $W = 0$, $q \neq 0$
   (c) $\Delta E = W = 0$, $q \neq 0$
   (d) $W = 0$, $q = 0$, $\Delta E \neq 0$

5. **A gas is allowed to expand in a well insulated container against a constant external pressure of 2.5 atm from an initial volume of 2.50 L to a final volume of 4.50 L. The change in internal energy ΔU of the gas in joules will be [NEET 2017]**
   (a) 1136.25 J
   (b) −500 J
   (c) −505 J
   (d) +505 J

Subtopic 1.3 : Enthalpy (ΔH, relation with ΔU, constant pressure processes)

6. **In an endothermic reaction, the value of ΔH is [CBSE AIPMT 1999]**
   (a) zero
   (b) positive
   (c) negative
   (d) constant

7. **Assume each reaction is carried out in an open container. For which reaction will $\Delta H = \Delta E$? [CBSE AIPMT 2006]**
   (a) $H_2(g) + Br_2(g) \longrightarrow 2\,HBr(g)$
   (b) $C(s) + 2\,H_2O(g) \longrightarrow 2\,H_2(g) + CO_2(g)$
   (c) $PCl_5(g) \longrightarrow PCl_3(g) + Cl_2(g)$
   (d) $2\,CO(g) + O_2(g) \longrightarrow 2\,CO_2(g)$

8. **For the reaction, $C_3H_8(g) + 5\,O_2(g) \longrightarrow 3\,CO_2(g) + 4\,H_2O(l)$ at constant temperature, $\Delta H - \Delta E$ is [CBSE AIPMT 2003]**
   (a) $+3RT$
   (b) $-RT$
   (c) $+RT$
   (d) $-3RT$

9. **If ΔE is the heat of reaction for $C_2H_5OH(l) + 3\,O_2(g) \longrightarrow 2\,CO_2(g) + 3\,H_2O(l)$ at constant volume, the ΔH (heat of reaction at constant pressure), then the correct relation is [CBSE AIPMT 2000]**
   (a) $\Delta H = \Delta E + RT$
   (b) $\Delta H = \Delta E - RT$
   (c) $\Delta H = \Delta E - 2RT$
   (d) $\Delta H = \Delta E + 2RT$

10. **For the reaction, $N_2 + 3\,H_2 \rightleftharpoons 2\,NH_3$, $\Delta H =$? [CBSE AIPMT 1991]**
   (a) $\Delta E + 2RT$
   (b) $\Delta E - 2RT$
   (c) $\Delta H = RT$

(d) $\Delta E - RT$

11. **If ΔH is the change in enthalpy and ΔE, the change in internal energy accompaning a gaseous reaction, then [CBSE AIPMT 1990]**
    (a) ΔH is always greater than ΔE
    (b) $\Delta H < \Delta E$ only if the number of moles of products is greater than the number of moles of the reactants
    (c) ΔH is always less than ΔE
    (d) $\Delta H < \Delta E$ only if the number of moles of products is less than the number of moles of the reactants

12. **Standard enthalpy of vaporisation $\Delta_{\text{vap}}H^\circ$ for water at 100°C is 40.66 kJ mol^{-1}. The internal energy of vaporisation of water at 100°C (in kJ mol^{-1}) is (assume water vapour to behave like an ideal gas). [CBSE AIPMT 2012]**
    (a) +37.56
    (b) −43.76
    (c) +43.76
    (d) +40.66

Subtopic 1.4 : Heat Capacity (C_p, C_V, relation between C_p & C_V)

13. **Which one among the following is the correct option for right relationship between C_p and C_V for one mole of ideal gas? [NEET 2021]**
    (a) $C_p + C_V = R$
    (b) $C_p - C_V = R$
    (c) $C_p = RC_V$
    (d) $C_V = RC_p$

14. **The molar heat capacity C of water at constant pressure is 75 JK^{-1} mol^{-1}, when 1.0 kJ of heat is supplied to 100 g of water which is free to expand, the increase in temperature of water is [CBSE AIPMT 2003]**
    (a) 4.8 K
    (b) 6.6 K
    (c) 1.2 K
    (d) 2.4 K

Subtopic 1.5 : Isothermal Process (PV work, ΔU, ΔH at constant temperature)

15. **One mole of an ideal gas at 300 K is expanded isothermally from an initial volume of 1 L to 10 L. The ΔE for this process is ($R = 2$ cal mol^{-1} K^{-1}) [CBSE AIPMT 1998]**
    (a) 163.7 cal
    (b) zero
    (c) 1381.1 cal

(d) 9 L atm

16. **During isothermal expansion of an ideal gas, its [CBSE AIPMT 1991, 94]**
    (a) internal energy increases
    (b) enthalpy decreases
    (c) enthalpy remains unaffected
    (d) enthalpy reduces to zero

17. **Under isothermal condition, a gas at 300 K expands from 0.1 L to 0.25 L against a constant external pressure of 2 bar. The work done by the gas is (Given that 1 L bar = 100 J) [NEET (National) 2019]**
    (a) 5 kJ
    (b) 25 J
    (c) 30 J
    (d) -30 J

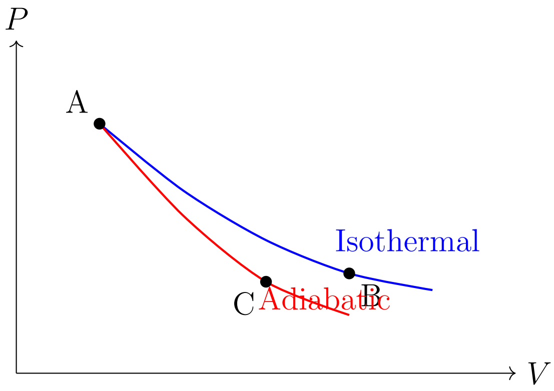
18. **An ideal gas expands isothermally from 10^{-3} m^3 to 10^{-2} m^3 at 300 K against a constant pressure of 10^5 Nm^{-2}. The work done on the gas is [NEET (Odisha) 2019]**
    (a) $+270$ kJ
    (b) -900 J
    (c) $+900$ kJ
    (d) -900 kJ

Subtopic 1.6 : Adiabatic Process (PV^γ = constant, work, temperature change)

19. **The correct option for free expansion of an ideal gas under the adiabatic condition is [NEET (Sept.) 2020]**
    (a) $q = 0$, $\Delta T < 0$ and $w > 0$
    (b) $q < 0$, $\Delta T < 0$ and $w = 0$
    (c) $q > 0$, $\Delta T < 0$ and $w > 0$
    (d) $q = 0$, $\Delta T = 0$ and $w = 0$

20. **Which one of the following is correct option for free expansion of an ideal gas under adiabatic condition? [CBSE AIPMT 2011]**
    (a) $q \neq 0$, $\Delta T = 0$, $W = 0$
    (b) $q = 0$, $\Delta T = 0$, $W = 0$
    (c) $q = 0$, $\Delta T < 0$, $W \neq 0$
    (d) $q = 0$, $\Delta T \neq 0$, $W = 0$

21. **Reversible expansion of an ideal gas under isothermal and adiabatic conditions are as shown in the figure. [NEET (Odisha) 2019]**



$A \to B$: Isothermal expansion
$A \to C$: Adiabatic expansion
Which of the following option is not correct?

(a) $\Delta S_{\text{isothermal}} > \Delta S_{\text{adiabatic}}$
(b) $T_A = T_B$
(c) $W_{\text{isothermal}} > W_{\text{adiabatic}}$
(d) $T_C > T_A$

Topic–2 : Thermochemistry

Subtopic 2.1 : Basics of Thermochemistry (exothermic/endothermic reactions, sign conventions)

1. **A reaction having equal energies of activation for forward and reverse reactions has [NEET 2013]**
   (a) $\Delta S = 0$
   (b) $\Delta G = 0$
   (c) $\Delta H = 0$
   (d) $\Delta H = \Delta G = \Delta S = 0$

Subtopic 2.2 : Hess's Law (reaction enthalpy via multiple steps)

2. **From the given reactions, $S(s) + \frac{3}{2}O_2(g) \longrightarrow SO_3(g) + x$ kcal; $SO_2(g) + \frac{1}{2}O_2(g) \longrightarrow SO_3(g) + y$ kcal, the heat of formation of SO_2 is [CBSE AIPMT 1999]**
   (a) $(x + y)$
   (b) $(x - y)$
   (c) $(2x + y)$
   (d) $(2x - y)$

3. **Given that, $C(s) + O_2(g) \longrightarrow CO_2(g)$, $\Delta H^\circ = -x$ kJ; $2\,CO(g) + O_2(g) \longrightarrow 2\,CO_2(g)$, $\Delta H^\circ = -y$ kJ. The enthalpy of formation of carbon monoxide will be [CBSE AIPMT 1997]**
   (a) $y - 2x$
   (b) $2x - y$

(c) $\dfrac{y-2x}{2}$
(d) $\dfrac{2x-y}{2}$

4. **Heat of combustion ΔH° for C(s), H_2(g) and CH_4(g) are -94, -68 and -213 kcal/mol. Then, ΔH° for $C(s) + 2\,H_2(g) \longrightarrow CH_4(g)$ is [CBSE AIPMT 2002]**
   (a) -17 kcal/mol
   (b) -111 kcal/mol
   (c) -170 kcal/mol
   (d) -85 kcal/mol

5. **The enthalpy of combustion of H_2, cyclohexene (C_6H_{10}) and cyclohexane (C_6H_{12}) are -241, -3800 and -3920 kJ per mol respectively. Heat of hydrogenation of cyclohexene is [CBSE AIPMT 2006]**
   (a) -121 kJ per mol
   (b) $+121$ kJ per mol
   (c) $+242$ kJ per mol
   (d) -242 kJ per mol

Subtopic 2.3 : Enthalpy of Formation

6. **Change in enthalpy for reaction, $2\,H_2O_2(l) \longrightarrow 2\,H_2O(l) + O_2(g)$ if heat of formation of H_2O_2(l) and H_2O(l) are -188 and -286 kJ/mol respectively is [CBSE AIPMT 2001]**
   (a) -196 kJ/mol
   (b) $+196$ kJ/mol
   (c) $+948$ kJ/mol
   (d) -948 kJ/mol

7. **Consider the following reactions, (i) $H^+(aq) + OH^-(aq) \longrightarrow H_2O(l)$, $-x_1$ kJ mol^{-1}; (ii) $H_2(g) + \frac{1}{2}\,O_2(g) \longrightarrow H_2O(l)$, x_2 kJ mol^{-1}; (iii) $CO_2(g) + H_2(g) \longrightarrow CO(g) + H_2O(l)$, $-x_3$ kJ mol^{-1}; (iv) $C_2H_2(g) + \frac{5}{2}\,O_2(g) \longrightarrow 2\,CO_2(g) + H_2O(l)$, $+x_4$ kJ mol^{-1}. Enthalpy of formation of H_2O(l) is [CBSE AIPMT 2007]**
   (a) $-x_2$ kJ mol^{-1}
   (b) $+x_3$ kJ mol^{-1}
   (c) $-x_4$ kJ mol^{-1}
   (d) $+x_1$ kJ mol^{-1}

8. **For which one of the following equations ΔH_r° equal to ΔH_f° for the product? [CBSE AIPMT 2003]**
   (a) $Xe(g) + 2\,F_2(g) \longrightarrow XeF_4(g)$
   (b) $2\,CO(g) + O_2(g) \longrightarrow 2\,CO_2(g)$
   (c) $N_2(g) + O_3(g) \longrightarrow N_2O_3(g)$
   (d) $CH_4(g) + 2\,Cl_2(g) \longrightarrow CH_2Cl_2(l) + 2\,HCl(g)$

Subtopic 2.4 : Enthalpy of Combustion

9. **The heat of combustion of carbon to CO_2 is -393.5 kJ/mol. The heat released upon the formation of 35.2 g of CO_2 from carbon and oxygen gas is [CBSE AIPMT 2015]**
   (a) -315 kJ
   (b) $+315$ kJ
   (c) -630 kJ
   (d) -31.5 kJ

10. **If enthalpies of formation of $C_2H_4(g)$, $CO_2(g)$ and $H_2O(l)$ at 25°C and 1 atm pressure are 52, -394 and -286 kJ/mol, the enthalpy of combustion of ethene is equal to [CBSE AIPMT 1995]**
    (a) -141.2 kJ/mol
    (b) -1412 kJ/mol
    (c) $+14.2$ kJ/mol
    (d) $+1412$ kJ/mol

11. **Enthalpy of the reaction, $CH_4 + \frac{1}{2}O_2 \longrightarrow CH_3OH$, is negative. If enthalpy of combustion of CH_4 and CH_3OH are x and y respectively, then which relation is correct? [CBSE AIPMT 2001]**
    (a) $x > y$
    (b) $x < y$
    (c) $x = y$
    (d) $x \geq y$

Subtopic 2.5 : Bond Enthalpy

12. **At standard conditions, if the change in the enthalpy for the following reaction is -109 kJ mol^{-1}, $H_2(g) + Br_2(g) \longrightarrow 2\,HBr(g)$. Given that, bond energy of H_2 and Br_2 is 435 kJ mol^{-1} and 192 kJ mol^{-1} respectively, what is the bond energy (in kJ mol^{-1}) of HBr? [NEET (Oct.) 2020]**
    (a) 368
    (b) 736
    (c) 518
    (d) 259

13. **Given that bond energies of H—H and Cl—Cl are 430 kJ mol^{-1} and 240 kJ mol^{-1} respectively and ΔH_f for HCl is -90 kJ mol^{-1}. Bond enthalpy of HCl is [CBSE AIPMT 2007]**
    (a) 290 kJ mol^{-1}
    (b) 380 kJ mol^{-1}
    (c) 425 kJ mol^{-1}
    (d) 245 kJ mol^{-1}

14. **If the bond energies of H—H, Br—Br and H—Br are 433, 192 and 364 kJ mol^{-1} respectively, then ΔH° for the reaction $H_2(g) + Br_2(g) \longrightarrow 2\,HBr(g)$ is [CBSE AIPMT 2004]**
    (a) -261 kJ
    (b) $+103$ kJ
    (c) $+261$ kJ
    (d) -103 kJ

15. **Bond dissociation enthalpy of H_2, Cl_2 and HCl are 434, 242 and 431 kJ mol^{-1} respectively. Enthalpy of formation of HCl is [CBSE AIPMT 2008]**
    (a) 93 kJ mol^{-1}
    (b) -245 kJ mol^{-1}
    (c) -93 kJ mol^{-1}
    (d) 245 kJ mol^{-1}

16. **The bond dissociation energies of X_2, Y_2, and XY are in the ratio of 1 : 0.5 : 1. ΔH for the formation of XY is -200 kJ mol^{-1}. The bond dissociation energy of X_2 will be [NEET 2018]**
    (a) 800 kJ mol^{-1}
    (b) 100 kJ mol^{-1}
    (c) 200 kJ mol^{-1}
    (d) 400 kJ mol^{-1}

17. **Enthalpy change for the reaction, $4\,H(g) \longrightarrow 2\,H_2(g)$ is -869.6 kJ. The dissociation energy of H—H bond is [CBSE AIPMT 2011]**
    (a) -869.6 kJ
    (b) $+434.8$ kJ
    (c) $+217.4$ kJ
    (d) -434.8 kJ

18. **From the following bond energies: H—H bond energy: 431.37 kJ mol^{-1}; C=C bond energy: 606.10 kJ mol^{-1}; C—C bond energy: 336.49 kJ mol^{-1}; C—H bond energy: 410.50 kJ mol^{-1}. Enthalpy for the reaction, $C_2H_4 + H_2 \longrightarrow C_2H_6$ will be [CBSE AIPMT 2009]**
    (a) 1523.6 kJ mol^{-1}
    (b) -243.6 kJ mol^{-1}
    (c) -120.0 kJ mol^{-1}
    (d) 553.0 kJ mol^{-1}

Subtopic 2.6 : Other Enthalpies (solution, neutralisation, atomisation, hydration, lattice, etc.)

19. **The absolute enthalpy of neutralisation of the reaction $MgO(s) + 2\,HCl(aq) \longrightarrow MgCl_2(aq) + H_2O(l)$ will be [CBSE AIPMT 2005]**

(a) less than -57.33 kJ mol^{-1}
(b) -57.33 kJ mol^{-1}
(c) greater than -57.33 kJ mol^{-1}
(d) 57.33 kJ mol^{-1}

20. **Equal volumes of molar hydrochloric acid and sulphuric acid are neutralised by dilute NaOH solution and x kcal and y kcal of heat are liberated respectively. Which of the following is true? [CBSE AIPMT 1991]**
(a) $x = y$
(b) $x = \frac{1}{2}y$
(c) $x = 2y$
(d) None of the above

Topic–3 : Second Law of Thermodynamics

Subtopic 3.1 : Entropy – Theoretical (ΔS concept, disorder, spontaneity)

1. **Unit of entropy is [CBSE AIPMT 2002]**
(a) JK^{-1} mol^{-1}
(b) J mol^{-1}
(c) J^{-1} K^{-1} mol^{-1}
(d) JK mol^{-1}

2. **Considering entropy (S) as a thermodynamic parameter, the criterion for the spontaneity of any process is [CBSE AIPMT 2004]**
(a) $\Delta S_{\text{system}} + \Delta S_{\text{surrounding}} > 0$
(b) $\Delta S_{\text{system}} - \Delta S_{\text{surrounding}} > 0$
(c) $\Delta S_{\text{system}} > 0$
(d) $\Delta S_{\text{surrounding}} > 0$

3. **For irreversible expansion of an ideal gas under isothermal condition the correct option is [NEET 2021]**
(a) $\Delta U = 0$, $\Delta S_{\text{total}} = 0$
(b) $\Delta U \neq 0$, $\Delta S_{\text{total}} \neq 0$
(c) $\Delta U = 0$, $\Delta S_{\text{total}} \neq 0$
(d) $\Delta U \neq 0$, $\Delta S_{\text{total}} = 0$

4. **In which case change in entropy is negative? [NEET (National) 2019]**
(a) Expansion of a gas at constant temperature
(b) Sublimation of solid to gas
(c) $2\,H(g) \longrightarrow H_2(g)$
(d) Evaporation of water

5. **For the reaction, $2\,Cl(g) \longrightarrow Cl_2(g)$, the correct option is [NEET (Sep.) 2020]**
   (a) $\Delta_r H > 0$ and $\Delta_r S < 0$
   (b) $\Delta_r H < 0$ and $\Delta_r S > 0$
   (c) $\Delta_r H < 0$ and $\Delta_r S < 0$
   (d) $\Delta_r H > 0$ and $\Delta_r S > 0$

6. **For the gas phase reaction, $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$, which of the following conditions are correct? [CBSE AIPMT 2008]**
   (a) $\Delta H = 0$ and $\Delta S < 0$
   (b) $\Delta H > 0$ and $\Delta S > 0$
   (c) $\Delta H < 0$ and $\Delta S < 0$
   (d) $\Delta H > 0$ and $\Delta S < 0$

7. **Identify the correct statement regarding entropy. [CBSE AIPMT 1998]**
   (a) At absolute zero temperature, entropy of a perfectly crystalline substance is taken to be zero
   (b) At absolute zero temperature, the entropy of a perfectly crystalline substance is positive
   (c) At absolute zero temperature, the entropy of all crystalline substances is to be zero
   (d) At 0°C, the entropy of a perfectly crystalline substance is taken to be zero

8. **According to the third law of thermodynamics which one of the following quantities for a perfectly crystalline solid is zero at absolute zero? [CBSE AIPMT 1996]**
   (a) Free energy
   (b) Entropy
   (c) Enthalpy
   (d) Internal energy

9. **For an ideal solution, the correct option is [NEET (National) 2019]**
   (a) $\Delta_{\text{mix}} V \neq 0$ at constant T and p
   (b) $\Delta_{\text{mix}} H = 0$ at constant T and p
   (c) $\Delta_{\text{mix}} G = 0$ at constant T and p
   (d) $\Delta_{\text{mix}} S = 0$ at constant T and p

Subtopic 3.2 : Entropy – Numerical (entropy calculations, phase change, ideal gas)

10. **For a sample of perfect gas when its pressure is changed isothermally from p_i to p_f, the entropy change is given by [NEET 2016, Phase II]**
   (a) $\Delta S = nR\ln\left(\frac{p_f}{p_i}\right)$
   (b) $\Delta S = nR\ln\left(\frac{p_i}{p_f}\right)$
   (c) $\Delta S = nRT\ln\left(\frac{p_f}{p_i}\right)$

(d) $\Delta S = RT \ln\left(\frac{p_i}{p_f}\right)$

11. **2 moles of an ideal gas at 27°C temperature is expanded reversibly from 2 L to 20 L. Find entropy change ($R = 2$ cal/mol K). [CBSE AIPMT 2002]**
    (a) 92.1
    (b) 0
    (c) 4
    (d) 9.2

12. **The enthalpy of fusion of water is 1.435 kcal/mol. The molar entropy change for the melting of ice at 0°C is [CBSE AIPMT 2012]**
    (a) 10.52 cal/mol K
    (b) 21.04 cal/mol K
    (c) 5.260 cal/mol K
    (d) 0.526 cal/mol K

13. **If the enthalpy change for the transition of liquid water to steam is 30 kJ mol^{-1} at 27°C, the entropy change for the process would be [CBSE AIPMT 2011]**
    (a) 1.0 J mol^{-1} K^{-1}
    (b) 0.1 J mol^{-1} K^{-1}
    (c) 100 J mol^{-1} K^{-1}
    (d) 10 J mol^{-1} K^{-1}

14. **What is the entropy change (in J K^{-1} mol^{-1}) when one mole of ice is converted into water at 0°C? (The enthalpy change for the conversion of ice to liquid water is 6.0 kJ mol^{-1} at 0°C) [CBSE AIPMT 2003]**
    (a) 2.198 J K^{-1} mol^{-1}
    (b) 21.98 J K^{-1} mol^{-1}
    (c) 20.13 J K^{-1} mol^{-1}
    (d) 2.013 J K^{-1} mol^{-1}

15. **The entropy change in the fusion of one mole of a solid melting at 27°C (latent heat of fusion is 2930 J mol^{-1}) is [CBSE AIPMT 2000]**
    (a) 9.77 J K^{-1} mol^{-1}
    (b) 10.73 J K^{-1} mol^{-1}
    (c) 2930 J K^{-1} mol^{-1}
    (d) 108.5 J K^{-1} mol^{-1}

16. **Given the following entropy values (in JK^{-1} mol^{-1}) at 298 K and 1 atm: $H_2(g)$: 130.6, $Cl_2(g)$: 223.0, $HCl(g)$: 186.7. The entropy change (in JK^{-1} mol^{-1}) for the reaction $H_2(g) + Cl_2(g) \longrightarrow 2\,HCl(g)$ is [CBSE AIPMT 1996]**
    (a) +540.3

(b) $+727.0$
(c) -166.9
(d) $+19.8$

Subtopic 3.3 : Gibbs Free Energy – Theoretical (ΔG, spontaneity criteria)

17. **A chemical reaction will be spontaneous if it is accompanied by a decrease in [CBSE AIPMT 1994]**
    (a) entropy of the system
    (b) enthalpy of the system
    (c) internal energy of the system
    (d) free energy of the system

18. **The correct thermodynamic conditions for the spontaneous reaction at all temperatures is [NEET 2016, Phase I]**
    (a) $\Delta H > 0$ and $\Delta S < 0$
    (b) $\Delta H < 0$ and $\Delta S > 0$
    (c) $\Delta H < 0$ and $\Delta S < 0$
    (d) $\Delta H < 0$ and $\Delta S = 0$

19. **Which of the following pairs of a chemical reaction is certain to result in a spontaneous reaction? [CBSE AIPMT 2005]**
    (a) Exothermic and decreasing disorder
    (b) Endothermic and increasing disorder
    (c) Exothermic and increasing disorder
    (d) Endothermic and decreasing disorder

20. **A reaction occurs spontaneously if [CBSE AIPMT 2005]**
    (a) $T\Delta S < \Delta H$ and both ΔH and ΔS are +ve
    (b) $T\Delta S > \Delta H$ and both ΔH and ΔS are +ve
    (c) $T\Delta S = \Delta H$ and both ΔH and ΔS are +ve
    (d) $T\Delta S > \Delta H$ and ΔH is +ve and ΔS is −ve

21. **Consider the following reaction occurring in an automobile: $2\,C_8H_{18}(g) + 25\,O_2(g) \longrightarrow 16\,CO_2(g) + 18\,H_2O(g)$. The sign of ΔH, ΔS and ΔG would be [CBSE AIPMT 1994]**
    (a) $+, -, +$
    (b) $-, +, -$
    (c) $-, +, +$
    (d) $+, +, -$

22. **In which of the following reactions, standard reaction entropy changes (ΔS°) is positive and standard Gibbs energy change (ΔG°) decreases sharply with increasing temperature? [CBSE AIPMT 2012]**

(a) C(graphite) + $\frac{1}{2}O_2(g) \to CO(g)$
(b) $CO(g) + \frac{1}{2}O_2(g) \to CO_2(g)$
(c) $Mg(s) + \frac{1}{2}O_2(g) \to MgO(s)$
(d) $\frac{1}{2}$C(graphite) + $\frac{1}{2}O_2(g) \to \frac{1}{2}CO_2(g)$

23. **Identify the correct statement for change of Gibbs free energy for a system (ΔG_{system}) at constant temperature and pressure. [CBSE AIPMT 2006]**
(a) If $\Delta G_{\text{system}} > 0$, the process is spontaneous
(b) If $\Delta G_{\text{system}} = 0$, the system has attained equilibrium
(c) If $\Delta G_{\text{system}} = 0$, the system is still moving in a particular direction
(d) If $\Delta G_{\text{system}} < 0$, the process is not spontaneous

24. **Standard Gibb's free energy change for the isomerisation reaction cis-2-pentene $\rightleftharpoons$ trans-2-pentene is -3.67 kJ/mol at 400 K. If more trans-2-pentene is added to the reaction vessel, then [CBSE AIPMT 1995]**
(a) more cis-2-pentene is formed
(b) equilibrium remains unaffected
(c) additional trans-2-pentene is formed
(d) equilibrium is shifted in forward direction

25. **$PbO_2 \longrightarrow PbO$, $\Delta G_{298} < 0$; $SnO_2 \longrightarrow SnO$, $\Delta G_{298} > 0$. Most probable oxidation state of Pb and Sn will be [CBSE AIPMT 2001]**
(a) Pb^{4+}, Sn^{4+}
(b) Pb^{4+}, Sn^{2+}
(c) Pb^{2+}, Sn^{2+}
(d) Pb^{2+}, Sn^{4+}

26. **Which of the following statements is correct for the spontaneous absorption of a gas? [CBSE AIPMT 2014]**
(a) ΔS is negative and therefore, ΔH should be highly positive
(b) ΔS is negative and therefore, ΔH should be highly negative
(c) ΔS is positive and therefore, ΔH should be negative
(d) ΔS is positive and therefore, ΔH should also be highly positive

Subtopic 3.4 : Gibbs Free Energy – Numerical (ΔG calculations, equilibrium)

27. **Standard enthalpy and standard entropy changes for the oxidation of ammonia at 298 K are -382.64 kJ mol^{-1} and -145.6 JK^{-1} mol^{-1}, respectively. Standard Gibbs energy change for the same reaction at 298 K is [CBSE AIPMT 2004]**
(a) -221.1 kJ mol^{-1}

(b) -339.3 kJ mol^{-1}
(c) -439.3 kJ mol^{-1}
(d) -523.2 kJ mol^{-1}

28. **For the reaction, $X_2O_4(l) \longrightarrow 2\,XO_2(g)$, $\Delta U = 2.1$ kcal, $\Delta S = -20$ cal K^{-1} at 300 K. Hence, ΔG is [CBSE AIPMT 2014]**
(a) 2.7 kcal
(b) -2.7 kcal
(c) 9.3 kcal
(d) -9.3 kcal

29. **If for a certain reaction $\Delta_r H$ is 30 kJ mol^{-1} at 450 K, the value of $\Delta_r S$ (in JK^{-1} mol^{-1}) for which the same reaction will be spontaneous at the same temperature is [NEET (Oct.) 2020]**
(a) 70
(b) -33
(c) 33
(d) -70

30. **For a given reaction, $\Delta H = 35.5$ kJ mol^{-1} and $\Delta S = -83.6$ JK^{-1} mol^{-1}. The reaction is spontaneous at: (Assume that ΔH and ΔS do not vary with temperature) [NEET 2017]**
(a) $T < 425$ K
(b) $T > 425$ K
(c) all temperatures
(d) $T > 298$ K

31. **The values of ΔH and ΔS for the reaction, C(graphite) + $CO_2(g) \rightarrow 2\,CO(g)$ are 170 kJ and 170 JK^{-1}, respectively. This reaction will be spontaneous at [CBSE AIPMT 2009]**
(a) 710 K
(b) 910 K
(c) 1110 K
(d) 510 K

32. **The enthalpy and entropy change for the reaction, $Br_2(l) + Cl_2(g) \longrightarrow 2\,BrCl(g)$ are 30 kJ mol^{-1} and 105 JK^{-1} mol^{-1} respectively. The temperature at which the reaction will be in equilibrium is [CBSE AIPMT 2006]**
(a) 285.7 K
(b) 273 K
(c) 450 K
(d) 300 K

33. **Which of the following statements is correct for a reversible process in a state of equi-**

librium? [CBSE AIPMT 2015]

(a) $\Delta G = -RT \times 2.30 \log K$
(b) $\Delta G = 2.30 RT \log K$
(c) $\Delta G^\circ = -2.30 RT \log K$
(d) $\Delta G^\circ = 2.30 RT \log K$

34. **The correct relationship between free energy and equilibrium constant K of a reaction is [CBSE AIPMT 1996]**

(a) $\Delta G^\circ = -RT \ln K$
(b) $\Delta G = RT \ln K$
(c) $\Delta G^\circ = RT \ln K$
(d) $\Delta G = -RT \ln K$

35. **Hydrolysis of sucrose is given by the following reaction. Sucrose + $H_2O \rightleftharpoons$ Glucose + Fructose. If the equilibrium constant (K_C) is 2×10^{13} at 300 K, the value of $\Delta_r G^\circ$ at the same temperature will be [NEET (Sept.) 2020]**

(a) $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$
(b) $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(3 \times 10^{13})$
(c) $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(4 \times 10^{13})$
(d) $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$

36. **The factor of ΔG values is important in metallurgy. The ΔG values for the following reactions at 800°C are given as: $S_2(s) + 2\,O_2(g) \longrightarrow 2\,SO_2(g)$, $\Delta G = -544$ kJ; $2\,Zn(s) + S_2(s) \longrightarrow 2\,ZnS(s)$, $\Delta G = -293$ kJ; $2\,Zn(s) + O_2(g) \longrightarrow 2\,ZnO(s)$, $\Delta G = -480$ kJ. The ΔG for the reaction, $2\,ZnS(s) + 3\,O_2(g) \longrightarrow 2\,ZnO(s) + 2\,SO_2(g)$ will be [CBSE AIPMT 2000]**

(a) -357 kJ
(b) -731 kJ
(c) -773 kJ
(d) -229 kJ

37. **The densities of graphite and diamond at 298 K are 2.25 and 3.31 g cm^{-3}, respectively. If the standard free energy difference (ΔG°) is equal to 1895 J mol^{-1}, the pressure at which graphite will be transformed into diamond at 298 K is [CBSE AIPMT 2003]**

(a) 9.92×10^6 Pa
(b) 9.92×10^5 Pa
(c) 9.92×10^8 Pa
(d) 9.92×10^7 Pa

38. **Consider the following liquid-vapour equilibrium: Liquid $\rightleftharpoons$ Vapour. Which of the following relations is correct? [NEET 2016, Phase I]**

(a) $\dfrac{d \ln P}{dT} = -\dfrac{\Delta H_v}{RT}$

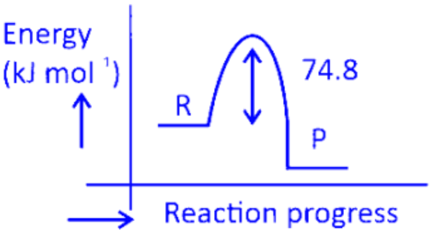
(b) $\dfrac{d\ln P}{dT} = -\dfrac{\Delta H_v}{T^2}$

(c) $\dfrac{d\ln P}{dT} = -\dfrac{\Delta H_v}{RT^2}$

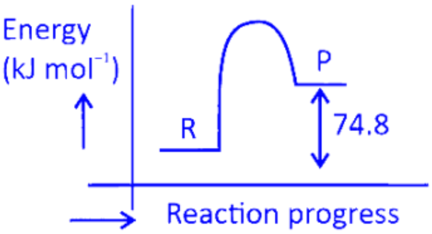
(d) $\dfrac{d\ln G}{dT} = -\dfrac{\Delta H_v}{RT^2}$

Topic–4 : NEET 2025-2022

1. **$C(s) + 2\,H_2(g) \longrightarrow CH_4(g)$; $\Delta H = -74.8$ kJ mol^{-1}. Which of the following diagrams gives an accurate representation of the above reaction? [R → reactants; P → products] [NEET 2025]**



(a)



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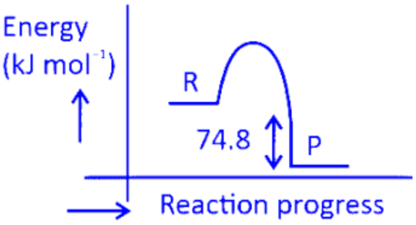

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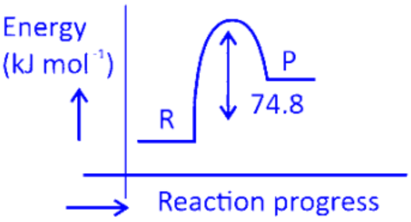


(d)

2. **The standard heat of formation, in kcal/mol of Ba^{2+} is: [Given: standard heat of formation of $SO_4^{2-}(aq) = -216$ kcal/mol, standard heat of crystallisation of $BaSO_4(s) = -4.5$ kcal/mol, standard heat of formation of $BaSO_4(s) = -349$ kcal/mol] [NEET 2025]**
   - (a) $+133.0$
   - (b) $+220.5$
   - (c) -128.5

(d) -133.0

3. **Choose the correct statement for the work done in the expansion and heat absorbed or released when 5 litres of an ideal gas at 10 atmospheric pressure isothermally expands into vacuum until volume is 15 litres: [NEET 2024 Re]**
   (a) Both the heat and work done will be greater than zero
   (b) Heat absorbed will be less than zero and work done will be positive
   (c) Work done will be zero and heat will also be zero
   (d) Work done will be greater than zero and heat will remain zero

4. **For an endothermic reaction: (A) q_p is negative. (B) $\Delta_r H$ is positive. (C) $\Delta_r H$ is negative. (D) q_p is positive. Choose the correct answer from the options given below: [NEET 2024 Re]**
   (a) B and D
   (b) C and D
   (c) A and B
   (d) A and C

5. **For the following reaction at 300 K: $A_2(g) + 3\,B_2(g) \longrightarrow 2\,AB_3(g)$, the enthalpy change is $+15$ kJ, then the internal energy change is: [NEET 2024 Re]**
   (a) 19988.4 J
   (b) 200 J
   (c) 1999 J
   (d) 1.9988 kJ

6. **In which of the following processes entropy increases? A. A liquid evaporates to vapour. B. Temperature of a crystalline solid lowered from 130K to 0K. C. $2\,NaHCO_3(s) \longrightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$ D. $Cl_2(g) \longrightarrow 2\,Cl(g)$ Choose the correct answer from the options given below: [NEET 2024]**
   (a) A and C
   (b) A, B and D
   (c) A, C and D
   (d) C and D

7. **Match List I with List II.**

List-I (Process)		List-II (Conditions)	
A.	Isothermal process	I.	No heat exchange
B.	Isochoric process	II.	Carried out at constant temperature
C.	Isobaric process	III.	Carried out at constant volume
D.	Adiabatic process	IV.	Carried out at constant pressure

Choose the correct answer from the options given below: [NEET 2024]
   (a) A-IV, B-III, C-II, D-I

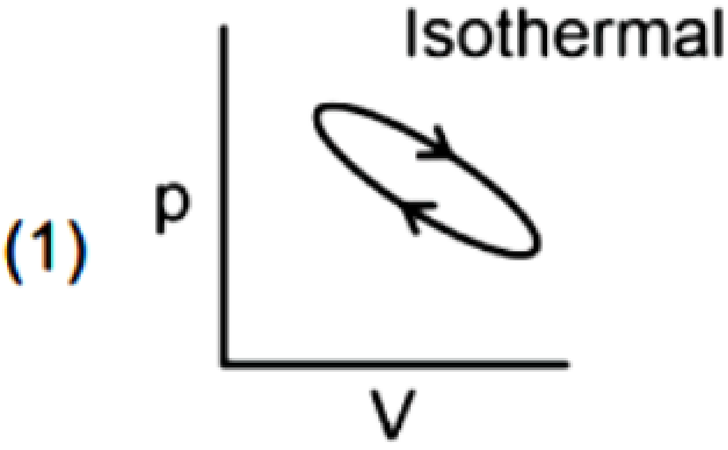
(b) A-IV, B-II, C-III, D-I
(c) A-I, B-II, C-III, D-IV
(d) A-II, B-III, C-IV, D-I

8. **The work done during reversible isothermal expansion of one mole of hydrogen gas at 25°C from pressure of 20 atmosphere to 10 atmosphere is (Given $R = 2.0$ cal K^{-1} mol^{-1}) [NEET 2024]**
   (a) 0 calorie
   (b) -413.14 calories
   (c) 413.14 calories
   (d) 100 calories

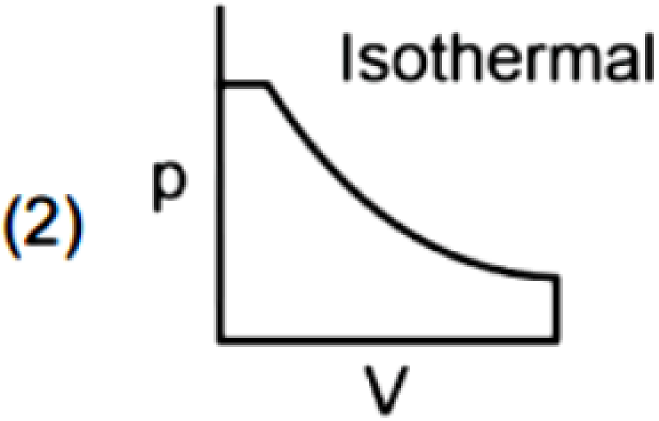
9. **Which amongst the following options is the correct relation between change in enthalpy and change in internal energy? [NEET 2023]**
   (a) $\Delta H = \Delta U + \Delta n_g RT$
   (b) $\Delta H - \Delta U = -\Delta nRT$
   (c) $\Delta H + \Delta U = \Delta nR$
   (d) $\Delta H = \Delta U - \Delta n_g RT$

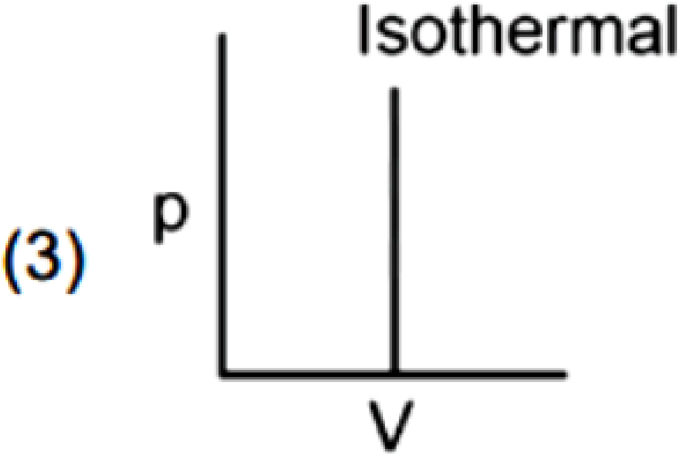
10. **Consider the following reaction: $2\,H_2(g) + O_2(g) \longrightarrow 2\,H_2O(g)$ $\Delta_r H^\circ = -483.64$ kJ. What is the enthalpy change for decomposition of one mole of water? (Choose the right option). [NEET 2023 MPR]**
    (a) 120.9 kJ
    (b) 241.82 kJ
    (c) 18 kJ
    (d) 100 kJ

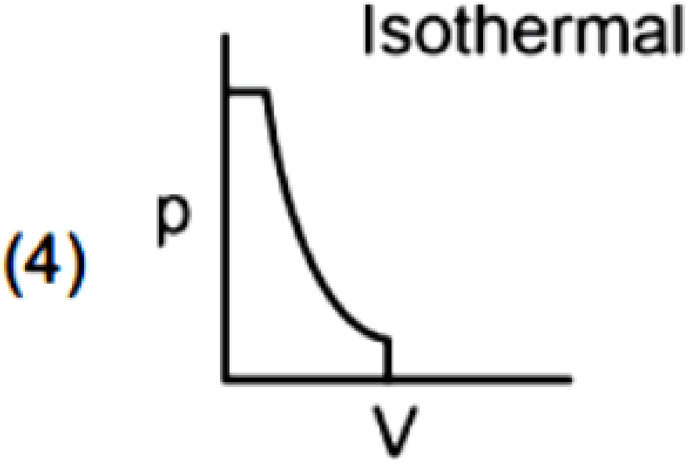
11. **Which of the following $p - V$ curve represents maximum work done? [NEET 2022]**



(a)

(b) 

(c) 

(d) 

One mole of an ideal gas at 300K is expanded isothermally from 1L to 10L volume. ΔU for this process is: (Use $R = 8.314$ JK^{-1}mol^{-1}) [NEET Re-2022]

(a) 0 J
(b) 1260 J
(c) 2520 J
(d) 5040 J

Chapter Analysis : Chemical Thermodynamics

Overall Statistics

- **Total Questions (1988-2025):** 91 questions
- **Old Pattern (1988-2021):** 78 questions
- **New Pattern (2022-2025):** 13 questions
- **Expected in NEET 2026:** 3-4 questions

Topic-wise Distribution

Topic	Old (1988-2021)	New (2022-2025)	Change
First Law	20	7	↑
Thermochemistry	20	5	→
Second Law	38	1	↓↓
Total	**78**	**13**	

The BIG Shift (2022-2025)

What's HOT Now:

1. **Isothermal Processes** – 3 questions (free expansion, work, $\Delta U = 0$)
2. $\Delta H = \Delta U + \Delta n_g RT$ – 3 questions (direct formula)
3. **Sign Conventions** – 2 questions (exo/endothermic, diagrams)
4. **Formation Enthalpy** – 2 questions (Hess's Law application)
5. **Process Matching** – 1 question (definitions)

Common Mistakes

1. **Free expansion mistake:** Remember $P_{ext} = 0 \Rightarrow w = 0$ (and for isothermal, $q = 0$ too)
2. Δn_g **error:** Count ONLY gases, not liquids or solids
3. **Sign confusion:** Heat absorbed = positive, Heat released = negative

Bottom Line

The pattern has changed! NEET now focuses on **First Law basics** and **isothermal processes** instead of Gibbs/Entropy numericals. Master these 4 things for guaranteed marks:

1. $\Delta H = \Delta U + \Delta n_g RT$
2. Isothermal process ($\Delta U = 0$)
3. Free expansion (w = 0, q = 0)
4. Sign conventions

Time needed: 12-15 hours — **Expected questions:** 3-4 — **Difficulty:** Medium