

# MIX TEST-2 [NEET] – SOLUTIONS

Chapter : Thermodynamics + Some Basic Concepts Of Chemistry

Don't look back with regret. Look forward with determination.

**Q1. Which of the following is true for an adiabatic process?**

**Explanation / Approach:**

Adiabatic process ka matlab hota hai ki system aur surroundings ke beech \*\*heat exchange (Q)\*\* nahi hota. Sochne ka simple tareeka – adiabatic = “no heat transfer”.

**Solution:**

$$\Delta Q = 0 \Rightarrow \text{First Law: } \Delta U = -\Delta W$$

Baaki sab quantities (enthalpy, volume, work) change ho sakti hain depending on process, but  $\Delta Q = 0$  is always true.

**Correct Option: (3)**

**Q2. Which of the following is not a state function?**

**Explanation / Approach:**

State function woh hota hai jo sirf initial aur final state pe depend karta hai, path pe nahi. Examples:  $U$ ,  $H$ ,  $S$ . Work and heat path pe depend karte hain.

**Solution:**

Internal energy ( $U$ ), Enthalpy ( $H$ ), Entropy ( $S$ ) all are state functions.

Work ( $W$ ) depends on path  $\rightarrow$  Not a state function.

**Correct Option: (3)**

**Q3. Among the intensive property is**

**Explanation / Approach:**

Intensive properties wo hote hain jo amount of substance pe depend nahi karte. Mass, volume extensive hote hain. Surface tension intensive hai.

**Solution:**

- Mass  $\rightarrow$  Extensive - Volume  $\rightarrow$  Extensive - Enthalpy  $\rightarrow$  Extensive - Surface tension  $\rightarrow$  Independent of quantity  $\rightarrow$  **Intensive**

**Correct Option: (3)**

**Q4. At constant T and P, for  $\text{CO(g)} + \frac{1}{2}\text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)}$**

**Explanation / Approach:**

Relation between  $\Delta H$  and  $\Delta E$ :

$$\Delta H = \Delta E + \Delta n_{gas}RT$$

$$\Delta n_{gas} = n_{products} - n_{reactants}$$

**Solution:**

Reactants:  $1 + 0.5 = 1.5$  mol gas

Products: 1 mol gas

$$\Delta n_{gas} = 1 - 1.5 = -0.5$$

So,  $\Delta H = \Delta E - 0.5RT \Rightarrow \Delta E > \Delta H$ .

**Correct Option: (2)**

**Q5. For the reaction  $N_2 + 3H_2 \rightarrow 2NH_3$ ,  $\Delta H=?$**

**Explanation / Approach:**

$$\text{Formula: } \Delta H = \Delta E + \Delta n_{gas}RT$$

**Solution:**

Reactants:  $1 + 3 = 4$  mol gas

Products: 2 mol gas

$$\Delta n_{gas} = 2 - 4 = -2$$

$$\Delta H = \Delta E - 2RT$$

**Correct Option: (2)**

**Q6. During an isothermal expansion of an ideal gas**

**Explanation / Approach:**

Isothermal = temperature constant. Internal energy  $U$  depends only on  $T$  for ideal gas. So  $\Delta U = 0$  and  $\Delta H = 0$ .

**Solution:**

Enthalpy change  $\Delta H = 0$  because  $T$  constant. So enthalpy remains unaffected.

**Correct Option: (3)**

**Q7. The internal energy of a substance**

**Explanation / Approach:**

Internal energy = microscopic kinetic energy + potential energy of particles. With increase in temperature  $\rightarrow$  kinetic energy increases  $\rightarrow U$  increases.

**Solution:**

- Option (1): Correct  $\rightarrow U$  increases with  $T$ . - Option (2): Wrong (decreases). - Option (3):  $E = mc^2$  mass-energy relation, not chemical internal energy. - Option (4): Wrong.

Correct Option: (1)

**Q8. Work done during isothermal expansion of one mole of an ideal gas from 10 atm to 1 atm at 300 K is ( $R = 2 \text{ cal mol}^{-1}\text{K}^{-1}$ )**

Explanation / Approach:

Isothermal process ke liye:

$$W = 2.303 nRT \log\left(\frac{P_1}{P_2}\right)$$

Bas values put karni hai.

Solution:

$$n = 1, R = 2, T = 300, P_1 = 10, P_2 = 1$$

$$W = 2.303 \times 1 \times 2 \times 300 \times \log(10/1)$$

$$= 2.303 \times 600 \times 1 = 1381.8 \text{ cal}$$

Correct Option: (3)

**Q9. For  $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{l})$ , find  $\Delta H - \Delta E$ .**

Explanation / Approach:

Formula:  $\Delta H - \Delta E = \Delta n_{gas}RT$  Yaha  $\Delta n_{gas}$  count karna hai.

Solution:

Reactants:  $1 + 5 = 6$  mol gas

Products: 3 mol gas ( $\text{CO}_2$  only,  $\text{H}_2\text{O}$  liquid hai, count nahi karte)

$$\Delta n_{gas} = 3 - 6 = -3$$

$$\Delta H - \Delta E = -3RT$$

Correct Option: (3)

**Q10. The work done by a system is 8 J, when 40 J heat is supplied. Find  $\Delta U$ .**

Explanation / Approach:

First law:

$$\Delta U = Q - W$$

Solution:

$$Q = 40, W = 8$$

$$\Delta U = 40 - 8 = 32 \text{ J}$$

Correct Option: (3)

**Q11. Internal energy is**

**Explanation / Approach:**

Internal energy = sum of microscopic KE + PE. Matlab partly kinetic, partly potential.

**Solution:**

**Correct Option: (1)**

**Q12. Work done when gas expands from 4 dm<sup>3</sup> to 6 dm<sup>3</sup> against  $P_{ext} = 3$  atm. (1 L atm = 101.32 J)**

**Explanation / Approach:**

Formula:

$$W = -P_{ext}\Delta V$$

Note: volume in litre.

**Solution:**

$$\Delta V = 6 - 4 = 2 \text{ dm}^3 = 2 \text{ L}$$

$$W = -3 \times 2 = -6 \text{ L atm}$$

Convert to J:

$$-6 \times 101.32 = -608 \text{ J}$$

**Correct Option: (4)**

**Q13. If  $10^{20}$  molecules are removed from 50 mg N<sub>2</sub>O, number of moles left? (approx)**

**Explanation / Approach:**

Step 1: Calculate initial moles from mass. Step 2: Convert removed molecules to moles. Step 3: Subtract.

**Solution:**

Molar mass N<sub>2</sub>O = 44 g/mol

Mass = 50 mg =  $5 \times 10^{-2}$  g

$$n_{initial} = \frac{0.05}{44} \approx 1.14 \times 10^{-3} \text{ mol}$$

Removed molecules =  $10^{20}$

Moles removed =  $\frac{10^{20}}{6.022 \times 10^{23}} \approx 1.66 \times 10^{-4}$

$$n_{final} \approx (1.14 - 0.166) \times 10^{-3} \approx 9.7 \times 10^{-4} \text{ mol}$$

Nearest option =  $10^{-3}$  mol. **Correct Option: (2)**

**Q14. If % of cobalt in complex = 0.25% (by mass), min. molar mass? (Co = 59)**

**Explanation / Approach:**

$$\text{Mass percent} = \frac{\text{Mass of Co atom}}{\text{Molar Mass of complex}} \times 100$$

**Solution:**

$$0.25 = \frac{59}{M} \times 100$$
$$M = \frac{59 \times 100}{0.25} = 23600$$
$$M \approx 2.36 \times 10^4$$

**Correct Option: (3)**

**Q15. Calculate the molarity of  $\text{CaCl}_2$  when it is dissolved in 250 mL solution and gives  $3.011 \times 10^{23}$  chloride ions.**

**Explanation / Approach:**

Step 1:  $\text{Cl}^-$  ions se moles nikal lo. Step 2:  $\text{CaCl}_2 \rightarrow 2 \text{Cl}^-$ , so divide by 2. Step 3: Volume (L) se molarity nikal lo.

**Solution:**

$$\text{Moles of } \text{Cl}^- = \frac{3.011 \times 10^{23}}{6.022 \times 10^{23}} = 0.5 \text{ mol}$$

$$\text{So, moles of } \text{CaCl}_2 = 0.5/2 = 0.25 \text{ mol}$$

$$\text{Volume} = 250 \text{ mL} = 0.25 \text{ L}$$

$$M = \frac{0.25}{0.25} = 1 \text{ M}$$

**Correct Option: (4)**

**Q16. Maximum number of oxygen atoms are present in:**

**Explanation / Approach:**

Sab compounds ka moles nikal ke O atoms count karna hai.

**Solution:**

$$(1) 24 \text{ g } \text{O}_3, M = 48 \rightarrow 0.5 \text{ mol} \rightarrow 0.5 \times 3 \times N_A = 1.5N_A \text{ atoms}$$

$$(2) 11 \text{ g } \text{CO}_2, M = 44 \rightarrow 0.25 \text{ mol} \rightarrow 0.25 \times 2N_A = 0.5N_A \text{ atoms}$$

$$(3) 32 \text{ g } \text{SO}_2, M = 64 \rightarrow 0.5 \text{ mol} \rightarrow 0.5 \times 2N_A = 1N_A \text{ atoms}$$

$$(4) 8 \text{ g } \text{O}_2, M = 32 \rightarrow 0.25 \text{ mol} \rightarrow 0.25 \times 2N_A = 0.5N_A \text{ atoms}$$

Maximum = Option (1). **Correct Option: (1)**

**Q17. Mole fraction of  $\text{NaOH} = 0.001$ . Find molarity (dilute solution).**

**Explanation / Approach:**

Dilute solution ke liye mole fraction  $\approx$  molarity/55.5.

**Solution:**

$$M \approx 0.001 \times 55.5 = 0.0555 M \approx 0.056 M$$

**Correct Option: (1)**

**Q18.  $A + B_2 \rightarrow AB_2$ . If 100 atoms A + 100 atoms B react, number of  $AB_2$  molecules formed?**

**Explanation / Approach:**

Stoichiometry:  $1 A + 1 B_2 \rightarrow 1 AB_2$ . Limiting reagent check karna hai.

**Solution:**

100 atoms B = 50  $B_2$  molecules.

Reaction:  $100 A + 50 B_2 \rightarrow$  only 50  $AB_2$  possible ( $B_2$  limiting).

**Correct Option: (2)**

**Q19. Number of H atoms in 3 mol  $C_2H_6$  (ethane).**

**Explanation / Approach:**

Each  $C_2H_6$  has 6 H atoms. Multiply by moles.

**Solution:**

3 mol molecules =  $3N_A$  molecules.

Each has 6 H  $\rightarrow 18N_A$  atoms.

$$= 18 \times 6.022 \times 10^{23} = 1.08 \times 10^{25}$$

**Correct Option: (3)**

**Q20. 25 mL of 3 M HCl + 75 mL of 0.05 M HCl  $\rightarrow$  final molarity?**

**Explanation / Approach:**

Use formula:

$$M_{final} = \frac{M_1V_1 + M_2V_2}{V_1 + V_2}$$

**Solution:**

$$\begin{aligned} &= \frac{(3 \times 25) + (0.05 \times 75)}{100} \\ &= \frac{75 + 3.75}{100} = 0.7875 \approx 0.788M \end{aligned}$$

**Correct Option: (3)**

**Q21. 3 M  $Na_2CO_3$ , density = 1.5 g/cc. Find molality.**

**Explanation / Approach:**

Step 1: Find mass of 1 L solution. Step 2: Find solute mass. Step 3: Mass of solvent  $\rightarrow$  kg  $\rightarrow$  molality.

**Solution:**

$$1 \text{ L solution} = 1000 \text{ mL} \times 1.5 \text{ g/mL} = 1500 \text{ g}$$

$$\text{Moles solute} = 3 \text{ mol} \rightarrow \text{mass} = 3 \times 106 = 318 \text{ g}$$

$$\text{Mass solvent} = 1500 - 318 = 1182 \text{ g} = 1.182 \text{ kg}$$

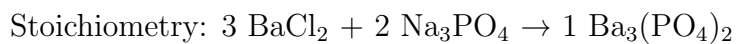
$$\text{Molality} = \frac{3}{1.182} \approx 2.54 \text{ Correct Option: (4)}$$

**Q22.**  $3\text{BaCl}_2 + 2\text{Na}_3\text{PO}_4 \rightarrow \text{Ba}_3(\text{PO}_4)_2 + 6\text{NaCl}$ . If 2 mol  $\text{BaCl}_2 + 2$  mol  $\text{Na}_3\text{PO}_4$  react, max  $\text{Ba}_3(\text{PO}_4)_2$  formed?

**Explanation / Approach:**

Check limiting reagent using stoichiometry.

**Solution:**



For 2 mol  $\text{BaCl}_2$ , need  $\frac{4}{3}$  mol  $\text{Na}_3\text{PO}_4$ . Available = 2 mol  $\rightarrow$   $\text{BaCl}_2$  limiting.

So, product =  $\frac{2}{3}$  mol.

**Correct Option: (4)**