



## DPP-4 [Ideal & Non-ideal Solution]

### Chapter: Solution

*“Everyone wants marks. Very few want to sit and solve.”*

#### TYPE-1 : Ideal Solution Basics

- Among the following that forms an ideal solution?**
  - water and methanol
  - acetone and ethanol
  - benzene and toluene
  - water and HCl
- The mixture of n-hexane and n-heptane is an example of**
  - ideal solution
  - non-ideal solution
  - dilute solution
  - none
- Among the following, that does not form an ideal solution is:**
  - $C_6H_6$  and  $C_6H_5CH_3$
  - $C_2H_5Cl$  and  $C_6H_5OH$
  - $C_6H_5Cl$  and  $C_6H_5Br$
  - $C_2H_5Br$  and  $C_2H_5I$
- Which condition is not satisfied by an ideal solution**
  - $\Delta H_{\text{mixing}} = 0$
  - $\Delta V_{\text{mixing}} = 0$
  - $\Delta S_{\text{mixing}} = 0$
  - Obeys Raoult's law
- Which one of the following is incorrect for ideal solution?**
  - $\Delta P = P_{\text{obs}} - P_{\text{calculated by Raoult's law}} = 0$
  - $\Delta G_{\text{mix}} = 0$
  - $\Delta H_{\text{mix}} = 0$
  - $\Delta U_{\text{mix}} = 0$
- For an ideal solution of A and B which statement is incorrect:-**
  - The enthalpy change of mixing of A and B is zero
  - The volume change of solution A and B is zero
  - The intermolecular forces of A and B is same as that of A-A and B-B
  - The entropy change of mixture of A and B is zero
- For an ideal solution, the correct option is**
  - $\Delta_{\text{mix}}S = 0$  at constant T and P
  - $\Delta_{\text{mix}}V \neq 0$  at constant T and P

[NEET-2019]

- (3)  $\Delta_{\text{mix}}H = 0$  at constant T and P  
 (4)  $\Delta_{\text{mix}}G = 0$  at constant T and P
8. **Which one is not equal to zero for an ideal solution:-**
- (1)  $\Delta S_{\text{mix}}$   
 (2)  $\Delta V_{\text{mix}}$   
 (3)  $\Delta P = P_{\text{observed}} - P_{\text{Raoult}}$   
 (4)  $\Delta H_{\text{mix}}$
9. **Which of the following is less than zero for ideal solutions?**
- (A)  $\Delta H_{\text{mix}}$   
 (B)  $\Delta V_{\text{mix}}$   
 (C)  $\Delta G_{\text{mix}}$   
 (D)  $\Delta S_{\text{mix}}$
10. **Which condition is not satisfied by an ideal solution?**
- (1)  $\Delta_{\text{mix}}H = 0$   
 (2)  $\Delta_{\text{mix}}V = 0$   
 (3)  $\Delta_{\text{mix}}S = 0$   
 (4) Obeys Raoult's Law
11. **Which of the following statement about the composition of the vapour over an ideal 1 : 1 molar mixture of benzene and toluene is correct? Assume that the temperature is constant at 25°C. (Given: Vapour Pressure Data at 25°C, benzene = 12.8 kPa, Toluene = 3.85 kPa)**
- (1) The vapour will contain a higher percentage of benzene  
 (2) The vapour will contain a higher percentage of toluene  
 (3) The vapour will contain equal amounts of benzene and toluene  
 (4) Not enough information is given to make a prediction

## TYPE-2 : Non-ideal Solution & Deviations

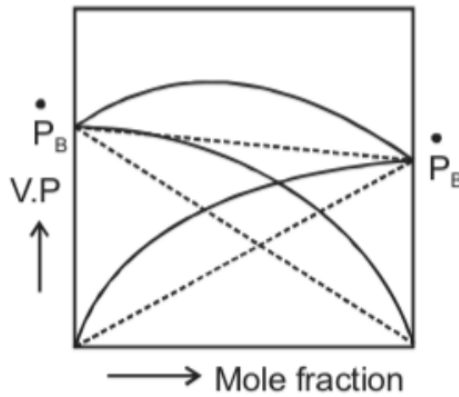
1. **If solute-solvent interactions are more than solute-solute and solvent-solvent interactions then**
- (1) It is ideal solution  
 (2) It is non-ideal solution with positive deviation  
 (3) It is non-ideal solution with negative deviation  
 (4) None of these
2. **A solution of sulphuric acid in water exhibits:**
- (A) Negative deviations from Raoult's law  
 (B) Positive deviations from Raoult's law  
 (C) Ideal properties  
 (D) The applicability of Henry's law
3. **On mixing 10 mL of acetone with 40 mL of chloroform, the total volume of the solution is**
- (1)  $< 50$  mL  
 (2)  $> 50$  mL  
 (3)  $= 50$  mL

- (4) Cannot be predicted
4. **On mixing 10 ml of ethanol with 10 ml of benzene the total volume of the solution is**
- (1)  $> 20$  ml
  - (2)  $< 20$  ml
  - (3)  $= 20$  ml
  - (4) Can't be predicted
5. **Which of the following is correct for a solution showing positive deviation from Raoult's law?**
- (1)  $\Delta V_{\text{mix}} > 0, \Delta H_{\text{mix}} > 0$
  - (2)  $\Delta V_{\text{mix}} < 0, \Delta H_{\text{mix}} < 0$
  - (3)  $\Delta V_{\text{mix}} = 0, \Delta H_{\text{mix}} = 0$
  - (4)  $\Delta V_{\text{mix}} > 0, \Delta H_{\text{mix}} < 0$
6. **Which of the following is correct about a solution showing positive deviation?**
- (1) Vapour pressure observed will be the less than that calculated from Raoult's law
  - (2) Minimum boiling azeotrope will be formed
  - (3)  $\Delta H_{\text{mix}} < 0$
  - (4)  $\Delta V_{\text{mix}} < 0$
7. **Which of the following mixture will show positive deviation from ideal behaviour?**
- (1)  $\text{H}_2\text{O} + \text{C}_2\text{H}_5\text{OH}$
  - (2)  $\text{H}_2\text{O} + \text{HNO}_3$
  - (3)  $\text{CHCl}_3 + \text{CH}_3\text{-CO-CH}_3$
  - (4) All of these
8. **A mixture of liquid showing positive deviation in Raoult's law is:-**
- (1)  $(\text{CH}_3)_2\text{CO} + \text{C}_2\text{H}_5\text{OH}$
  - (2)  $(\text{CH}_3)_2\text{CO} + \text{CHCl}_3$
  - (3)  $(\text{C}_2\text{H}_5)_2\text{O} + \text{CHCl}_3$
  - (4)  $(\text{CH}_3)_2\text{CO} + \text{C}_6\text{H}_5\text{NH}_2$
9. **Which of the following mixtures will show positive deviation from ideal behaviour?**
- (1)  $\text{H}_2\text{O}$  and  $\text{HNO}_3$
  - (2)  $\text{H}_2\text{O}$  and  $\text{C}_2\text{H}_5\text{OH}$
  - (3)  $\text{CHCl}_3$  and  $\text{CH}_3\text{-CO-CH}_3$
  - (4) n-hexane and n-heptane
10. **Which of the following statements is correct regarding a solution of two components A and B exhibiting positive deviation from ideal behaviour?** [NEET-2019 (Odisha)]
- (1) Intermolecular attractive forces between A-A and B-B are equal to those between A-B
  - (2) Intermolecular attractive forces between A-A and B-B are stronger than those between A-B
  - (3)  $\Delta_{\text{mix}}H = 0$  at constant T and P
  - (4)  $\Delta_{\text{mix}}V = 0$  at constant T and P
11. **A solution of acetone in ethanol**
- (1) shows a positive deviation from Raoult's law
  - (2) behaves like a near ideal solution
  - (3) Obeys Raoult's law
  - (4) shows a negative deviation from Raoult's law
12. **Which of the following liquid pairs show a positive deviation from Raoult's law?** [NCERT]

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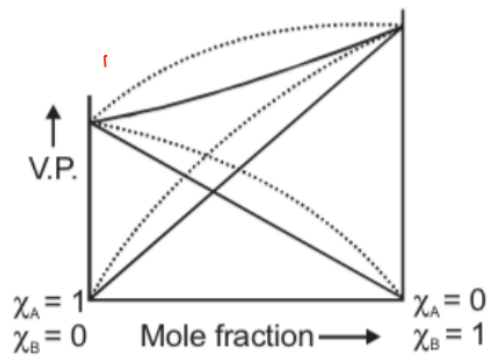
- (1) Water – Hydrochloric acid
- (2) Ether – Chloroform
- (3) Water – Nitric acid
- (4) Benzene – Acetone

13. **The graph plotted vapour pressure vs mole fraction is the graph for which of the following example**



- (1) Hexane and Heptane
- (2) Ethyl bromide and Ethyl chloride
- (3) Ethanol and Water
- (4) Chloroform and Acetone

14. **Vapour phase diagram for a solution is given below if dotted line represents deviation**



Correct observation for this solution

- (1)  $\Delta H_{\text{mix}}$  : +ve
- (2)  $\Delta S_{\text{mix}}$  : +ve
- (3)  $\Delta V_{\text{mix}}$  : +ve
- (4) All of these

### TYPE-3 : JEE Main & Advanced PYQs

1. **A binary liquid solution is prepared by mixing n-heptane and ethanol. Which one of the following statement is correct regarding the behaviour of the solution?** [AIEEE-2009, 4/144]
  - (1) The solution is non-ideal, showing +ve deviation from Raoult's Law.

- (2) The solution is non-ideal, showing –ve deviation from Raoult’s Law.
- (3) n-heptane shows +ve deviation while ethanol shows –ve deviation from Raoult’s Law.
- (4) The solution formed is an ideal solution.
2. **For an ideal solution of two components A and B, which of the following is true?**  
[JEE(Main) 2014 Online (19-04-14), 4/120]
- (1)  $\Delta H_{\text{mixing}} < 0$  (zero)
- (2)  $\Delta H_{\text{mixing}} > 0$  (zero)
- (3) A–B interaction is stronger than A–A and B–B interactions
- (4) A–A, B–B and A–B interactions are identical
3. **Total vapour pressure of mixture of 1 mol of volatile component A ( $p_A^\circ = 100$  mmHg) and 3 mol of volatile component B ( $p_B^\circ = 60$  mmHg) is 75 mm. For such case:**
- (1) there is positive deviation from Raoult’s law
- (2) boiling point has been lowered
- (3) force of attraction between A and B is smaller than that between A and A or between B and B
- (4) all the above statements are correct
4. **Which characterises the weak intermolecular forces of attraction in a liquid?**
- (1) High boiling point
- (2) High vapour pressure
- (3) High critical temperature
- (4) High heat of vaporization
5. **Which of the following liquid pairs shows a positive deviation from Raoult’s law?**
- (1) Acetone – chloroform
- (2) Benzene – methanol
- (3) Water – nitric acid
- (4) Water – hydrochloric acid
6. **Benzene and naphthalene form an ideal solution at room temperature. For this process, the true statement(s) is (are):** [JEE(Advanced) 2013, 4/120]
- (A)  $\Delta G$  is positive
- (B)  $\Delta S_{\text{system}}$  is positive
- (C)  $\Delta S_{\text{surroundings}} = 0$
- (D)  $\Delta H = 0$
7. **Mixture(s) showing positive deviation from Raoult’s law at 35°C is(are)** [JEE(Advanced) 2016, 4/124]
- (A) carbon tetrachloride + methanol
- (B) carbon disulphide + acetone
- (C) benzene + toluene
- (D) phenol + aniline
8. **100 ml of liquid A and 25 ml of liquid B is mixed to give a solution which does not obey Raoult’s law. The volume of the solution**
- (1) Will be 125 ml
- (2) Can be > or < than 125 ml
- (3) Can be >, = or < than 125 ml
- (4) Will be less than 125 ml

## TYPE-4 : Numerical & Calculation Based

- The vapour pressure of the solution of two liquids A( $p^\circ = 80$  mm) and B( $p^\circ = 120$  mm) is found to be 100 mm when  $x_A = 0.4$ . The result shows that**
  - solution exhibits ideal behaviour
  - solution shows positive deviations
  - solution shows negative deviations
  - solution will show positive deviations for lower concentration and negative deviations for higher concentrations.
- Consider a binary mixture of volatile liquids. If at  $X_A = 0.4$  the vapour pressure of solution is 580 torr then the mixture could be ( $p_A^\circ = 300$  torr,  $p_B^\circ = 800$  torr):**
  - $\text{CHCl}_3 - \text{CH}_3\text{COCH}_3$
  - $\text{C}_6\text{H}_5\text{Cl} - \text{C}_6\text{H}_5\text{Br}$
  - $\text{C}_6\text{H}_6 - \text{C}_6\text{H}_5\text{CH}_3$
  - $n\text{C}_6\text{H}_{14} - n\text{C}_7\text{H}_{16}$
- If vapour pressures of pure liquids 'A' & 'B' are 300 and 800 torr respectively at  $25^\circ\text{C}$ . When these two liquids are mixed at this temperature to form a solution in which mole percentage of 'B' is 92, then the total vapour pressure is observed to be 0.95 atm. Which of the following is true for this solution.**
  - $\Delta V_{\text{mix}} > 0$
  - $\Delta H_{\text{mix}} < 0$
  - $\Delta V_{\text{mix}} = 0$
  - $\Delta H_{\text{mix}} = 0$
- When KCl dissolves in water (assume endothermic dissolution), then:**
  - $\Delta H = + \text{ve}$ ,  $\Delta S = + \text{ve}$ ,  $\Delta G = + \text{ve}$
  - $\Delta H = + \text{ve}$ ,  $\Delta S = - \text{ve}$ ,  $\Delta G = - \text{ve}$
  - $\Delta H = + \text{ve}$ ,  $\Delta S = + \text{ve}$ ,  $\Delta G = - \text{ve}$
  - $\Delta H = - \text{ve}$ ,  $\Delta S = - \text{ve}$ ,  $\Delta G = + \text{ve}$
- The dissolving process is exothermic when:**
  - The energy released in solvation exceeds the energy used in breaking up solute-solute and solvent-solvent interactions.
  - The energy used in solvation exceeds the energy released in breaking up solute-solute and solvent-solvent interactions.
  - The energy released in solvation is about the same as the energy used in breaking up solute-solute and solvent-solvent interactions.
  - The energy used in solvation is about the same as the energy used in breaking up solute-solute and solvent-solvent interactions.
- Given P-x curve for a non-ideal liquid mixture (Fig.). Identify the correct T-x curve for the same mixture.**

