Today's Goal

Non-Ideal Solution

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Azeotropes

Non-Ideal Solution

Definition

The solution which do not obey Raoult’s law over the entire range of concentration are known as non ideal solutions.

There are two types of non ideal solutions

1. Positive deviation
2. Negative deviation

Properties of Positive deviation

1. $\Delta_{mix} H > 0$, $\Delta_{mix} V > 0$, $\Delta_{mix} P > 0$
2. $\Delta_{mix} S > 0$, $\Delta_{mix} G < 0$
3. If the intermolecular attractive forces between the A-A and B-B are greater than those between A-B, this leads to the formation of positive deviation.
4. Examples –

- Ethanol + Acetone
- CS_2 + Acetone
- Ethanol + H_2O

Graph of Positive deviation

Properties of Negative Deviation

1. $\Delta_{mix} H < 0$, $\Delta_{mix} V < 0$, $\Delta_{mix} P < 0$
2. $\Delta_{mix} S > 0$, $\Delta_{mix} G < 0$
3. If the intermolecular attractive forces between the A-A and B-B are lesser than those between A-B, this leads to the formation of negative deviation.
4. Examples –

- Phenol + Acetone
- Chloroform + Acetone
- $HNO_3 + H_2O$

Trick to find positive and negative deviation

1. CCl_4 + ……
2. $CHCl_3$ +……
3. Acid + Water
4. Important example $CHCl_3$ + Acetone

Graph of Negative deviation

Azeotropes

Definition

1. Some liquids on mixing, from azeotropes which are binary mixtures having the same composition in liquid and vapour phase and boil at a constant temperature.
2. In such cases, it is not possible to separate the components by fractional distillation.
3. There are two types of azeotropes called minimum boiling azeotropes and maximum boiling azeotropes.

Types of Azeotropes

1. Solution which show a large positive deviation from Raoult's law form minimum boiling azeotropes.
2. The solutions that show large negative deviation from Raoult's law form maximum boiling azeotropes.

Q.1 Which of the following liquid pairs shows a positive deviation from Raoult's law?

A. Acetone-Chloroform

B. Benzene-methanol

C. Water-nitric acid

D. Water-hydrochloric acid

Q

2. Which of the following solutions can have boiling point less than that of both the individual components ?

A. n-Hexane and n- Heptane

B. HNO_3 and H_2O

C. $HCl + H_2O$

D. C2H5OH and H_2O

Q

Azeotropic mixture :

A. Are those which can be fractionally distilled

B. Have definite constant boiling point

C. Have same definite composition at any pressure

D. Are those which have different composition in liquid and vapour state

Q

Select the mixture in which volume of solution is less than 2V . V mL on mixing V mL each of the two miscible liquids :

A $CCl_4 + CS_2$

B Benzene + Toulene

C $CHCl_3 + CH_3COCH_3$

D Hexane + Pentane

Q

Which of the following does not show negative deviation from Raoult's law ?

A. Chloroform-Acetone

B. Acetone-Benzene

C. Chloroform-Ether

D. Chloroform-Benzene

Q

Which will form maximum boiling azeotrope ?

A $C_6H_6 + C_6H_5CH_3$ Solution

B $HNO_3 + H_2O$ solution

C $C_2H_5OH + H_2O$ solution

D n-hexane and n-heptane

Q

The azeotropic mixture of water (B.P = 100°C) and HCl (B.P = 86°C) boils at about 120°C. During fractional distillation of this mixture, it is possible to obtain :

A. Pure HCl

B. Pure H_2O

C. Pure H_2O as well as pure HCl

D. Neither H_2O nor HCl

Q

Azeotropic mixture of water and HCl boils at 381.5 K. By distilling the mixture, it is possible to obtain:

A. Pure HCl only

B. Pure water only

C. Neither water nor HCl

D. Both water and HCl in pure state

Q

An azeotropic mixture of two liquids has a boiling point higher than either of them when it :

A. Shows positive deviation from Raoult’s law

B. Shows negative deviation from Raoult’s law

C. Shows ideal behaviour

D. N.O.T.A

Q

The boiling point of an azeotropic mixture of water-ethanol is less than that of both water and ethanol. Then :

A. The mixture will show negative deviation from Raoult's law

B. The mixture will show positive deviation from Raoult's law

C. The mixture will show no deviation from Raoult's law

D. This mixture cannot be considered as true solution

Q

Total vapour pressure of mixture of 1 mol X ($P°_X$=150 torr) and 2 mol Y ($P°_Y$=300 torr) is 240 torr. In this case:

A. There is negative deviation from Raoult's law

B. There is positive deviation from Raoult's law

C. There is no deviation from Raoult's law

D. Can not be decided

Q In a mixture of A and B, components show positive deviation when :

A A-B interaction is stronger than A-A and B-B interaction

B A-B interaction is weaker than A-A and B-B interaction

C $\Delta V \text{ mix} < 0, \Delta S \text{ mix} > 0$

D $\Delta V \text{ mix} = 0, \Delta S \text{ mix} > 0$

Q

A solution of acetone In ethanol :

A. Behaves like a near ideal solution

B. Obeys Raoult’s law

C. Show a negative deviation from Raoult’s law

D. Shows a positive deviation from Raoult’s law