Partially Miscible Liquids

Certain pairs of liquid are miscible with each other in limited range of concentration & are known as Partially Miscible liquids.

4 types of partially miscible liquids:

1. Those in which partial miscibility increases on increasing temperature.
eg phenol - water, aniline - water, aniline - hexane, $CH_3OH - CS_2$, cyclohexane - CH_3COOH.
At & above a certain temperature, liquid becomes completely miscible.

2. Partial miscibility increases on lowering the temperature.
eg. $(C_2H_5)_2NH - H_2O$, $(C_2H_5)_3N - H_2O$.

3. Partial miscibility increase on both raising & lowering the temperature in certain ranges.
e.g. H_2O - nicotine, H_2O - β-picoline.

These liquid pairs show complete miscibility both above & below certain temperature.

4. Those in which complete miscibility temperature cannot be obtained either on increasing or decreasing the temperature.
e.g. ether - H_2O, ethyl acetate - H_2O.

CST: Critical Solution Temperature or Consolute Temperature
It is the temperature at & above or below which a pair of partially miscible liquids become miscible in all proportions.

UCST - Upper CST:
liquid pair attain complete miscibility above a certain temperature.

LCST: Lower CST
liquid pair attain complete miscibility below a certain temperature.
All partially miscible liquid pair have a UCST or LCST.

UCST → It cannot be realized or achieved if 1 or both components boil out before UCST is reached.
LCST → It cannot be realized or achieved if 1 or both components freeze out before LCST is reached.
It means components of liquid pair should not change their phase before CST, otherwise the value of CST cannot be obtained or such pair of partially miscible liquids would not become miscible into each other.

UCST:

Let us understand UCST by taking an example.

If small quantity of phenol or ether or aniline is added to water at room temperature & the mixture is shaken, organic compound dissolves completely in water.

If addition of organic compound is continued, a stage is reached where compound is no longer soluble & two solutions are formed:

- Saturated solution of organic compound in water.
- Saturated solution of water in organic compound.

These two solutions called conjugate solutions are in equilibrium & their compositions are fixed. The composition is independent of relative amounts of two solutions. i.e. if