

Solutions 6.1

Solution Terminology
Types of Solutions

Solvent and Solute

Solvent

- The substance that is more plentiful in a solution.

Solute

- The substance that is less plentiful in a solution.

Suspensions or Mechanical Mixtures

- A heterogeneous mixture of two or more substances.
- The substances do not dissolve in one another.
- Particles remain suspended for a period of time but eventually sink to the bottom or float to the top.
- The concentrations of particles are not consistent throughout a suspension.
- Particles do not break up into individual ions or molecules.
- (e.g. sand and water)

Solutions

- A homogeneous mixture of two or more substances.
- The substances dissolve in one another.
- The concentration of solute particles remains the same at all locations in the solution so long as the temperature remains the same.
- Solute particles break up into individual ions or molecules
- (e.g. sugar and water)

Saturated Solution

- When the solvent has dissolved the maximum amount of solute possible at a certain temperature, and some solid particles remain undissolved.
- This is an equilibrium system where solid particles continually dissolve in the solvent and dissolved particles fall out of solution.



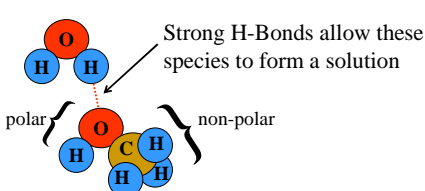
Unsaturated Solution

- When the solvent has dissolved less than the maximum amount of solute possible at a certain temperature.
- No undissolved solute remains in the system.

Types of Solutions

Liquid – Liquid Solutions

- CH_3OH (a type of alcohol) and water

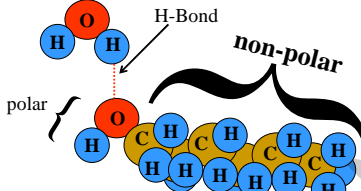


Methanol and water are **miscible** (soluble in all proportions). Miscible solutions never become saturated.

Types of Solutions

Liquid – Liquid Solutions

- $\text{CH}_3(\text{CH}_2)_5\text{OH}$ (another alcohol) and water



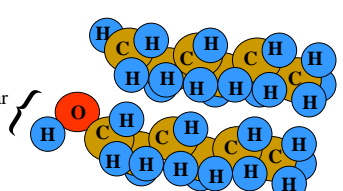
Hexanol and water are **not miscible**.

- Some hexanol will dissolve in water.
- The solubility of hexanol is limited by the long non-polar carbon chain.

Types of Solutions

Liquid – Liquid Solutions

- $\text{CH}_3(\text{CH}_2)_5\text{OH}$ and C_6H_{14}



Hexane and hexanol are **miscible**.

- Hexane is completely non-polar.
- Hexanol is mostly non-polar.

They form strong London dispersion forces of attraction for one another.

Types of Solutions

Solid – Liquid Solutions

- Many ionic compounds dissolve in polar solvents. (ion-dipole).
- Polar solids, such as glucose, dissolve in polar solvents. (dipole-dipole or H-bonds)
- Non-polar solids, such as mothballs, dissolve in non-polar solvents. (dispersion)

Types of Solutions

Gas – Liquid Solutions

- Carbonated drinks

$$\text{H}_2\text{O}_{(l)} + \text{CO}_{2(g)} \rightarrow \text{H}_2\text{CO}_{3(aq)}$$

- Oxygen gas dissolves in water

$$\text{O}_{2(g)} \rightarrow \text{O}_{2(aq)}$$

Types of Solutions

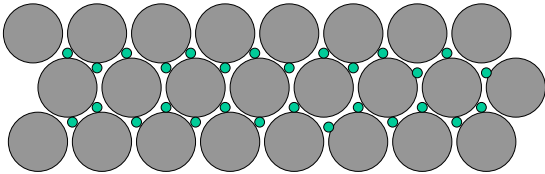
Gas – Gas Solutions

- Gases are always infinitely soluble in one another.
- Air
 - $\text{N}_{2(g)}$, $\text{O}_{2(g)}$, $\text{CO}_{2(g)}$, $\text{H}_2\text{O}_{(g)}$, etc.

Types of Solutions

Gas – Solid Solutions

- H_2 gas can occupy the spaces between some metal atoms such as iron, and palladium.



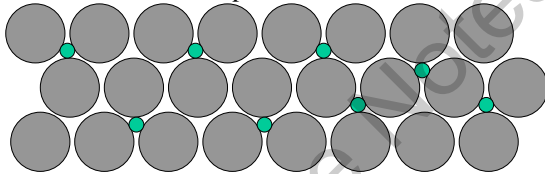
Types of Solutions

Solid – Solid Solutions

- Formed by melting, mixing, and solidifying

Steel – An interstitial alloy

- Carbon fills some spaces between iron atoms.



Types of Solutions

Solid – Solid Solutions

- Formed by melting, mixing, and solidifying.

Brass – A substitutional alloy

- Zinc atoms substitute some copper atoms.

