FREE COACHING

NEET 2025

CLASS 12

SOLUTIONS

Lecture 1

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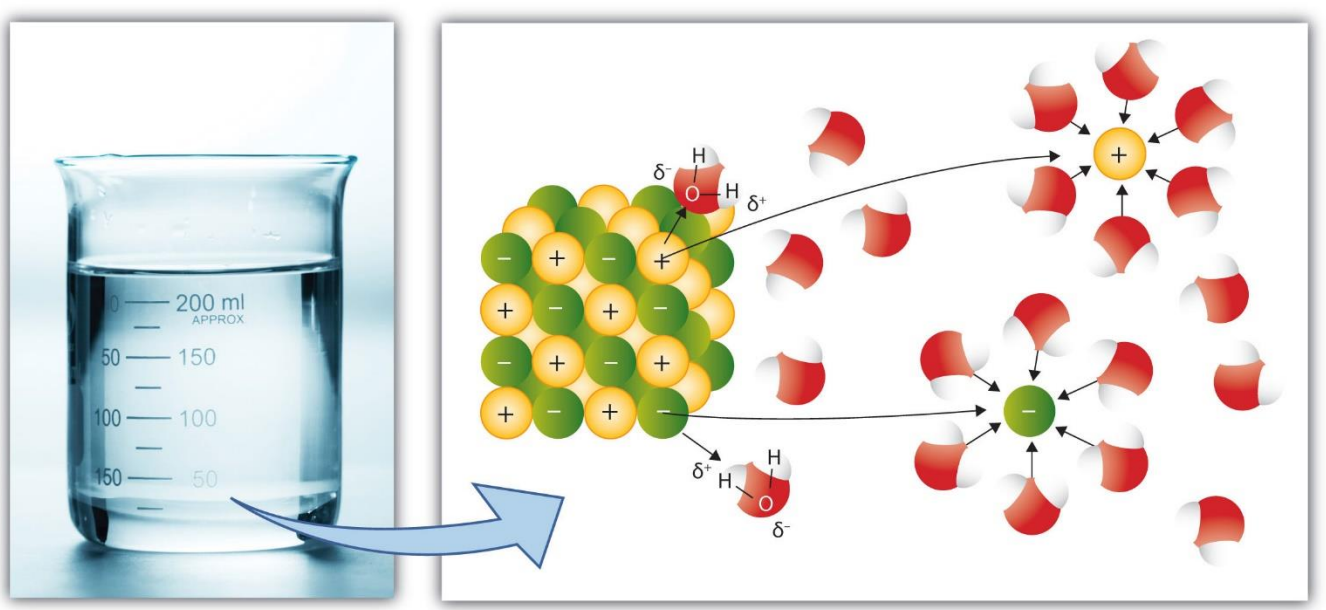
CONTENTS



Binary solutions: Solute and Solvent

- Solutes are spread uniformly throughout the solvent.
- Solutes are not visible, but can give a colour to the solution.
- Solute cannot be separated by filtration
- Properties like Density, Vapour Pressure, B.P, depend upon relative amount of solute & solvent.

Types of Solutions

Gaseous Solutions	Gas	Mixture of oxygen and nitrogen gases
	Liquid	Chloroform mixed with nitrogen gas
	Solid	Iodine in nitrogen gas

Liquid Solutions	Gas	Oxygen dissolved in water
	Liquid	Ethanol dissolved in water
	Solid	Glucose dissolved in water

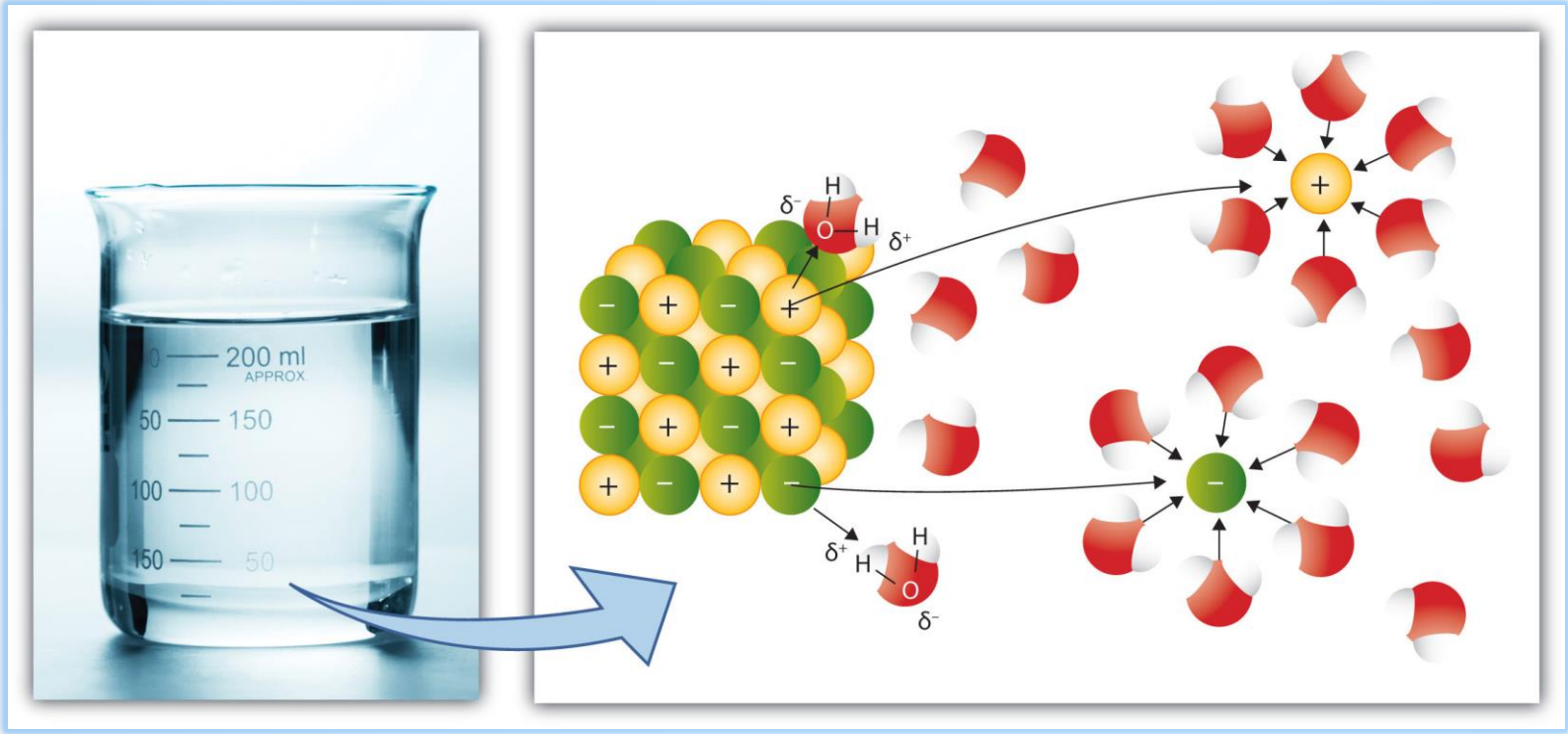
Solid Solutions	Gas	Solution of hydrogen in palladium
	Liquid	Amalgam of mercury with sodium
	Solid	Copper dissolved in gold

Dissolution Process

Polar and Non-polar Solvents

- Compounds with covalent bonds may have small electronegativity difference between the atoms.
- In some molecules, there are polar bonds, but the atom is symmetrical leading to an overall non-polar molecule.

Dissolution in water: Rock Salt



Dissolution in water: Rock Salt

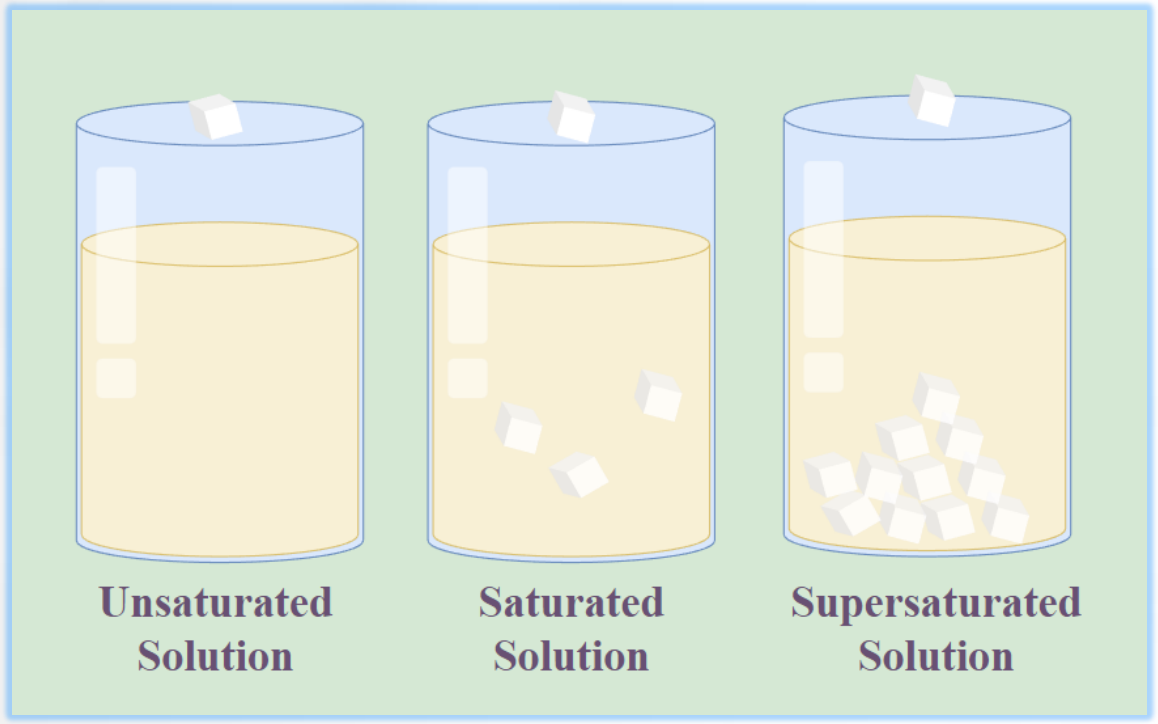
- When solid NaCl is placed in water, those ions that are less tightly held because of their position at a corner or an edge of the crystal are exposed to water molecules, which collide with them until an ion happens to break free.

Example

Will each of the following solutes dissolve in water?

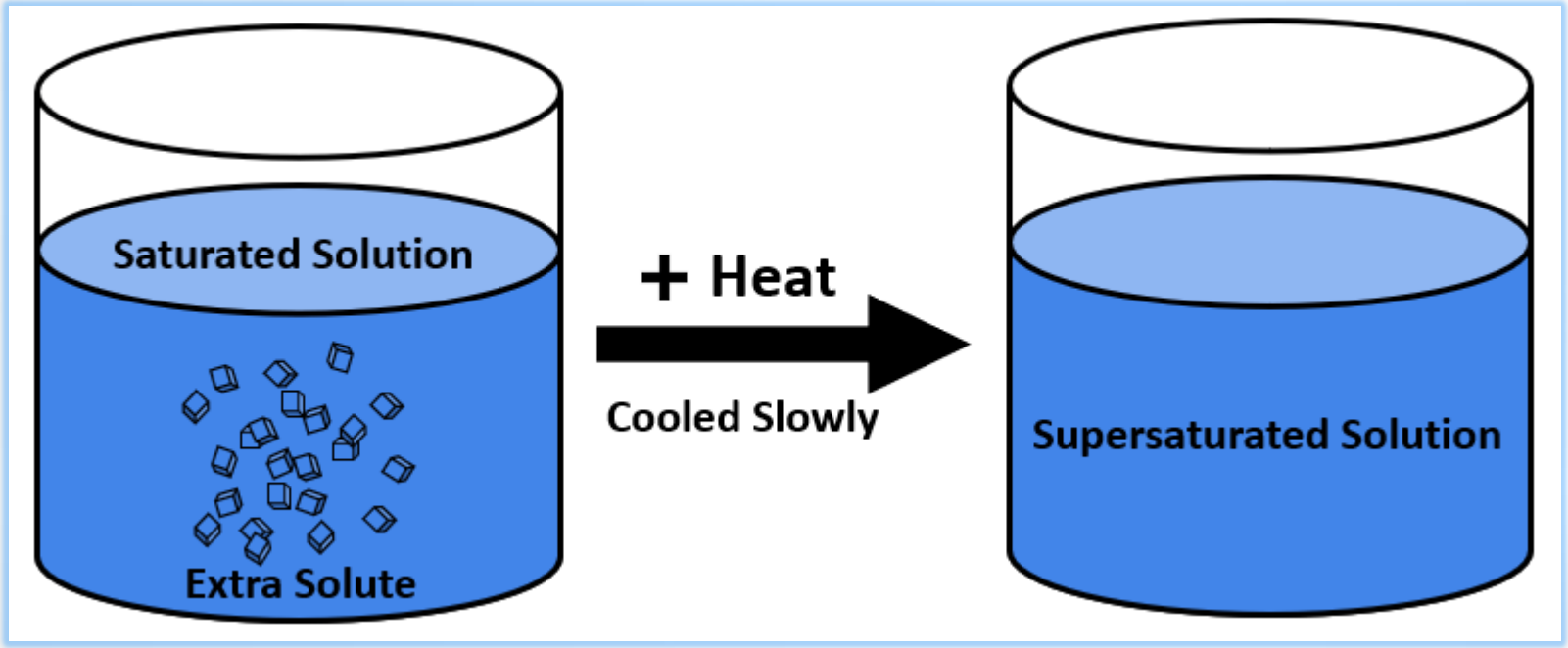
- Na_2SO_4
- Gasoline (nonpolar)
- I_2
- HCl

Dissolution & Crystallization: Unsaturated & Saturated Solutions



Super saturated Solutions

- When a saturated solution of sodium acetate is prepared at high temperature and then cooled slowly, a supersaturated solution results.



Thermodynamics of dissolution – Change in Enthalpy

Dissolution can be viewed as occurring in three steps:

1. **Breaking solute-solute attractions (endothermic), i.e., lattice energy in salts ($\Delta H_{solute\text{-}solute} > 0$).**

2. **Breaking solvent-solvent attractions (endothermic), i.e., hydrogen bonding and dipole- dipole interactions in water ($\Delta H_{solvent\text{-}solvent} > 0$).**

3. **Forming solvent-solute attractions (exothermic), i.e., salvation energy ($\Delta H_{solute\text{-}solvent} < 0$).**

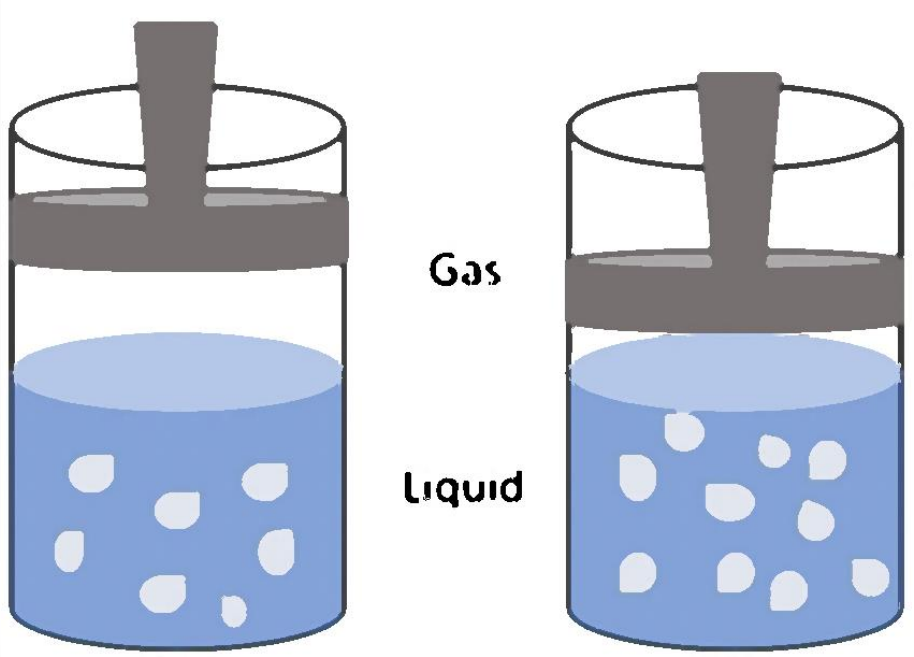
Thermodynamics of dissolution – Change in Entropy

Henry's Law

- The law states that at a constant temperature, the solubility of a gas in a liquid is directly proportional to the partial pressure of the gas present above the surface of liquid or solution

$p = K_H x$

Here K_H is the Henry's law constant.



Dalton's Law of Partial Pressure

- In a mixture of gases, each constituent gas has a Partial Pressure which is the pressure of that constituent gas if it is alone occupied the entire volume of the original mixture at the same temperature.

Application of Henry's Law: Scuba Diving

- Increased pressure increases the solubility of atmospheric gases in blood.
- When the divers come towards surface, the pressure gradually decreases.
- This releases the dissolved gases and leads to the formation of bubbles of nitrogen in the blood.
- This blocks capillaries and creates a medical condition known as bends, which are painful and dangerous to life.

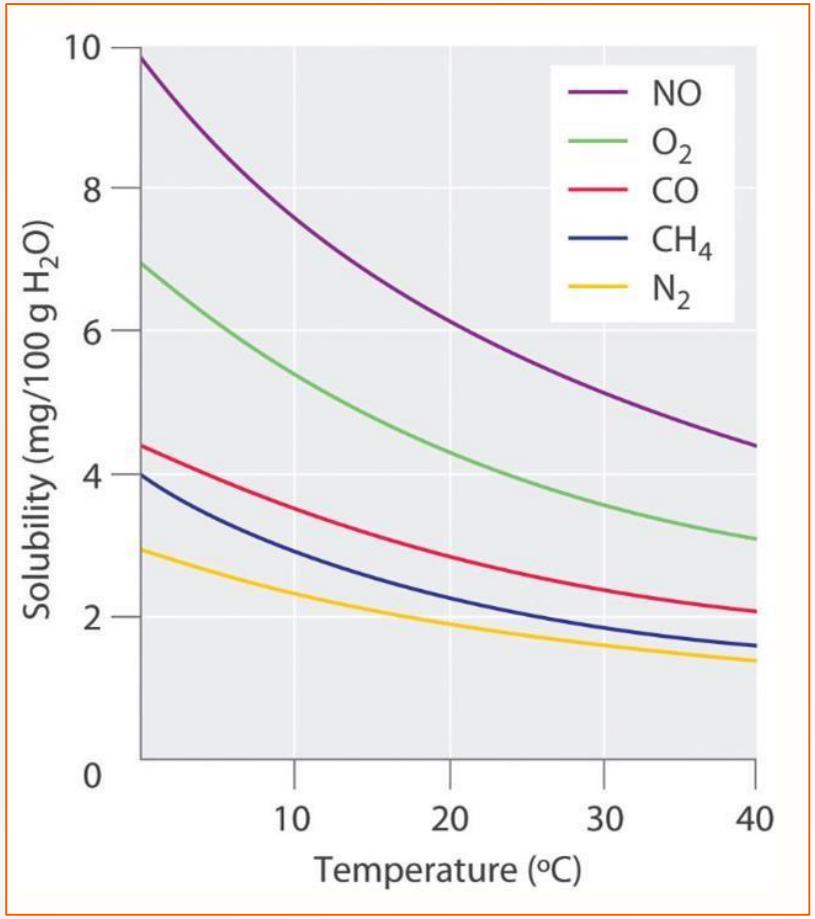
Application of Henry's Law: Scuba Diving

- To avoid bends, as well as the toxic effects of high concentrations of nitrogen in the blood, the tanks used by scuba divers are filled with air diluted with helium (11.7% helium, 56.2% nitrogen and 32.1% oxygen).

Application of Henry's Law: High Altitudes

- At high altitudes the partial pressure of oxygen is less than that at the ground level.
- This leads to low concentrations of oxygen in the blood and tissues of people living at high altitudes or climbers.
- Low blood oxygen causes climbers to become weak and unable to think clearly, symptoms of a condition known as anoxia.

Solubility of Gas & Temperature



Example

The value of Henry's constant K_H …….

A. greater for gases with higher solubility

B. greater for gases with lower solubility.

C. constant for all gases.

D. not related to the solubility of gases.

Example

Low concentration of oxygen in the blood and tissues of people living at high altitude is due to

A. low temperature
B. low atmospheric pressure
C. high atmospheric pressure
D. both low temperature and high atmospheric pressure

Example

Henry's law constant for dissolution of CH_4 in benzene at 298 K is 2×10^5 mm of Hg. Then solubility of CH_4 in benzene at 298 K under 760 mm of Hg is:

A. 1.2×10^{-5}
B. 3.8×10^{-3}
C. 4×10^{-7}
D. 1×10^{-2}

Example

Which of the following gas will have most solubility in water?

A. NH_3 **B.** H_2

C. O_2 **D.** He