

# School of Medical and Allied Sciences

Course Code: BPHT3002

Course Name: Physical Pharmaceutics I



## Unit 1

# Solubility of Drugs

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# Disclaimer

All the content material provided here is only for teaching purpose.

The logo of Galgotias University is a circular emblem with a stylized 'G' in the center. The 'G' is composed of three overlapping, curved segments in shades of yellow, orange, and blue. The background of the circle is a light, textured pattern.

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## FACTORS INFLUENCING SOLUBILITY

- The nature of solute and solvent
- Temperature
- Pressure (only applicable to gases)
- Surface area of solute
- Crystallinity, hydrophobicity of solute
- State of ionization of solute
- Influence of  $p^H$  of the medium
- Importance of  $P^{ka}$  of the drug.
- Common ion effect

# Nature of solute and solvent

- When two substances are similar they can dissolve in each other.
  - polar solutes dissolve in polar solvents
  - non polar solutes tend to dissolve in non-polar solvents.
- "Like dissolves like"
- Two liquids dissolve in each other because their molecules are alike in polarity.

# Nature of solute and solvent

- Ionic compounds are made up of charged ions similar to polar compounds.
- Ionic compounds are molar soluble in a polar solvent than in a non-polar solvent.

<b>SOLUTE</b>	<b>POLAR SOLVENT</b>	<b>NON-POLAR SOLVENT</b>
<b>POLAR</b>	Soluble	Insoluble
<b>NON-POLAR</b>	Insoluble	Soluble
<b>IONIC</b>	soluble	Insoluble

# TEMPERATURE

Solutions of gases in liquids are affected by temperature

- as temperature increases, the solubility of a GAS in a liquid decreases

## WHY?

- As temperature increases, the kinetic energy of the solute gas increases and the gas can escape

Solubility of SOLIDS in liquids: total opposite

- the solubility of a solid increases as the temperature increases (there are a few exceptions)

# TEMPERATURE

- Temperatures Affecting the Solubility as the Solution is Formed
  - When the temperature drops while you mix the solute and solvent, raising the temperature will increase solubility
  - If the temperature stays neutral, the temperature will have minimal or insignificant effect either way
  - If the temperature is increased when the solute and solvent are mixed, raising the temperature will decrease solubility



# PRESSURE

When the pressure is increased over the SOLVENT, the solubility of the gas is increased.

## WHY?

- pressure increases as gas molecules strike the surface to enter solution is increased

**Henry's Law:** solubility of gas is directly proportional to the partial pressure of the gas above the liquid





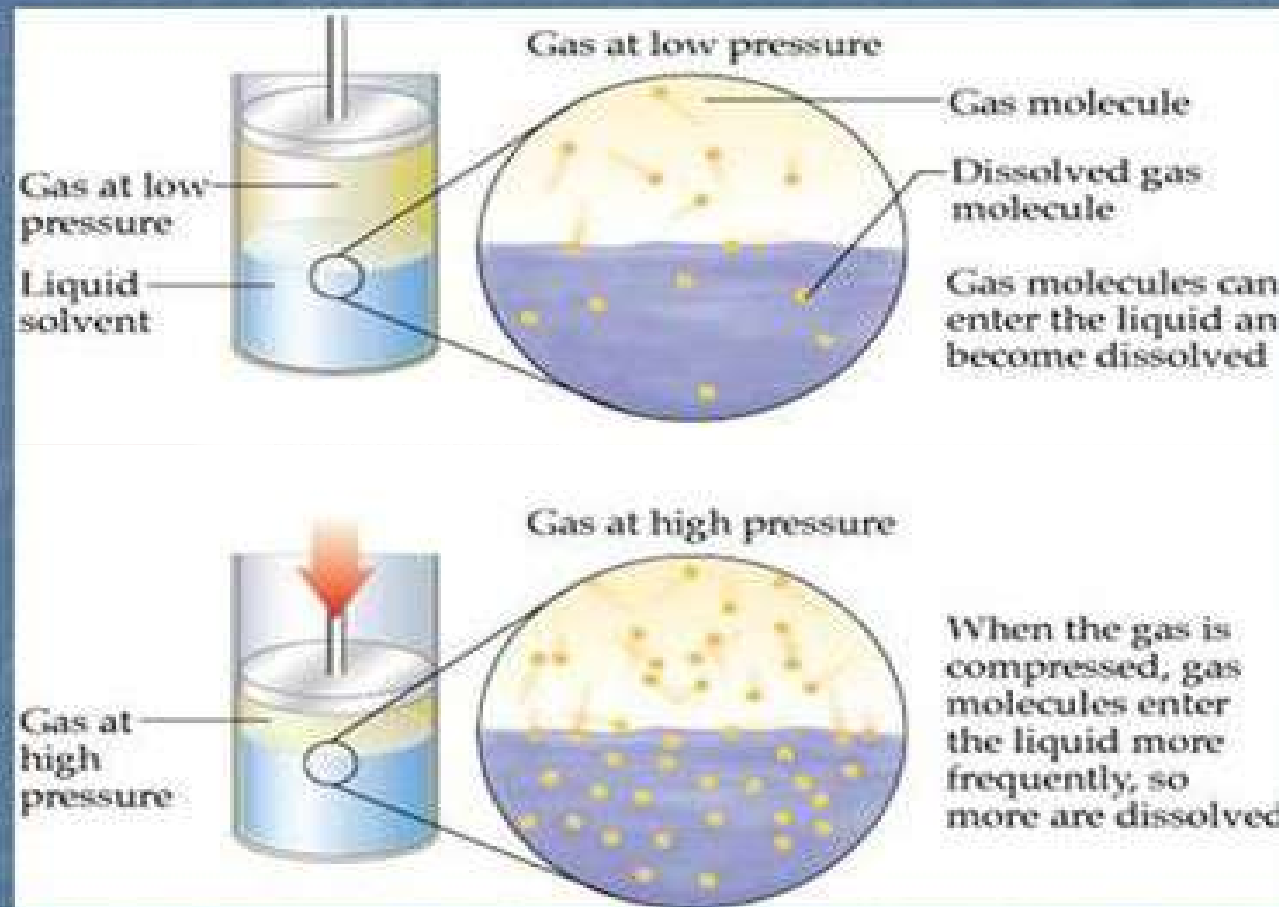
# HENRY'S LAW

$$P = k_h c$$

$p$  = partial pressure

$k_h$  = gas constant

$c$  = concentration of the solute





# Factors of Dissolving

- rate at which a solid solute dissolves in a solution depends on three factors: surface area, stirring, and temperature
- the rate of dissolving is unrelated to the solubility if the solutes dissolves quickly or slowly , does not alter or depend on its solubility

## SURFACE AREA

- The greater the surface area of solute per unit mass, the quicker it will dissolve

## STIRRING

- dissolving happens at the surface of the solvent
- contact between the solvent and the solute is increased by stirring.

# FACTORS AFFECTING SOLUBILITY

## The Common-Ion Effect

- If one of the ions in a solution equilibrium is already dissolved in the solution, the equilibrium will shift to the left and the solubility of the salt will decrease.

## EFFECT OF PH ON SOLUBILITY OF IONISABLE DRUGS

- Undissociated species cannot interact with water molecules to the same extent as the ionized form which is readily hydrated.
- So, acidic drug's solubility in acidic solution decreases as they remain unionized in acidic PH.
- SO, basic drug's solubility is more in acidic PH (in ionized form) and less in basic PH (unionized form)

## Structural features effecting aqueous solubility

- shape of solute molecules
- substituents etc..

### SHAPE:

As branching increases the solubility of solute increases.

### SUBSTITUENTS:

Nature, position of Hydrophilic, hydrophobic groups influence solubility

Parameters which determine solubility are

4 parameters which determine solubility are

- Degree of ionization
- Molecular size
- Interactions of substituents groups with solvent
- Crystal properties of solute



# References

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