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# منصة ادرينالين التعليمية

جامعة الازهر

## Physical Question

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### Physical Pharmacy

• It is a science studying the Physical phenomena, Physicochemical Principles that involved in Pharmacy sciences.

### Saturated solution

It is solution containing the maximum amount of solute that solvent can dissolve at a definite temperature.

### Unsaturated solution

It is solution containing the dissolved solute in a concentration below that necessary for complete saturation at a definite temperature.

### Supersaturated solution

It is the solution containing more solute in the dissolved state than would normally be dissolved at a definite temperature.

**Solubility** can be defined as: The concentration of the substance in a saturated solution at a certain temperature (i.e. the amount of the substance which can be dissolved). It is also the spontaneous interaction of two or more substances to form a homogeneous dispersion.

**Miscibility** when the two components forming a solution are either both gases or liquids

### Importance of solubility in pharmacy

1. Pharmacist can choose the best solvent media for a drug or combination of drugs.
2. He can overcome certain difficulties that arise in the preparation of solution
3. Solubility data serve as standard test for purity
4. Solubility gives information about the structure and intermolecular forces of a drug

| Description Forms (Solubility Definition) | Parts of Solvent Required for One Part of Solute |
|---|--|
| Very soluble                              | Less than 1                                      |
| Freely soluble                            | From 1 to 10                                     |
| Soluble                                   | From 10 to 30                                    |
| Sparingly soluble                         | From 30 to 100                                   |
| Slightly soluble                          | From 100 to 1000                                 |
| Very slightly soluble                     | From 1000 to 10,000                              |
| Practically insoluble                     | More than 10,000                                 |

### Classification of solvents according to their polarity

#### 1) polar solvents

Polar solvents dissolve ionic solutes and other polar substances. Accordingly, water mixes in all proportions with alcohol and dissolves sugars.

#### 2) non-polar solvents

Nonpolar solvents are unable to reduce the attraction between the ions of strong and weak electrolytes. oils and fats dissolve in carbon tetrachloride, benzene, and mineral oil.

#### 3) Semi-polar solvents

a) Semi-polar solvents can induce a certain degree of polarity in non-polar solvent molecule. For example, benzene becomes soluble in alcohol.

b) Semi-polar compounds may act as an intermediate solvent to bring about miscibility of polar and nonpolar liquids.

Accordingly,  
1- acetone increases the solubility of ether in water  
2- Propylene glycol has been shown to increase the mutual solubility of water and peppermint oil and water and benzyl benzoate.

## Polar Solvents

Polar solvents dissolve ionic solutes and polar substances.

### The solubility of a drug in polar solvent depends on:

1. The polarity of the solute and the solvent
2. The ability of the solute to form hydrogen bonds.
3. The ratio of polar to nonpolar groups of the molecule

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## Polar Solvents

### 1. The polarity of the solute and the solvent

Polar solvent ( water, methyl alcohol and ethyl alcohol) dissolve ionic solutes and other polar substance.

### 2. The ability of the solute to form hydrogen bonds.

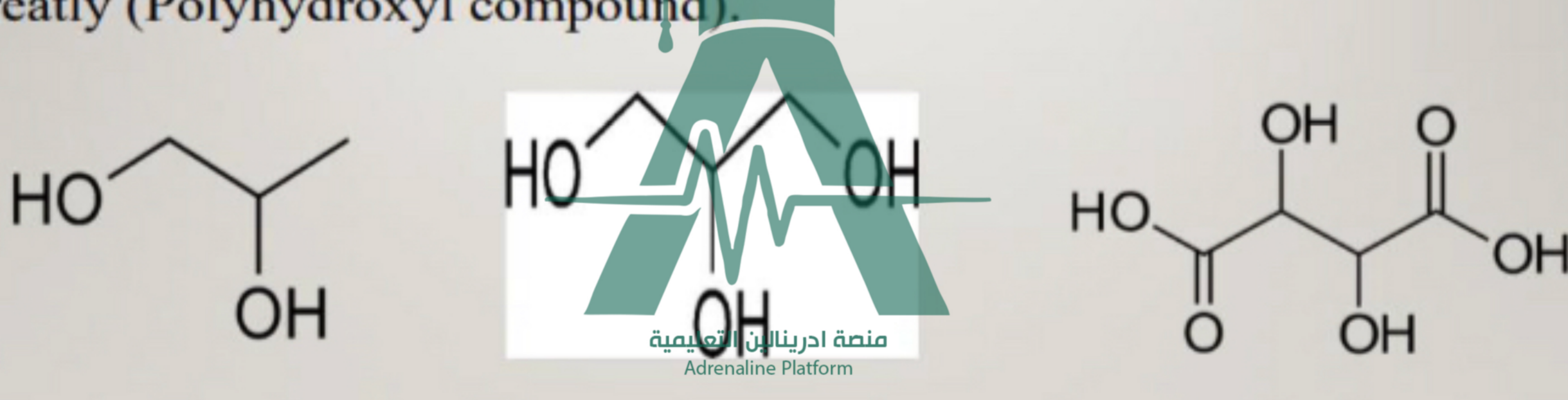
Water dissolves phenols, alcohols, aldehydes, ketones, amines, and other oxygen- and nitrogen-containing compounds that can form hydrogen bonds with water.

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✓ As the length of a nonpolar chain of an aliphatic alcohol increases, the solubility in water decreases (e.g. Straight chain monohydroxy alcohols, aldehydes, and acids with more than 4 carbons cannot enter into the hydrogen-bonded structure of water and hence are slightly soluble).

### 3. The ratio of polar to nonpolar groups of the molecule

When additional polar groups are present in the molecule (e.g. propylene glycol, glycerin, and tartaric acid), water solubility increases greatly (Polyhydroxyl compound).



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### Branching of the carbon chain reduces the nonpolar effect and leads to increased water solubility

(e.g. Tertiary butyl alcohol is miscible in all proportions with water, whereas n-butyl alcohol dissolves only to a small extent).



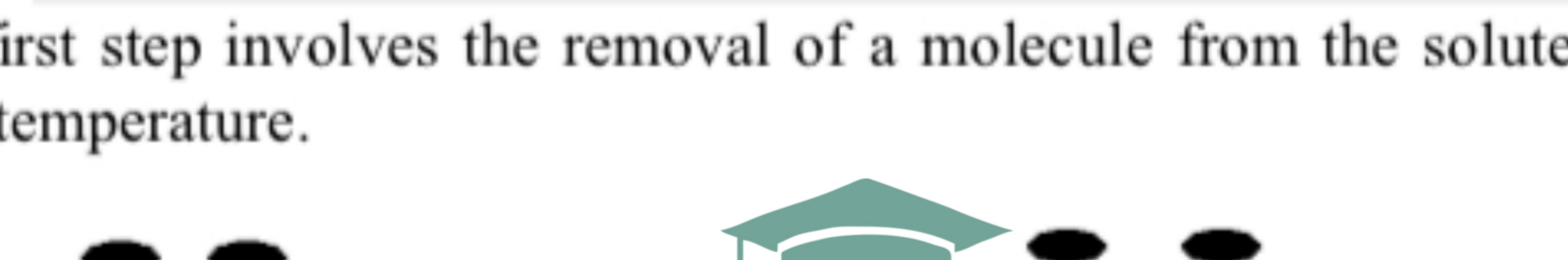
## Non-polar Solvents

Non polar solvents dissolve non polar solutes with similar attractive forces through induced dipole interactions (London forces) (e.g. CCl4 can dissolve oils and fats).

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## Solubility steps

a) The first step involves the removal of a molecule from the solute phase at a definite temperature.



b) The second step involves the creation of a hole in the solvent just large enough to accept the solute molecule.



c) The solute molecule is finally placed in the hole in the solvent.

