

Solute



Solvent

# SOLUBILITY

# Definition

Solution	A system in which molecules of a solute are dissolved in a solvent vehicle
Solubility	The concentration of solute in a saturated solution at a certain temperature and pressure
Saturated Solution	A solution contains a solute at the limit of its solubility at any given temperature and pressure
Sub-saturated Solution	A solution containing the dissolved solute in a concentration below that necessary for complete saturation
Supersaturated Solution	A Solution containing the dissolved solute above its normal solubility limit

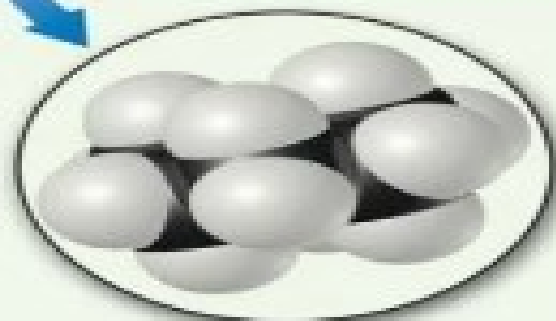
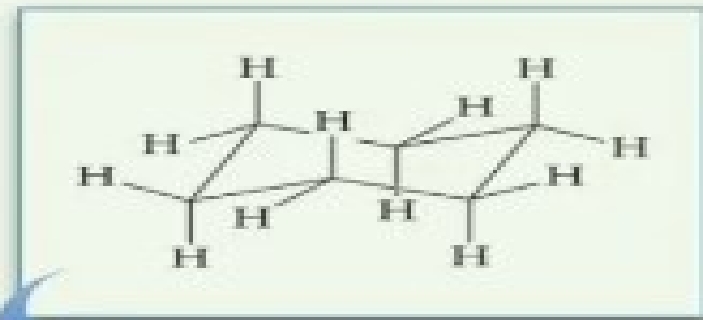
# Factors Affecting Solubility

- The stronger the attraction between solute and solvent molecules, the greater the solubility.
- ***Like dissolves like*** (the substances have similar intermolecular attractive forces.)
- Polar substances tend to dissolve in polar solvents. Non-polar substances do not dissolve in polar solvents.

# Factors Affecting Solubility

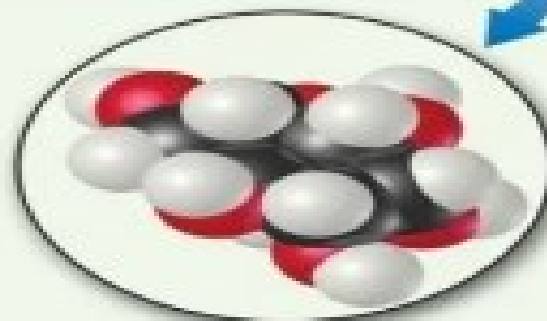
## HYDROGEN BONDING AND AQUEOUS SOLUBILITY

*The presence of OH groups capable of hydrogen bonding with water enhances the aqueous solubility of organic molecules.*



Cyclohexane,  $C_6H_{12}$ , has no polar OH groups

Cyclohexane is essentially insoluble in water.



Glucose,  $C_6H_{12}O_6$ , has five OH groups

Glucose is highly soluble in water.

Glucose (which has hydrogen bonding) is very soluble in water, while cyclohexane (which only has dispersion forces) is not.

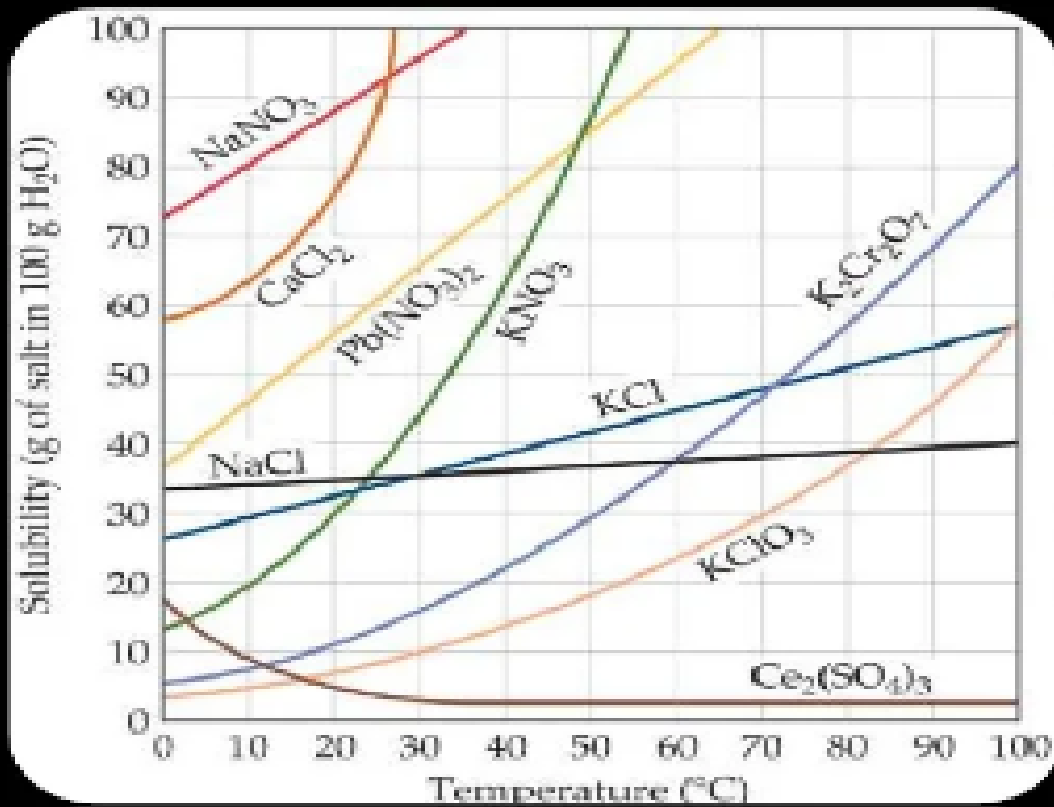
# LABORATORY ACTIVITY 2.8

## FACTORS SOLUBILITY

SOLVENT	WATER	KEROSENE	ACETONE	ALCOHOL
Oil	IMMISCIBLE	MISCIBLE	MISCIBLE	S/MISCIBLE

SOLVENT	NaCl	$C_{12}H_{22}O_{11}$	$C_{10}H_8$	$I_2$
Water	SOLUBLE	SOLUBLE	INSOLUBLE	INSOLUBLE

# Temperature



Generally, the solubility of **solid** solutes in liquid solvents increases with increasing temperature.

<b>SOLUTE</b>	<b>COLD WATER</b>	<b>HOT WATER</b>	<b>TIME TO DISSOLVE</b>
Salt	TAKES TIME TO DISSOLVE	EASILY DISSOLVED	
Sugar	TAKES TIME TO DISSOLVE	EASILY DISSOLVED	
$\text{KNO}_3$	TAKES TIME TO DISSOLVE	EASILY DISSOLVED	

# Molecular Size and Solubility

- Small molecules are often more soluble than larger molecules.

## LABORATORY ACTIVITY 2.8 FACTORS SOLUBILITY

SOLVENT	REFINED SALT	ROCK SALT
Water	EASILY DISSOLVED	TAKES TIME TO DISSOLVE

SOLVENT	REFINED $\text{KNO}_3$	$\text{KNO}_3$ CRYSTALS
Water	EASILY DISSOLVED	TAKES TIME TO DISSOLVE



# Effect of Stirring

- ✓ Stirring only increases the speed of the process - it increases the movement of the solvent that exposes solute, thus enabling solubility.
- ✓ As molecules in liquid substances are in constant move, the process would take place anyway, but it would take more time.

