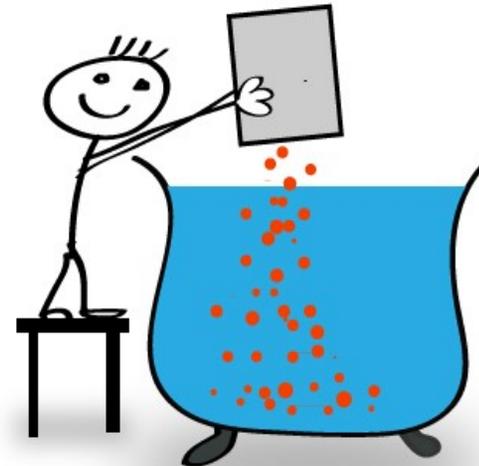


## DETERMINATION OF SOLUBILITY CLASS

Experiment :6

prepared by :

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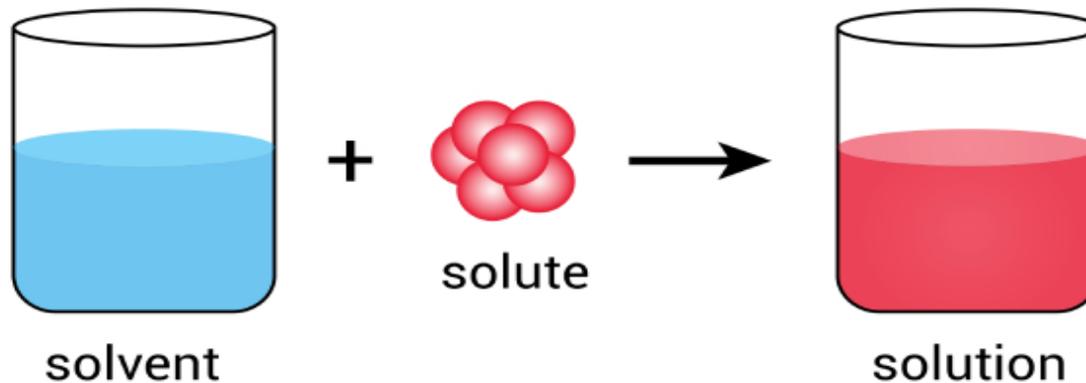
**SOLUBILITY**

# Introduction

**Solubility** : is the relative ability of a solute (can be a solid, liquid, or gas) that can be dissolved in a solvent (usually a liquid) and form a solution. .

▪ **The solubility of a substance depends on**

- The solvent used.
- Temperature.
- Pressure.



# Introduction

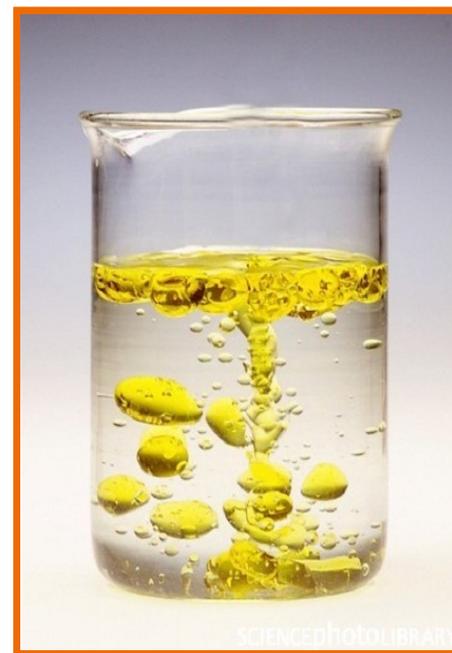
The degree of solubility ranges widely depending on the substances, from **soluble (fully miscible)**, such as ethanol in water, to **poorly soluble**, such as silver chloride in water.

The term “**insoluble**” is often applied to poorly soluble compounds.

- To predict whether a compound will be soluble in a given solvent, remember the saying,

**“Like dissolves like.”**

This means that polar solvents can only dissolve polar solutes, and nonpolar solvents can only dissolve nonpolar solutes.



## Introduction

■ Determining the solubility behavior of an unknown substance will yield three kinds of information.

■ **First, the presence of a functional group** .

For instance, because hydrocarbons are insoluble in water, the mere fact that an unknown is partially soluble in water indicates that a polar functional group is present.

**Second, solubility in certain solvents often leads to more specific information about the functional group present.**

For example, an unknown may be insoluble in water, but soluble in 5% sodium hydroxide solution indicating that an acidic functional group (like a carboxylic acid) is present.

## Introduction



**Third, information about molecular size and shape can often be obtained.**

For example, in homologous series of compounds, the members with fewer than five carbon atoms are water soluble, whereas the higher homologs are not. Additionally, in chain branching and positioning of functional groups toward the center of the molecule increases water solubility.

## Introduction

This is accomplished by testing the solubility of the compound in either of the following sets of solvents:

- 1- Distilled water solution.
- 2- Ether
- 3- 5% NaOH solution.
- 4- 5% NaHCO<sub>3</sub> solution.
- 5- 5% HCl solution.
- 6- cold concentrated H<sub>2</sub>SO<sub>4</sub>.

## Water

Because of its polarity and ability to form hydrogen bonds, water makes an excellent solvent, meaning that it can dissolve many different kinds of molecules.

## Introduction

### Ether:

is a non-polar solvent , Non-polar compounds are generally more soluble in ether because ethers do not have a hydrogen bonding network that would have to be broken up to dissolve the solute.

### 5% NaOH & 5% NaHCO<sub>3</sub>:

5% NaOH solution reacts with water insoluble compounds that are capable of donating protons such as strong and weak acids and it is called a detecting solvent.

5% NaHCO<sub>3</sub> solution is called a sub classifying solvent since it can react with strong acids only. That is, these two solvents give an idea about the acidity degree of the compound.

# Introduction

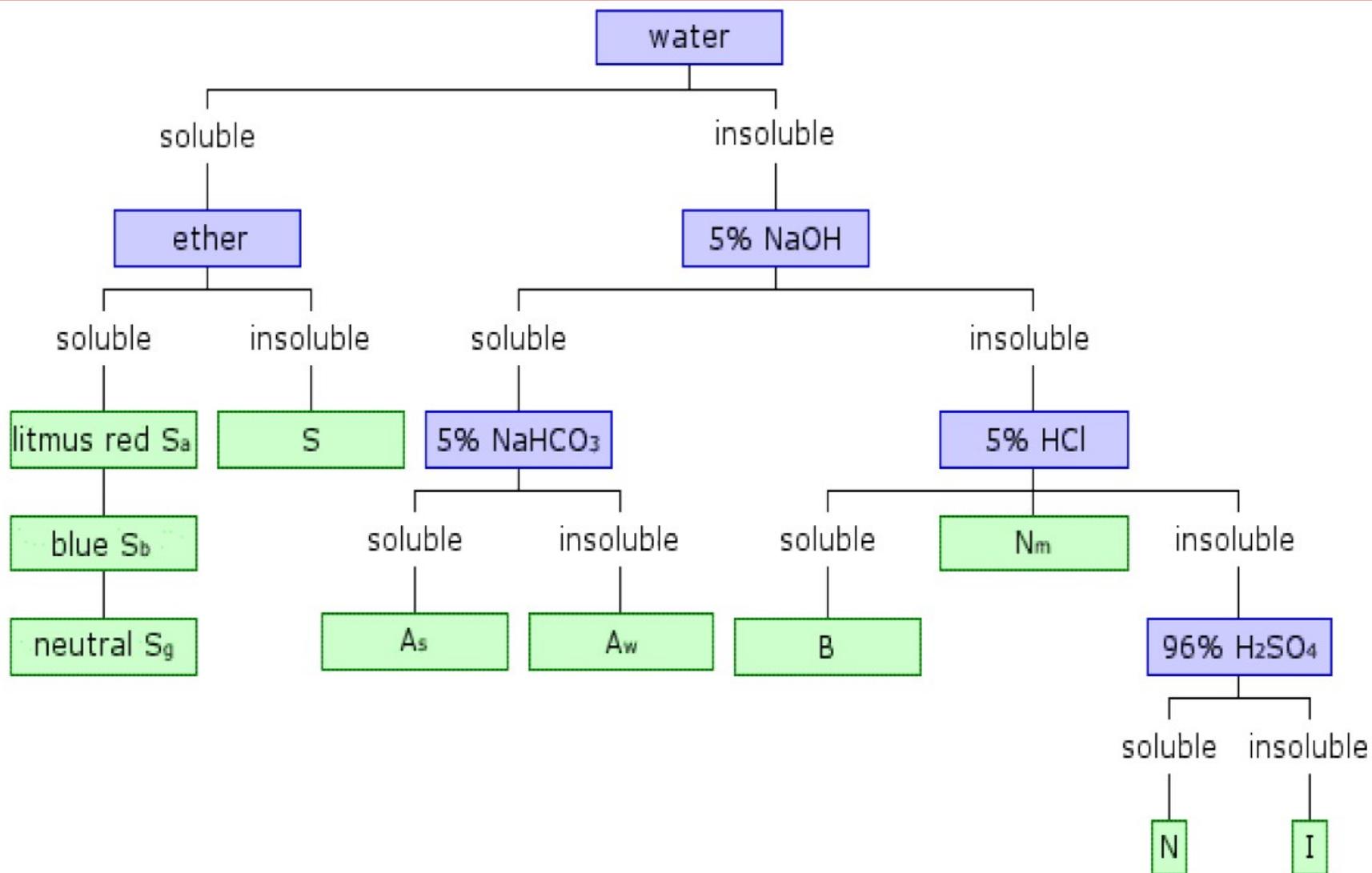
## HCl 5%

If the compound is insoluble in water and NaOH solution (and, hence, insoluble in  $\text{NaHCO}_3$  too), this means that the compound is not an acid but, rather, is either a basic compound or a neutral compound. 5% HCl solution, which can dissolve basic compounds.

## Cold concentrated $\text{H}_2\text{SO}_4$

If the compound is insoluble in water, NaOH, and HCl solution, solubility in cold con.  $\text{H}_2\text{SO}_4$  should be tested. If the compound is soluble in this acid that means includes neutral compounds such as aldehydes, ketones,

# Procedure



## Procedure

<b>Class</b>	<b>Functional Group Possibilities</b>
<b>Sa</b>	monofunctional carboxylic acids ( $\leq 5\text{C}$ ), arylsulfonic acids
<b>Sb</b>	monofunctional amines ( $\leq 6\text{C}$ )
<b>Sg</b>	Monofunctional alcohols, aldehydes, ketones, esters,
<b>S</b>	salts of organic acids, carbohydrates (sugars), polyhydroxy compounds, amine hydrochlorides.
<b>As</b>	carboxylic acids (high MW) phenols with electron-withdrawing groups in the ortho and/or para position(s);
<b>Aw</b>	phenols, thiophenols (high MW)
<b>B</b>	aliphatic amines (high MW)
<b>Nm</b>	neutral compounds containing N or S
<b>N</b>	alcohols, aldehydes, ketones (high MW)
<b>I</b>	Saturated hydrocarbons, haloalkanes, aryl halides, other deactivated aromatic compounds



Let's Start  
Experimenting

