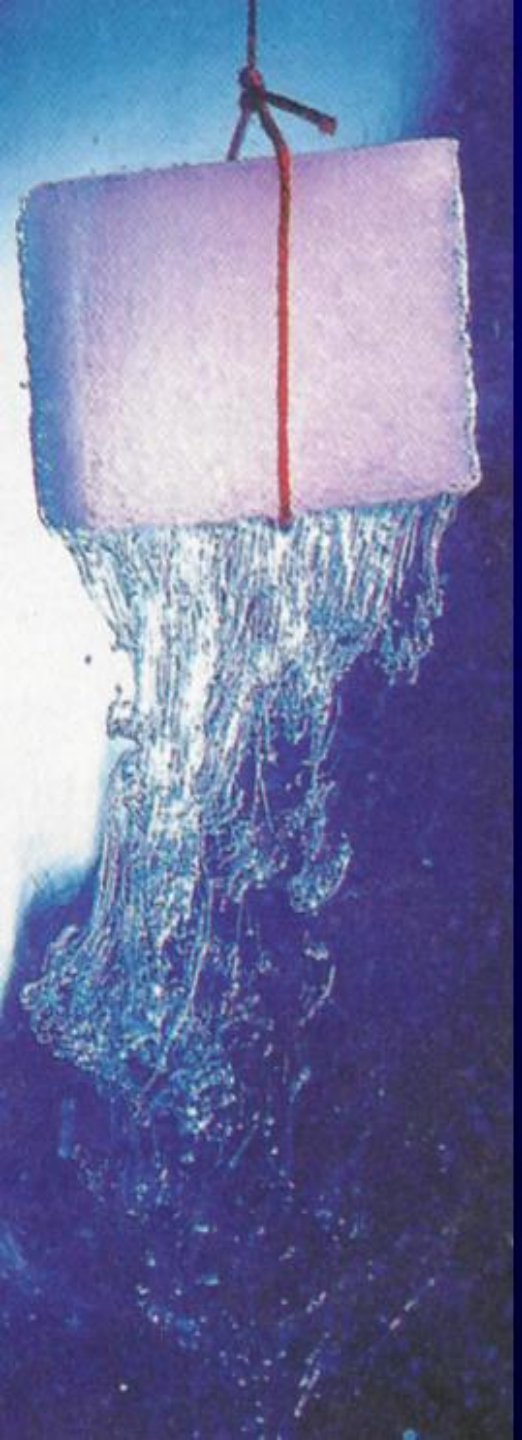
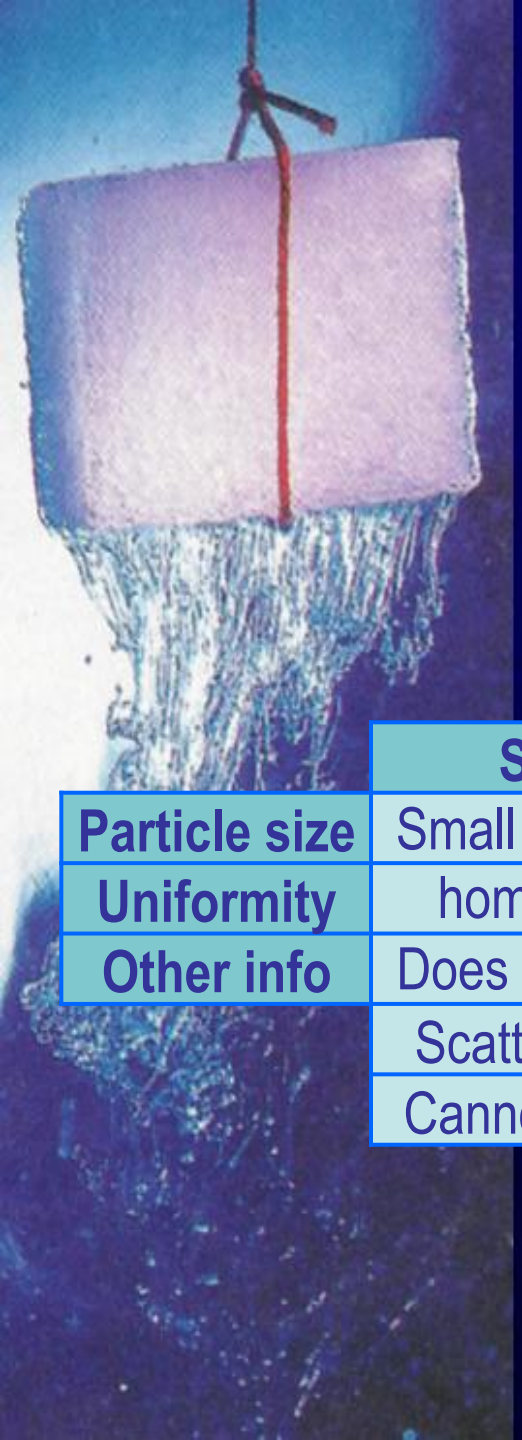


7.1: Solutions & Solubility

Remember:

- Have your **7.1 notesheet** ready!
- You can **pause** the video anytime.
- You can **rewind** the video anytime.
- Write down **questions/comments** as you go for discussion in class.

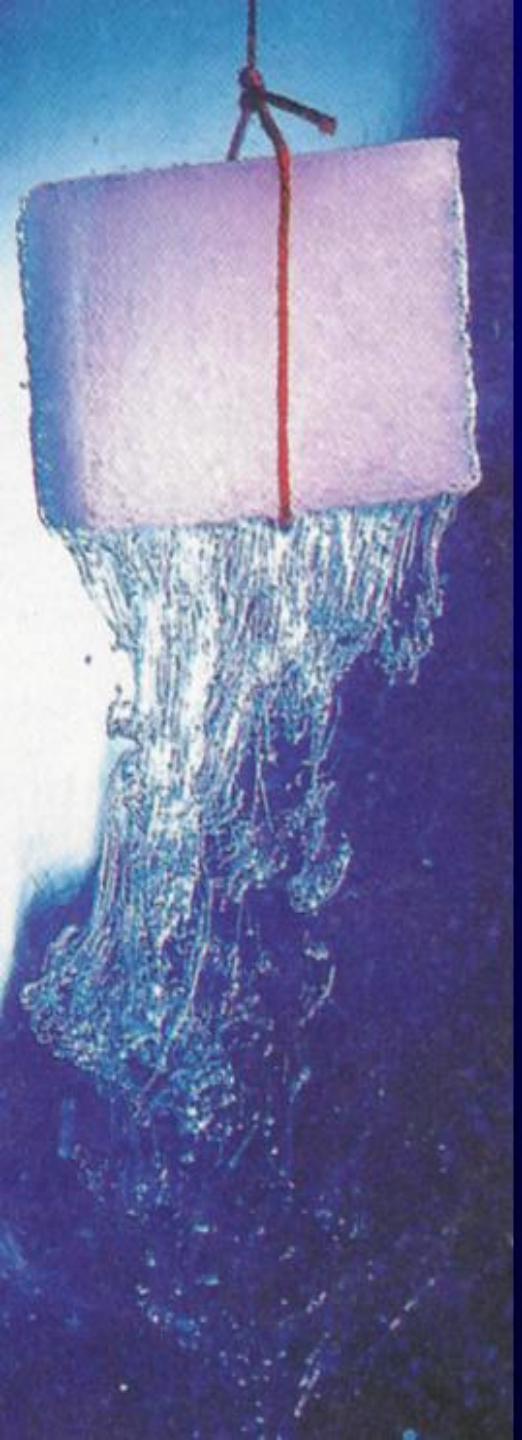
Are you ready???



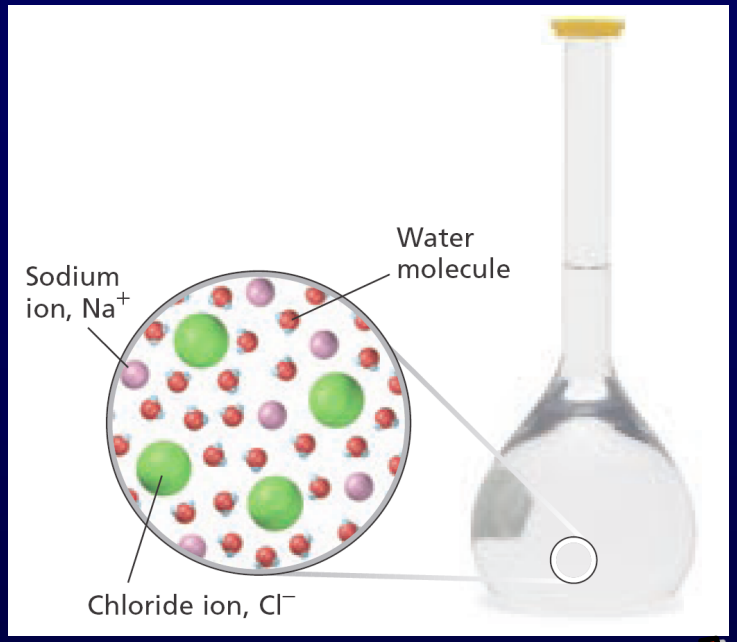
Part I: Solutions

- **Solutions** are composed of a solute and a solvent, mixed together (mixture).
  - **solute** = substance being dissolved
  - **solvent** = substance doing the dissolving (solutions in which water is the solvent = aqueous solutions)
- Types of **Mixtures**:
  - Can be any two phases (S, L, G) mixed together
  - Solute particle size determines type of mixture:

	Solution	Colloid	Suspension
Particle size	Small (0.01 – 1nm)	Medium (1 – 1000nm)	Large (1000nm or larger)
Uniformity	homogeneous	heterogeneous	heterogeneous
Other info	Does not separate	Does not separate	Separates over time
	Scatter light: no	Scatter light: yes	Scatter light: yes
	Cannot be filtered	Tyndall Effect	Can be filtered

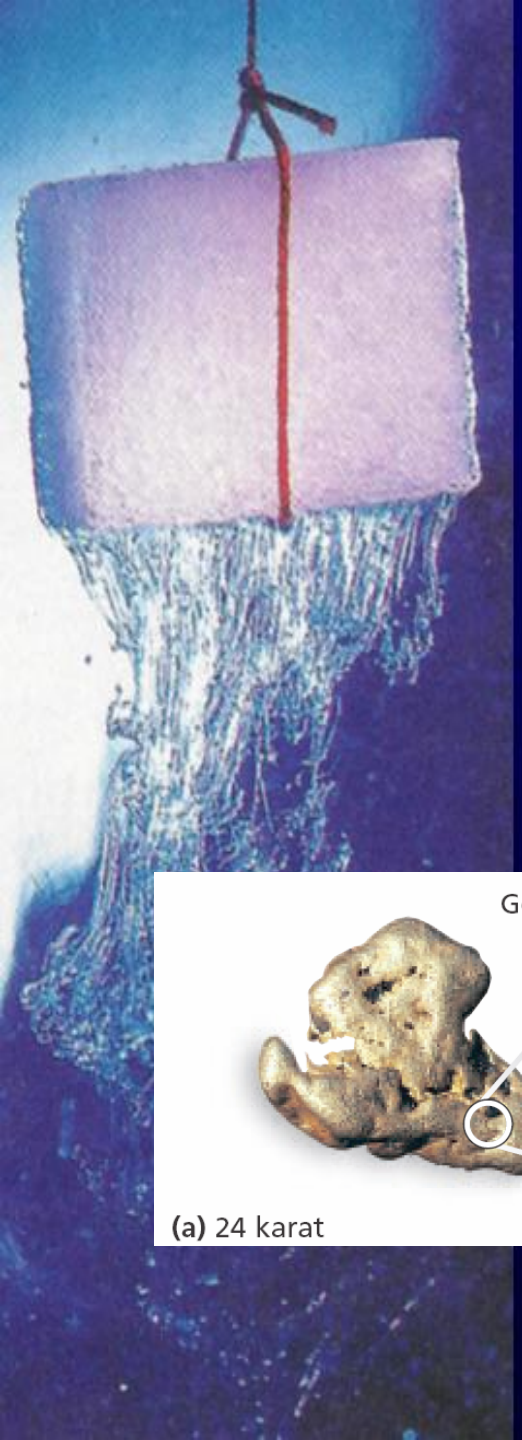


- **Homogeneous** = uniform composition throughout the solution

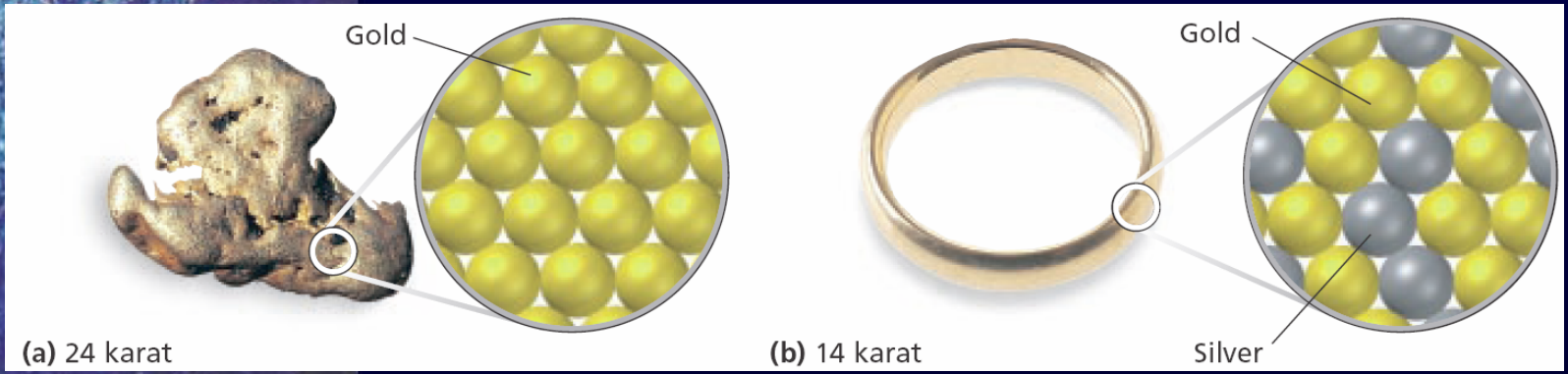


- **Heterogeneous** = non-uniform composition throughout the solution

- **Tyndall effect** = the scattering of light by a colloid's suspended particles.

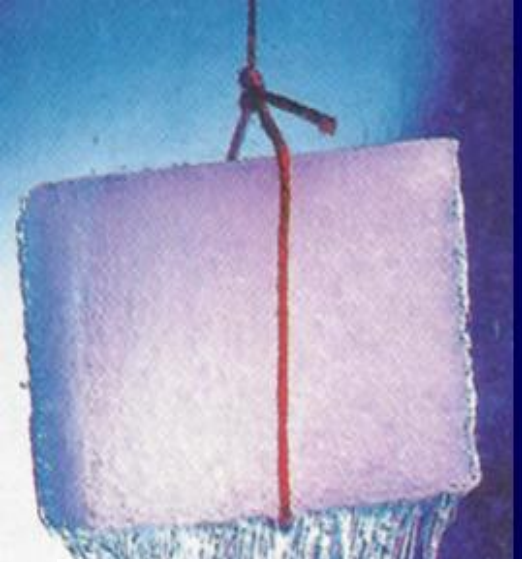


Solute state	Solvent state	Example
Gas	gas	oxygen in nitrogen
Gas	liquid	carbon dioxide in water
Liquid	gas	water in air
Liquid	liquid	alcohol in water
Liquid	solid	mercury in silver and tin (dental amalgam)
Solid	liquid	sugar in water
Solid	solid	copper in nickel (Monel™ alloy)

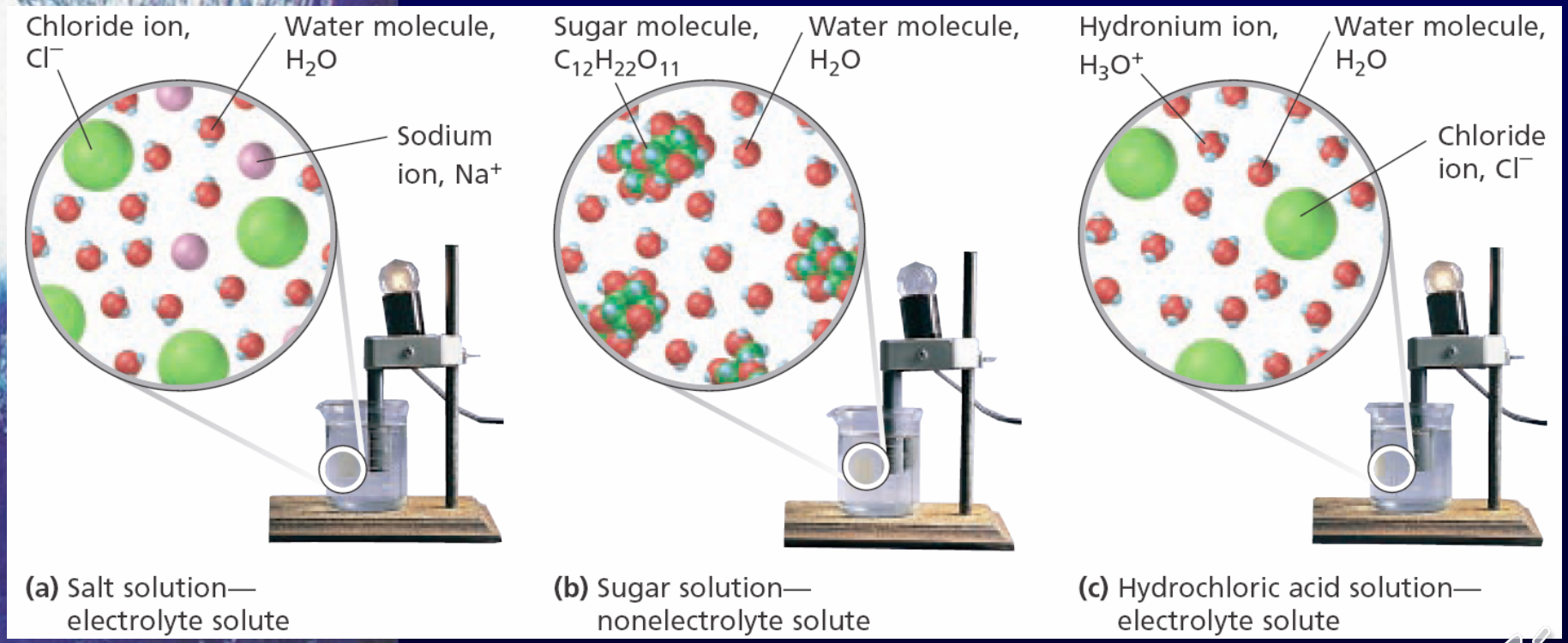


(a) 24 karat **(b)** 14 karat

Class of colloid	Phases	Example
Sol	solid dispersed in liquid	paints, mud
Gel	solid network extending throughout liquid	gelatin
Liquid emulsion	liquid dispersed in a liquid	milk, mayonnaise
Foam	gas dispersed in liquid	shaving cream, whipped cream
Solid aerosol	solid dispersed in gas	smoke, airborne particulate matter, auto exhaust
Liquid aerosol	liquid dispersed in gas	fog, mist, clouds, aerosol spray
Solid emulsion	liquid dispersed in solid	cheese, butter



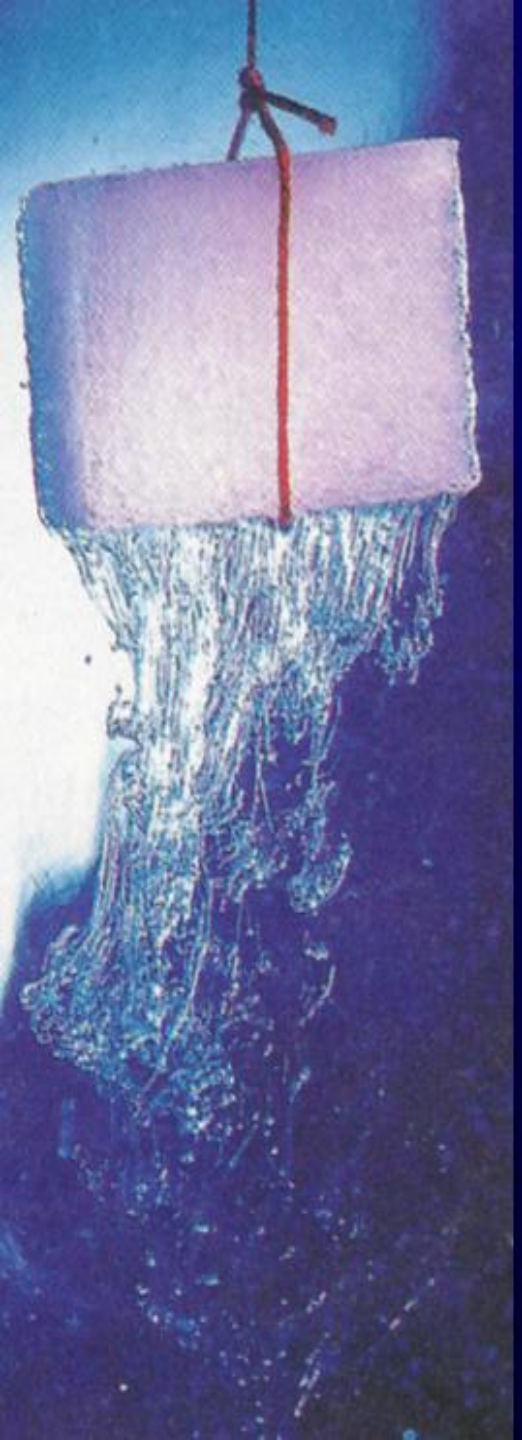
- Two types of solutes:
  - **electrolyte** = a solute that separates into charged particles (ions) that conduct electricity in an aqueous solution (saltwater)
  - **nonelectrolyte** = a solute that separates into particles that do not conduct electricity in an aqueous solution (sugar water)



(a) Salt solution—electrolyte solute

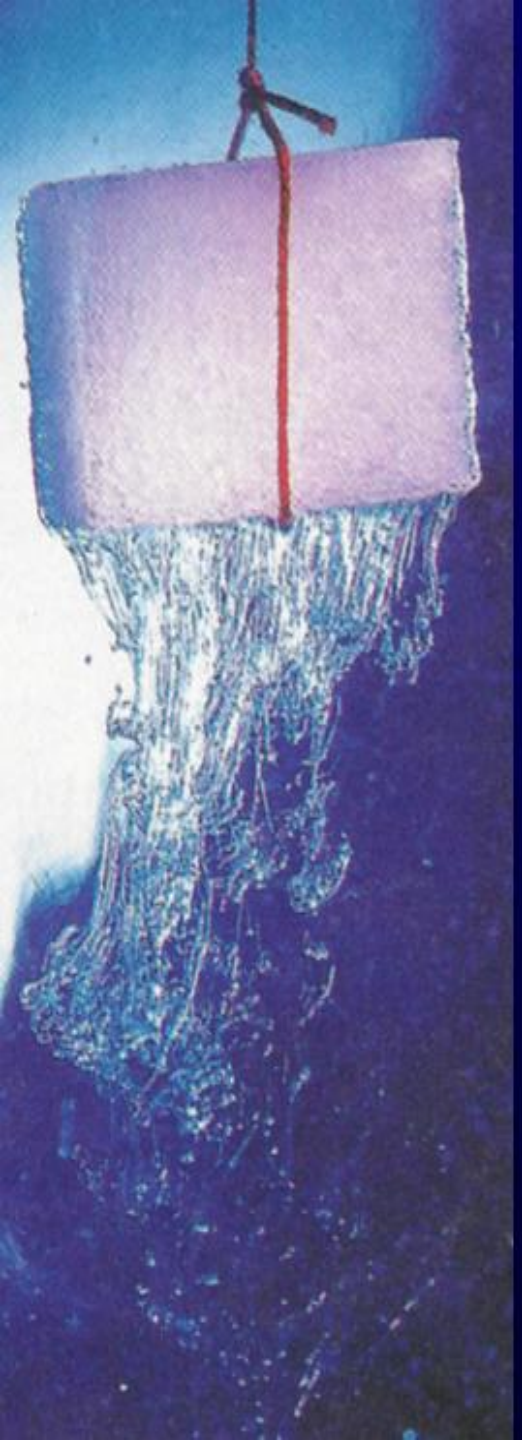
(b) Sugar solution—nonelectrolyte solute

(c) Hydrochloric acid solution—electrolyte solute



Part II: Solubility

- **Solubility** = the maximum quantity of a solute (in grams) that can be dissolved in a given amount of solvent (in grams) at a specified temperature.
- Factors that affect the **rate of dissolution** (make solute dissolve faster):
  - Increase the surface area of the solute (crush solute into small pieces)



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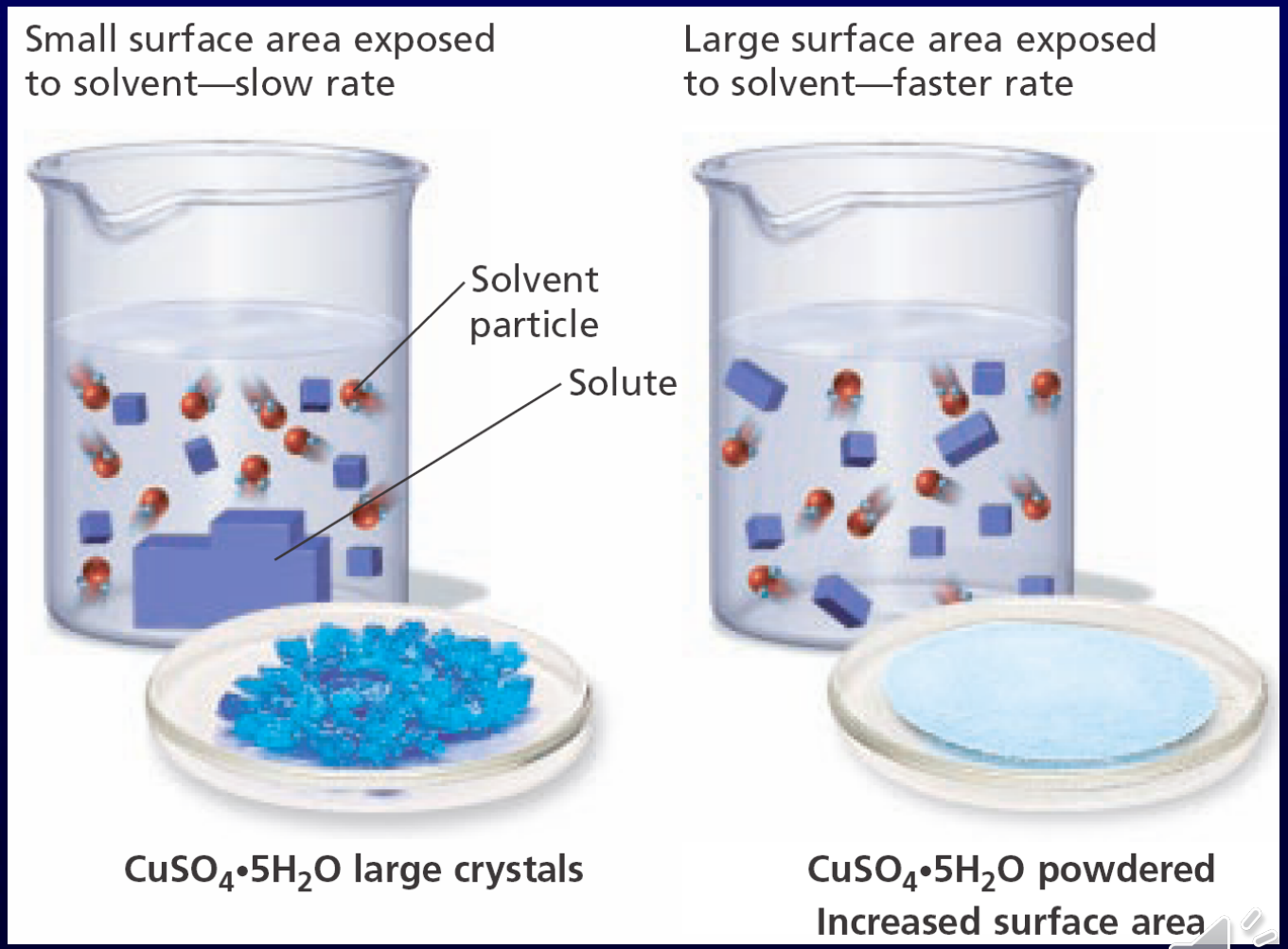
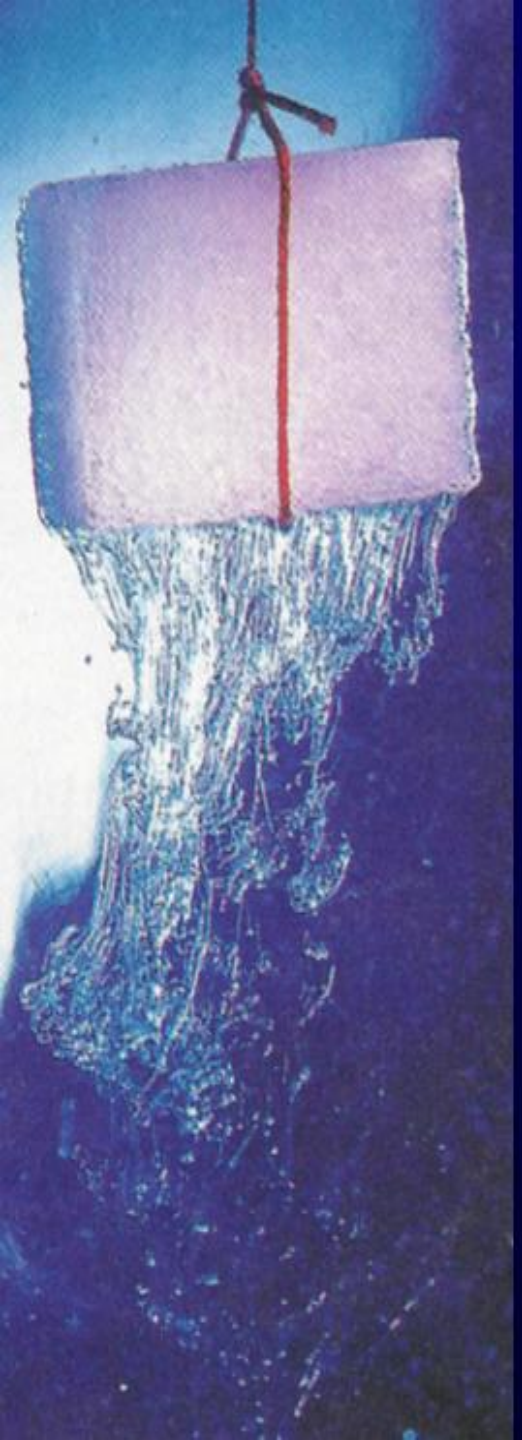
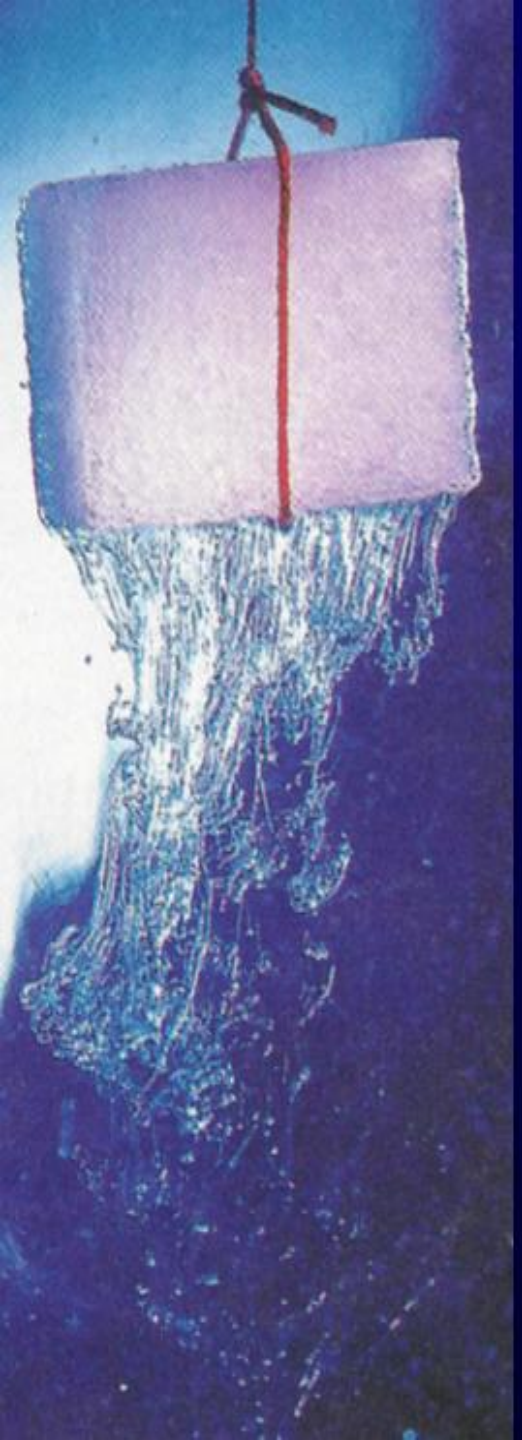
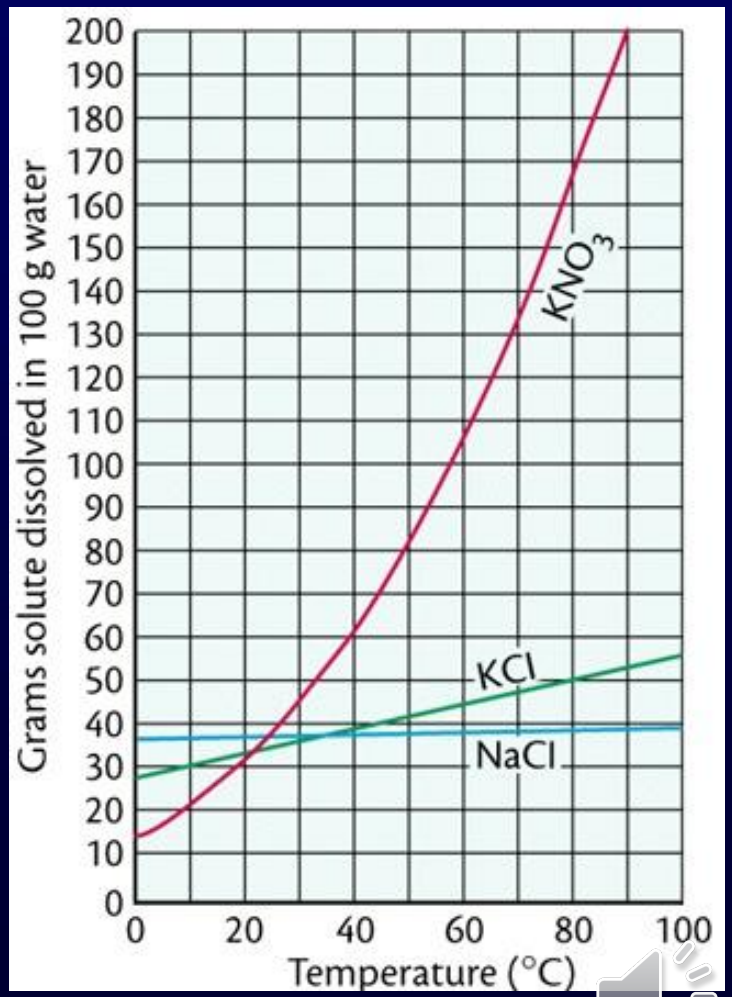


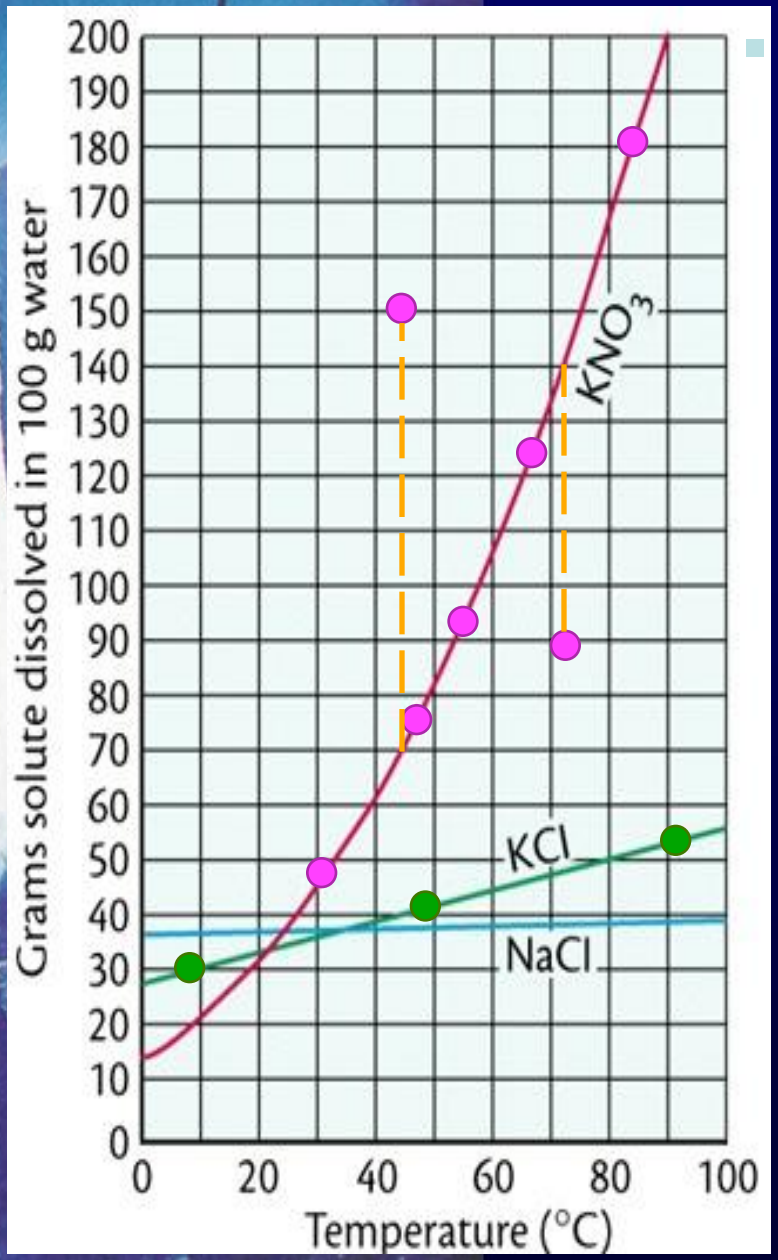


- Factors that affect the **rate of dissolution** (make solute dissolve faster):
  - Increase the surface area of the solute (crush solute into small pieces)
  - Agitate the solution (brings solvent into increased contact with solute)
  - Heating the solvent (increases KE of solute particles on surface)

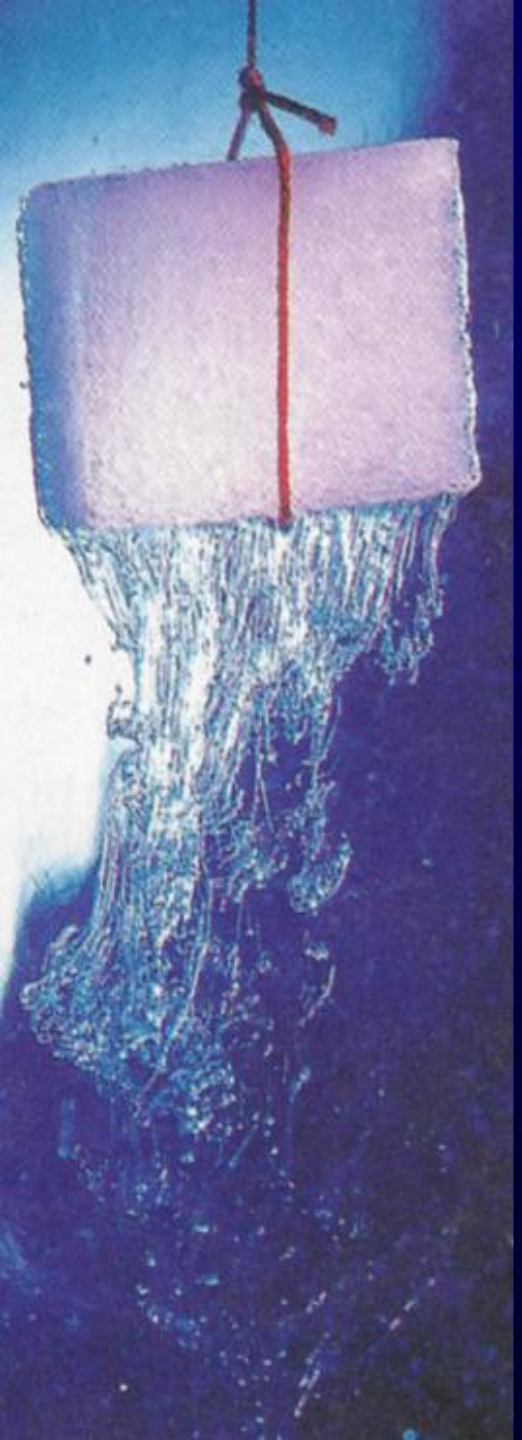


- Factors that affect a substance's **solubility**:
  - Amount of **solute** (in grams)
  - Amount of **solvent** (in grams)
  - Specified **temperature** (in °C)
- All 3 of these factors are shown on a **solubility curve**.
- A **solubility curve** shows the trend in solubility of a substance at a given temperature range

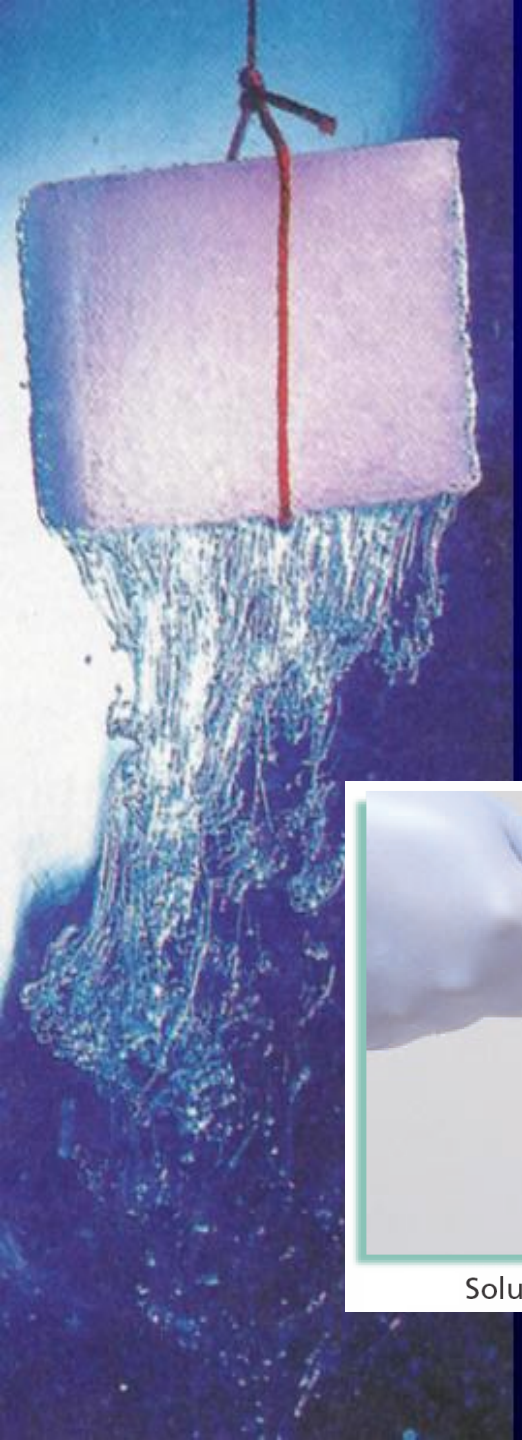




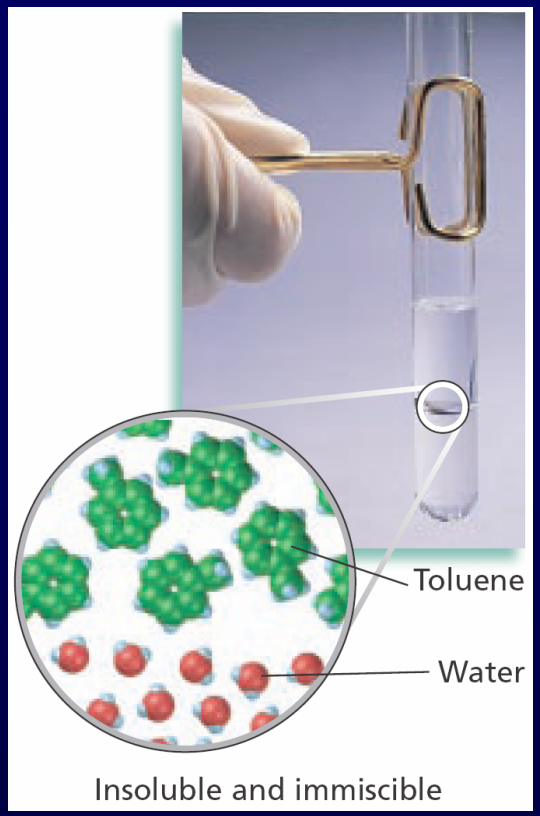
- Three types of solutions, in terms of solubility (see solubility curve):
  - Every point on the line itself represents a **saturated solution** (a solution in which the maximum amount of solute has been dissolved).
  - All points below the line represent an **unsaturated solution** (a solution in which an amount of solute less than the maximum amount has been dissolved).
  - All points above the line represent a **supersaturated solution** (a solution in which an amount of solute more than the maximum amount has been dissolved). These solutions can be agitated in order to get crystals of solute to form.



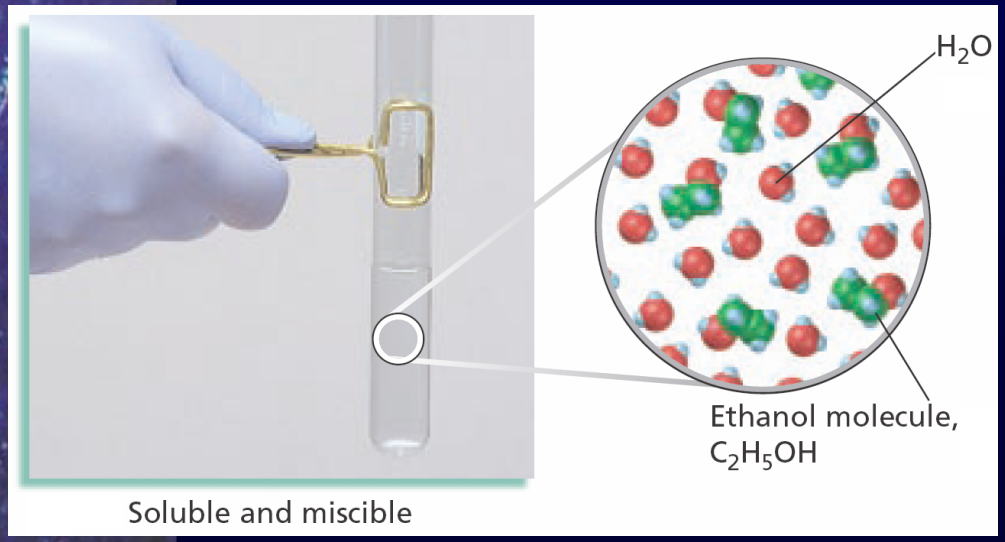
- "**Like dissolves like.**" = a phrase used to describe the dissolving capabilities of different types of substances.
  - **Polar** substances (like water) **dissolve** other **polar** substances (like ionic compounds = LiCl, etc.)



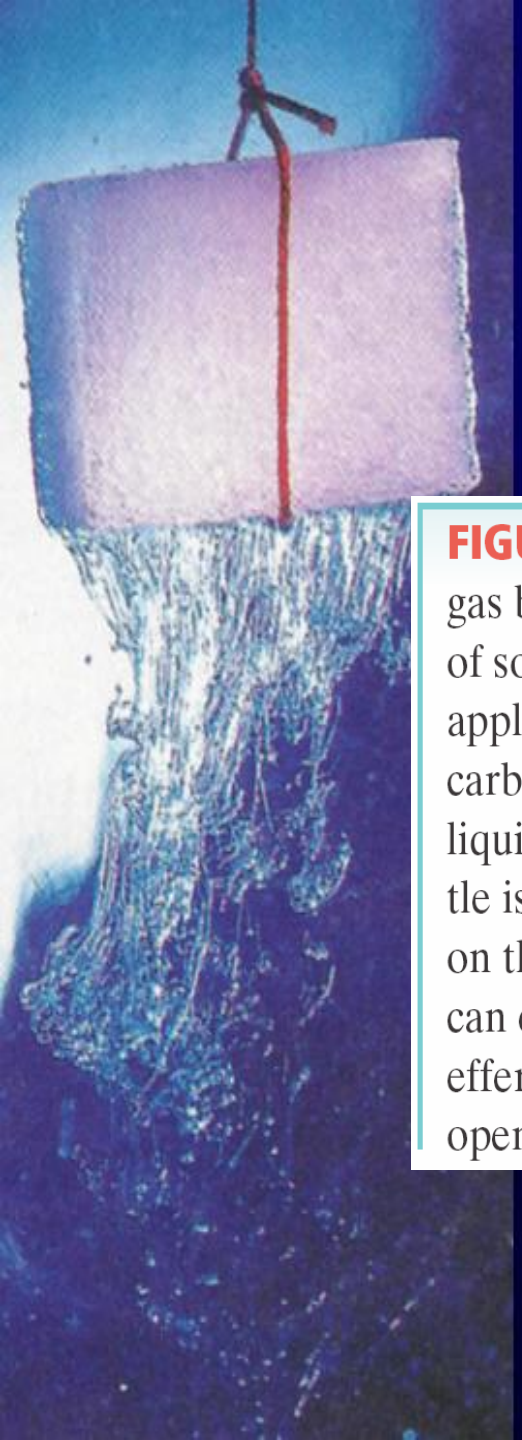
- **Miscibility** = the ability to dissolve in another substance
  - Solutes and solvents that are **not** soluble in each other (they **don't** mix) are called "**immiscible**."
  - Solutes and solvents that **are** soluble in each other (they mix) are called "**miscible**."



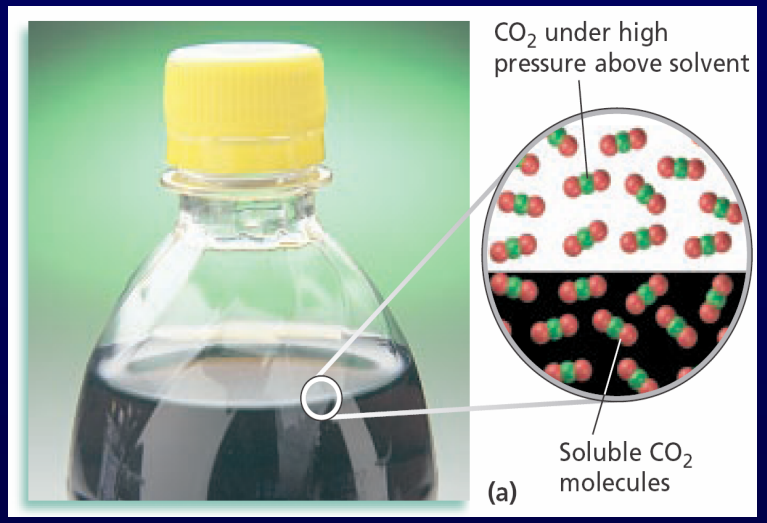
Insoluble and immiscible



Soluble and miscible



- For **gases**, **pressure** is also a factor in solubility. Higher pressure = higher amount of solubility (think soda bottles). *"The solubility of a gas in a liquid is directly proportional to the partial pressure of that gas on the surface of the liquid."* = **Henry's Law**



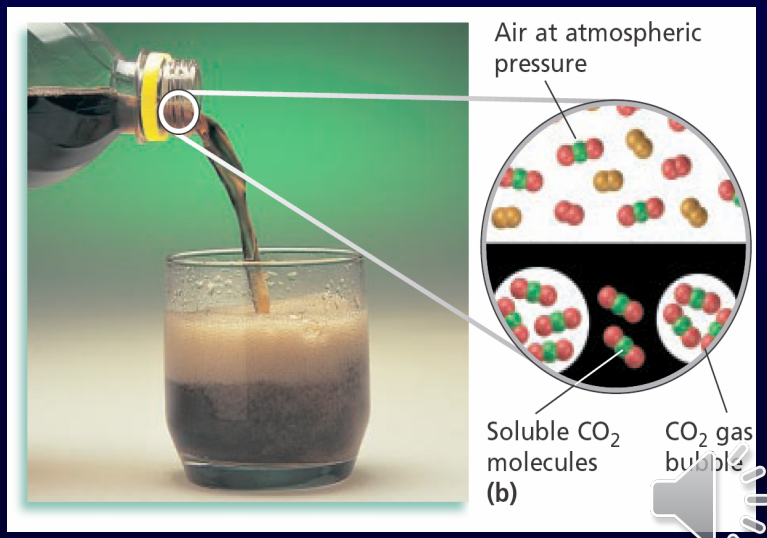
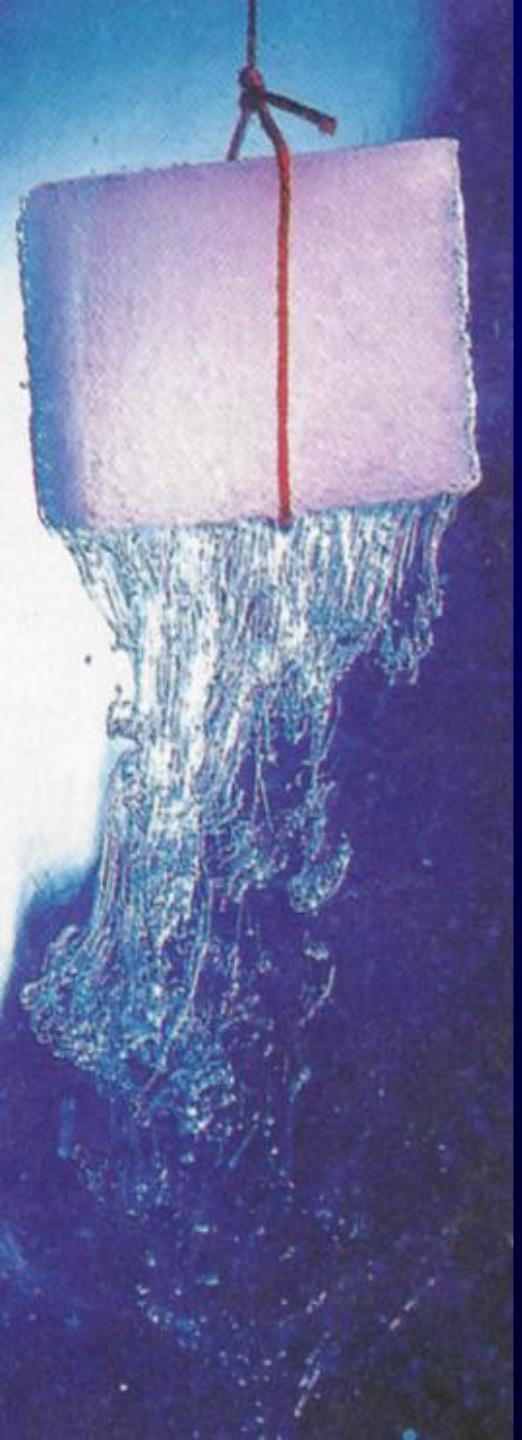


FIGURE 13-13 (a) There are no gas bubbles in the unopened bottle of soda because the pressure of CO_2 applied during bottling keeps the carbon dioxide gas dissolved in the liquid. (b) When the cap on the bottle is removed, the pressure of CO_2 on the liquid is reduced, and CO_2 can escape from the liquid. The soda effervesces when the bottle is opened and the pressure is reduced.



- Make sure notesheet is **completely filled in**
- Preview the **funsheet** (7.1)
- **Rewind and review** any parts that were not clear
- Bring both **notesheet** and **funsheet packets** to class