



Solution

A mixture in which a substance is dissolved in another substance.

Solution

- All solutions consist of 2 parts:

- Solute



- substance being dissolved
- substance present in the least amount
- Examples: Salt, Sugar, Kool-Aid

- Solvent



- substance doing the dissolving
- substance present in the most amount
- Example: Water – the universal solvent
(more later...)

Which is the solute and which is the solvent?

Substance present in the largest amount is generally the solvent.

NaCl (solute) + H₂O (solvent) = salt water

78% N₂ (solvent) + 21% O₂ (solute) + 1% Ar (solute) = air

**Must a
solution be
liquid?**

No... It can be a gas.



Air is a solution



Effervescence is the escape of a gas from a liquid solution.

It can be a solid.



Sterling silver is a solution of silver and copper.

Alloy

- a solution of two or more metals
 - Bronze-copper and tin
 - Brass-copper and zinc
 - Pewter-tin, copper and antimony
 - 12 carat gold (50% copper, 50% gold)
 - 14 carat gold (42% copper, 58% gold)
 - 22 carat gold (8% copper, 92% gold)
 - 24 carat gold (100% gold)

Three Classes of Solutions

■ Gaseous solutions

- Two or more gases mixed together
 - Used in SCUBA tanks, air we breathe

■ Solid solutions

- Two or more solids mixed together
 - When tin dissolves in copper to form bronze

■ Liquid solutions

- Gas, liquid or solid dissolved in a liquid
 - When salt is dissolved in water

Types of Liquid Solutions



Aqueous

- A solution with water as the solvent



Tincture

- A solution with alcohol as the solvent

Colloids & Suspensions

Colloids

- Tiny particles never settle out but scatter light.
- Evenly distributed throughout substance
- Can NOT be separated by filtering.
 - **Examples: Fog, Milk, Jell-O, Mayo**



Tyndall Effect-scattering of light by particles in a mixture

Suspensions

- Particles settle out upon standing
- Can be separated by filtering
 - **Examples: Oil & Vinegar Dressing, muddy water**



Insoluble

When a substance cannot be dissolved in a solvent...



Oil

+



water

=

don't mix

Therefore, oil is **INSOLUBLE** in water.

Dissolving Rate for Solid into Liquid

- Stirring-increases rate of dissolving by bringing fresh solvent into contact with more solute.



- Temperature-increasing temperature causes particles to speed up therefore more solvent bumps into solute breaking it down.



- Crushing-by crushing large molecules into smaller ones you increase the surface area. Larger surface area more solvent can come into contact with solute.



Dissolving Rate for Gas into Liquid

- Cool solvent and increase pressure of gas- allows gas to GO INTO solution.



- Stirring and shaking-causes gas to COME OUT of solution. More gas molecules exposed to surface and escape more freely.



Think of your Coke cola as it sits open it becomes flat because of getting warmer and losing gas.

Solubility

- The maximum number of grams of a substance that will dissolve in 100g of solvent at a certain temperature.

How much can be dissolved in



Solubility Value

- Tells how much can dissolve in a certain volume of water as long as the water is 25° C.
- You can use a solubility graph to determine the value.

Solution Concentration

- Refers to the amount of solute dissolved in a solvent
 - **Diluted** (less)
 - **Concentrated** (more)



5 grams of salt in 100 grams of water
dilute



VS



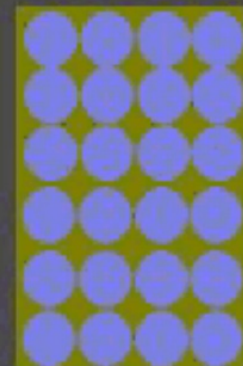
35 grams of salt in 100 grams of water
concentrated



Limits of Solubility

1. Saturated

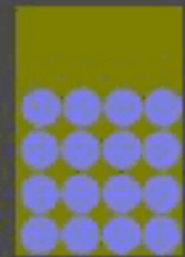
- Solution that has dissolved all the solute it normally can hold at a given temperature.
- If you heat a saturated solution it is possible to add more solute
- The point that no more solute can be added to the solvent



Limits of Solubility

2. Unsaturated

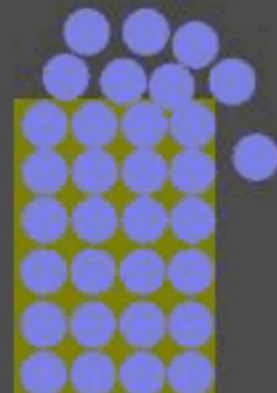
- Any solution that can dissolve more solute at a given temperature.
- This is not a precise term because it depends on the temperature-it may be considered saturated at one temperature but unsaturated at another.
- More solute can dissolve in the solvent



Limit of Solubility

3. Supersaturated

- More solute than a saturated one has at that temperature
- If you cool certain solutions with precaution you can keep the solute from falling out
- Very unstable
- Add one crystal to the supersaturated solution and the excess solute quickly crystallizes and falls out of solution.
- More solute than the solvent can handle.



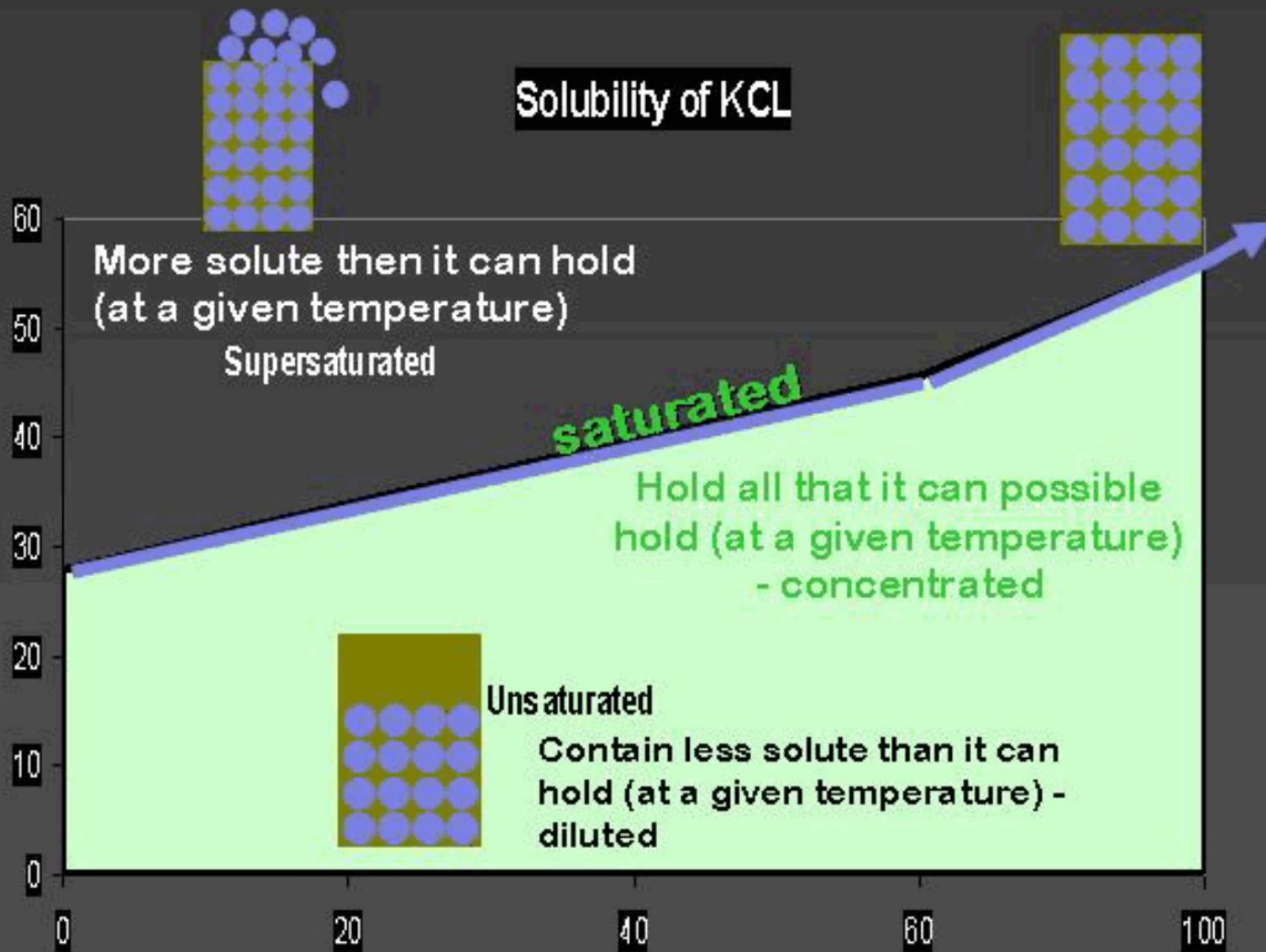
How to tell the difference

Add crystal to solution

1. Unsaturated= crystal dissolves
2. Saturated= crystal does not dissolve
3. Supersaturated=excess solute falls out

Solubility Graphs

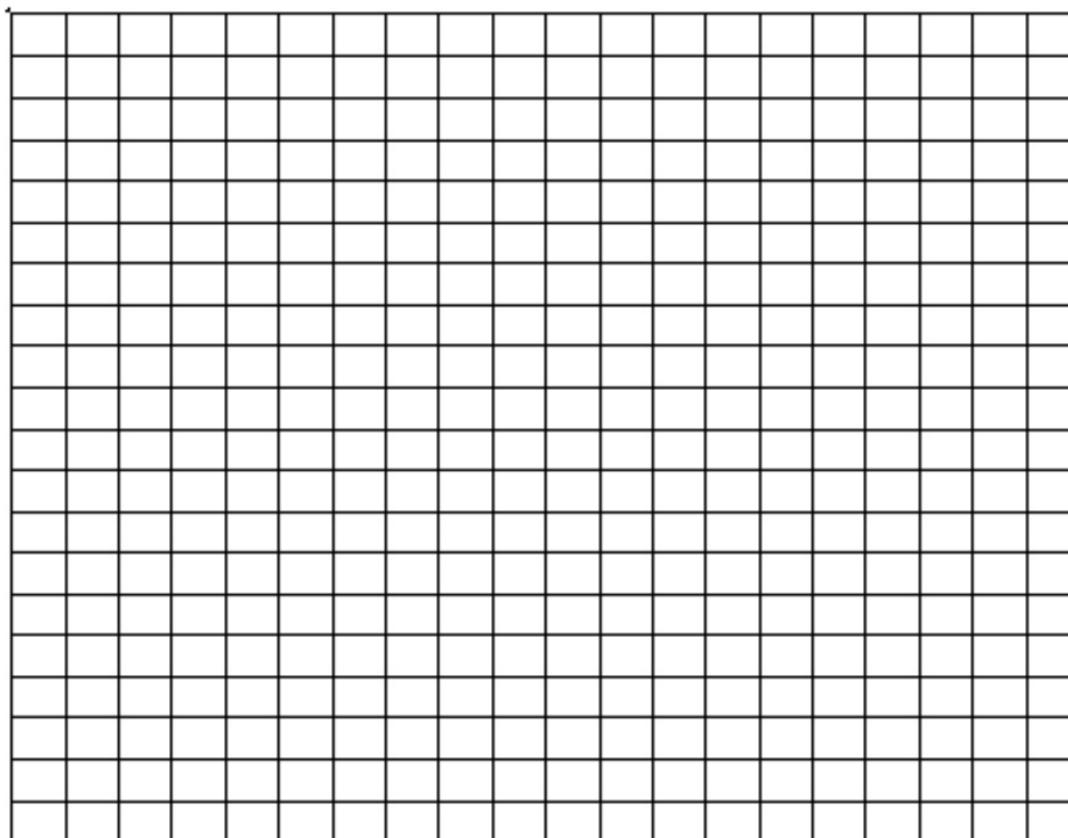
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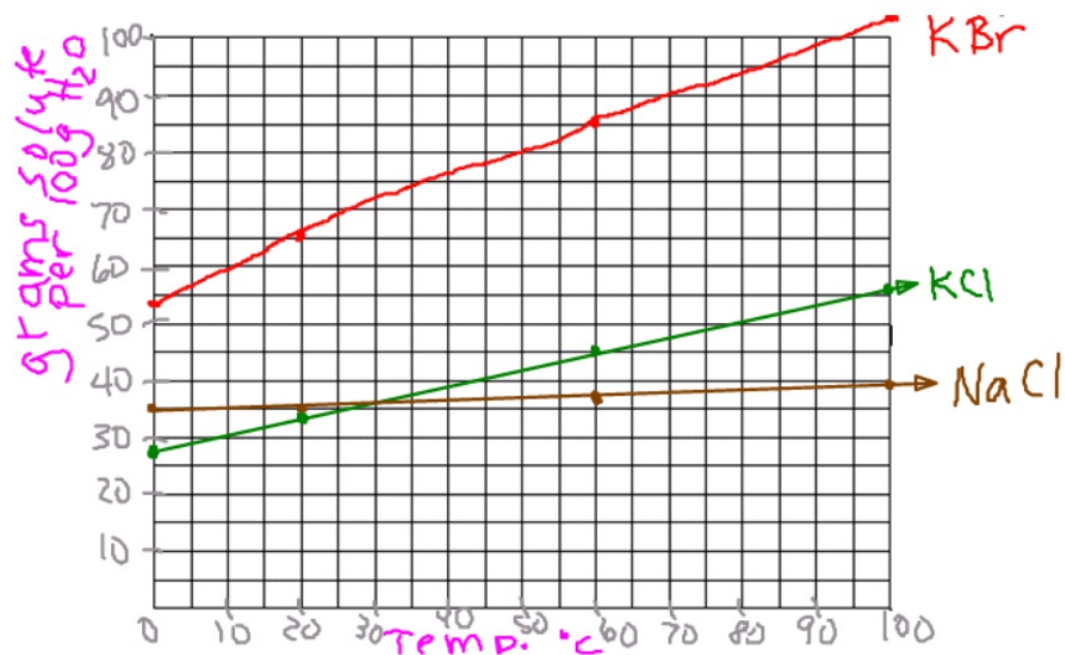


Independent Practice

Graph the solubility of these compounds in 100 grams water at various temperatures. Then answer the questions that follow.

| Compound | Formula | 0° | 20° | 60° | 100° |
|--------------------|---------|------|------|------|------|
| Potassium Chloride | KCl | 28.0 | 34.0 | 45.8 | 56.3 |
| Sodium Chloride | NaCl | 35.7 | 35.9 | 37.1 | 39.2 |
| Potassium Bromide | KBr | 53.6 | 65.3 | 85.5 | 104 |





1. How many grams of KCl need to be dissolved for a saturated solution at 50°C ?

42 g

2. If 82 grams of KBr are dissolved in 100 grams of water at 40°C, is this solution saturated, unsaturated or supersaturated?

Supersaturated

3. Which compound is the least soluble at 70°C ?

NaCl