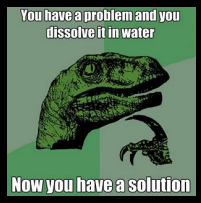
Solutions



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Terms

Solvent
Single substance that does the dissolving substance present in the largest amount

Solute
1 or more substance that is dissolved substance present in the lower amount

Solution
The result of dissolving the solute in a solvent

Solubility
Quantity of a solute that will dissolve at a fixed temperature
Typically expressed a grams solute/per 100 (mL or g)

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Terms

Saturated
Solution contains the maximum amount of solute
A dynamic equilibrium exists

Unsaturated
Solution contains less than the maximum amount of solute

Supersaturated
Solution contains more than the maximum amount of solute
Carefully prepared
Unstable

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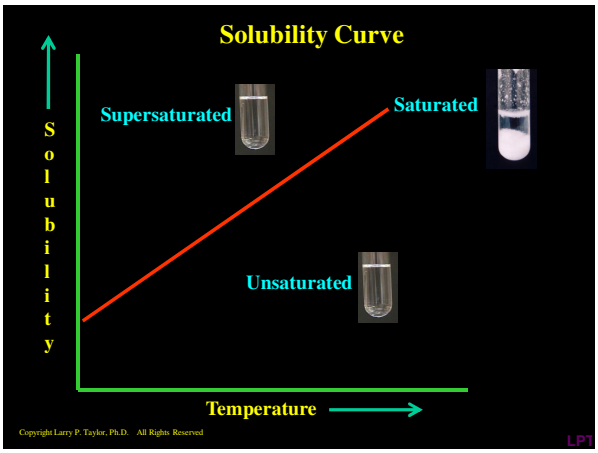
Solubility Curve
Supersaturated
Saturated
Unsaturated
Solubility
Temperature
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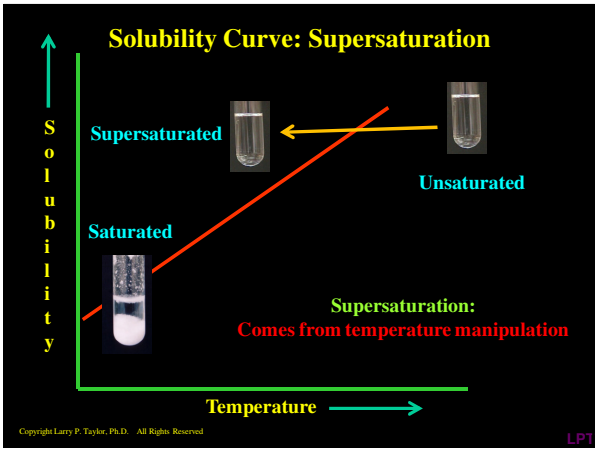
Solubility Curve: Supersaturation
Supersaturated
Unsaturated
Saturated
Supersaturation:
Comes from temperature manipulation
Solubility
Temperature
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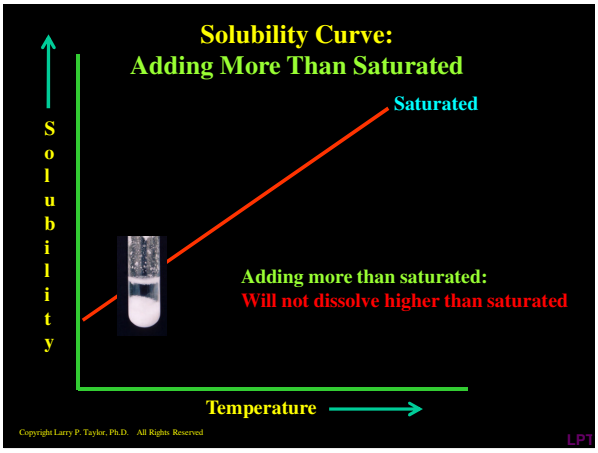
Solubility Curve:
Adding More Than Saturated
Saturated
Adding more than saturated:
Will not dissolve higher than saturated
Solubility
Temperature
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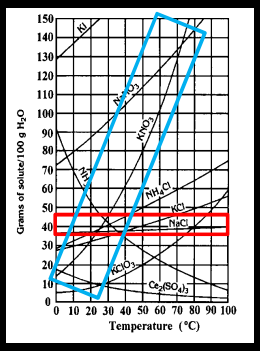
Solubility Curves



Plot of
Solubility vs. Temperature

For each compound (line):

Saturated
On the solubility line

Unsaturated
Below the line

Supersaturated
Above the line

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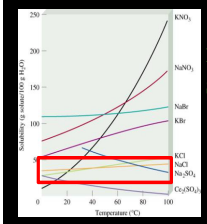
Solubility Curves



NaCl curve is "flat line"
Solubility does not change with temperature
Consider this:
Our nervous system is dependent on Na^+

If Na^+ solubility changed with temperature,
Our nervous systems would alter with temperature

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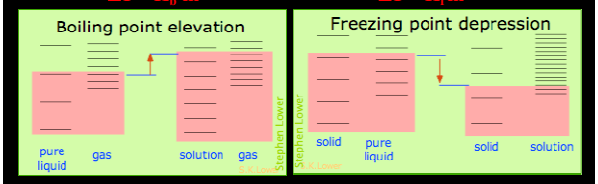
Solutions Alter Physical Properties
Dependent on Concentration of Solute

$\Delta T = K_b\, m$ $\Delta T = K_f m$



Adding salt to water:
Raises Boiling Point
Raises Cooking Temperature
(but not enough to be significant)

Adding salt to water:
Lowers Freezing Point
Keeps water on sidewalks liquid

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Mars
WATER ON MARS
It has been found
www.jacanaent.com
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chemists have all the solutions
Solutions Lab
You have a problem and you dissolve it in water
Now you have a solution
If You're Not Part Of The Solution Then You're Part Of The Precipitate
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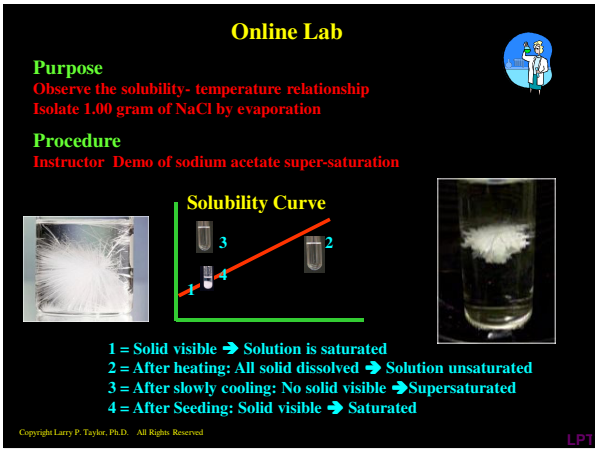
Online Lab
Purpose
Observe the solubility- temperature relationship
Isolate 1.00 gram of NaCl by evaporation
Procedure
Instructor Demo of sodium acetate super-saturation
Solubility Curve
3
2
4
1
1 = Solid visible → Solution is saturated
2 = After heating: All solid dissolved → Solution unsaturated
3 = After slowly cooling: No solid visible →Supersaturated
4 = After Seeding: Solid visible → Saturated
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Sodium Acetate Demo Photos




Ambient	~ 100 °C	After Cooling	After Seeding
White Solid Clear Liquid	No Solid Clear Liquid	No Solid Clear Liquid	White Solid Clear Liquid

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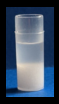
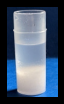
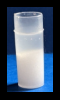
Solubility of NaCl & KNO_3

NaCl

Ambient ~ 100 °C After Cooling

KNO_3



Ambient ~ 100 °C After Cooling

Large or Small
Increase or Decrease in solubility
Less visible "stuff" ➔ greater the solubility

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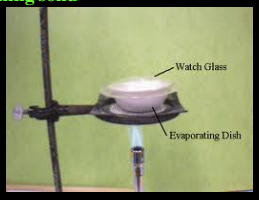
Isolate 1.00 g of NaCl From 2 M Solution

Calculate volume needed (See calculation slide)
Pour 2 M solution into evaporating dish
Cover with watch glass (limits spattering)
Remove water by heating with a Bunsen Burner
Weigh remaining solid



Hand On Set Up

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Volume of 2 M NaCl Solution Needed to Isolate 1.000 g NaCl

Determine Molecular Mass of NaCl

Na = 22.99
Cl = 35.45
58.44 g / mole

Dimensional analysis to solve for volume

$$1.000\ g\ NaCl \times \frac{1\ mole\ NaCl}{58.44\ g} \times \frac{1000\ mL}{2.000\ mol} = 8.560\ mL$$

The M means Moles per Liter or Moles per 1000 mL

Whenever you see M (Molarity), think moles / Liter or moles / 1000 mL

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Calculations

Mass of NaCl Solution:

Mass of evaporating dish , watch glass and NaCl Solution:
- Mass of evaporating dish and watch glass:
Mass of liquid:

Mass of NaCl Isolated:

Mass of evaporating dish , watch glass and NaCl Solid:
- Mass of evaporating dish and watch glass:
Mass of solid:

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Concentrations

% by Mass

$$\%\ (by\ mass) = \frac{grams\ \ solute}{grams\ solution} \times 100$$

Molarity

$$Molarity\ (M) = \frac{moles\ solute}{Liters\ solution}$$

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Yields

% Yield = $\frac{\text{Actual (Obtained in Experiment)}}{\text{Theoretical (Calculated Yield based on Stoichiometry)}}$ x 100

% Error = $\frac{\text{Actual Yield (g) - Theoretical Yield (g)}}{\text{Theoretical Yield (g)}}$ x 100

% Error should be small and negative

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Conclusion

Describe the solubility of NaCl when the temperature changes
Delete incorrect term
Compare the solubility change for KNO_3 to the NaCl

Describe % yield
Describe % error

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Let's Boldly Go Explore Today's Lab

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