

## 2. MEASURING SOLUBILITY

CH30S

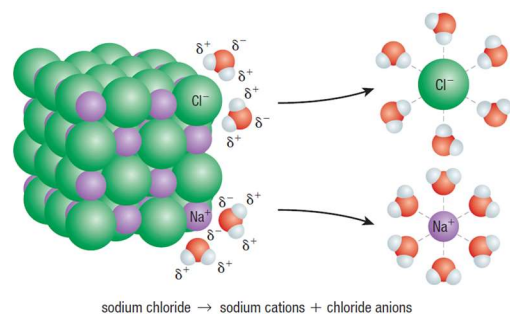
UNIT 3 - SOLUTIONS

WIEBE

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### REMEMBER...

- Previously, we described the solubility of a solute as being “highly soluble” & “low solubility”.
- Highly soluble compounds dissolve (dissociate) readily in water due to the polarity of the water molecules.
- The extent to which a compound dissolves in a solvent (i.e. water) is called the solubility of the solute.

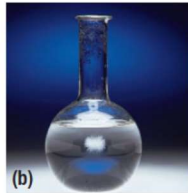
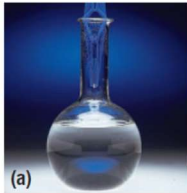


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## SOLUBILITY CAN BE DESCRIBED IN WORDS...

**saturated solution** a solution that contains the maximum quantity of solute at a given temperature and pressure

**unsaturated solution** a solution in which more solute can dissolve at a given temperature and pressure

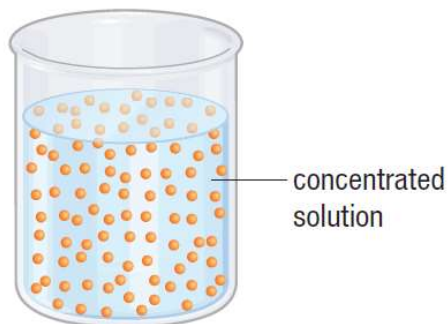


**supersaturated solution** a solution that contains more than the maximum quantity of solute that it should at a given temperature and pressure

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## SOLUBILITY CAN BE DESCRIBED USING NUMBERS...

The solubility of a solution is expressed as the mass of solute required to form a saturated solution in 100 g of water at a given temperature.



75 circles = 75 gram solute

200 mL water

@ 25°C

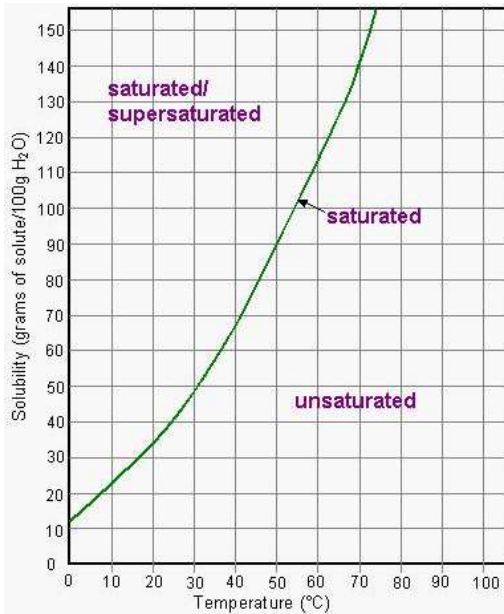
$$\text{Solubility} = \frac{\text{mass of solute (g)}}{\text{volume of water (ml)}} \times 100$$

$$\text{Solubility} = \frac{75 \text{ grams}}{200 \text{ mL}} \times 100$$

$$\text{Solubility} = 37.5 \text{ g/100 mL H}_2\text{O}$$

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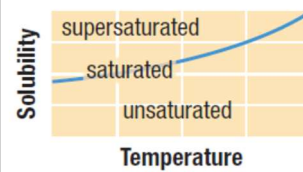
## SOLUBILITY DEPENDS ON TEMPERATURE



In the lab, you learned that **solubility is affected by temperature.**

### Interpreting Solubility Curves

Three labels define the different parts of the graph.

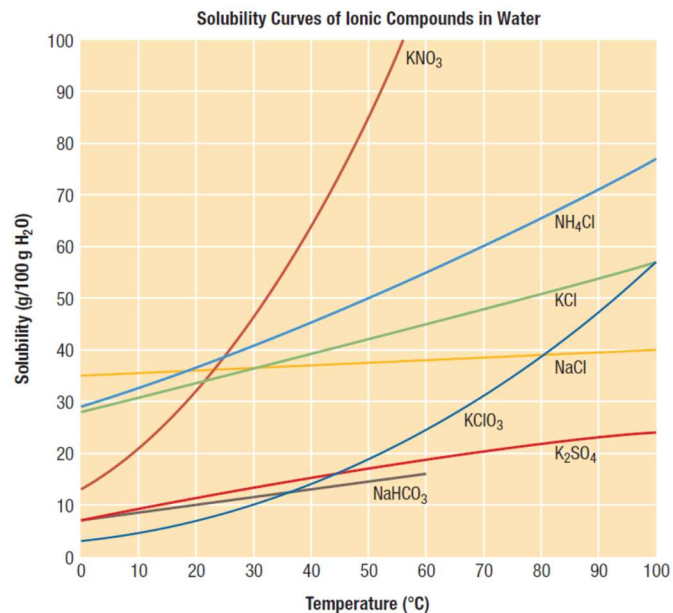


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## SOLUBILITY OF IONIC COMPOUNDS

The solubility of solid ionic compounds always increases with temperature.

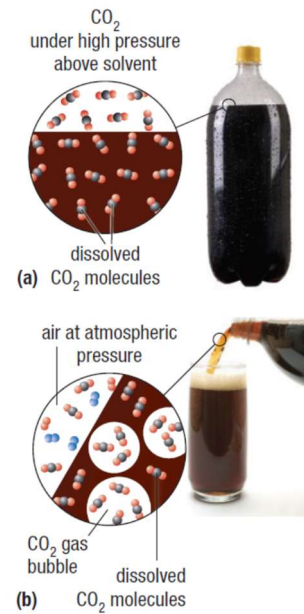
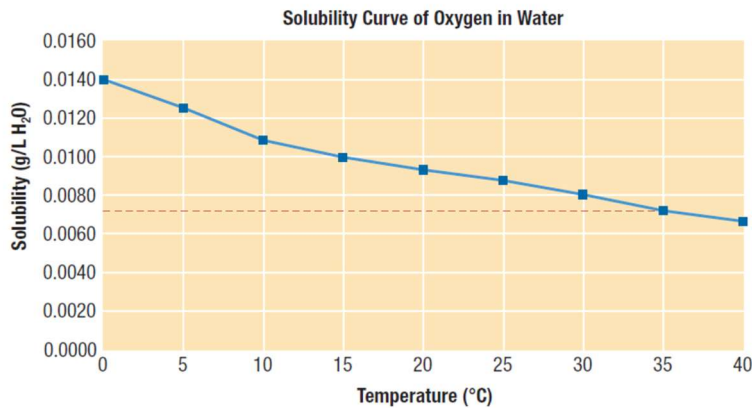
Some solutes are affected by temperature more than others, resulting in different "curves".



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## SOLUBILITY OF GASES

The solubility of gases tends to increase at low temperatures (opposite of solids) and high pressures.

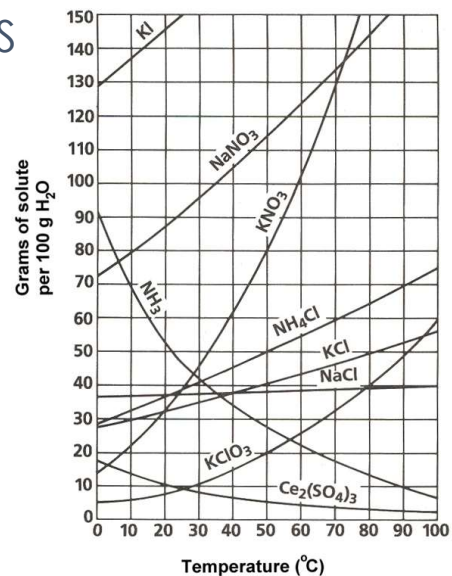


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## ANALYZING SOLUBILITY CURVES

What is the **solubility** of each of the following substances at the given temperature:

1. Sodium nitrate @ 10°C
2. Sodium nitrate @ 40°C

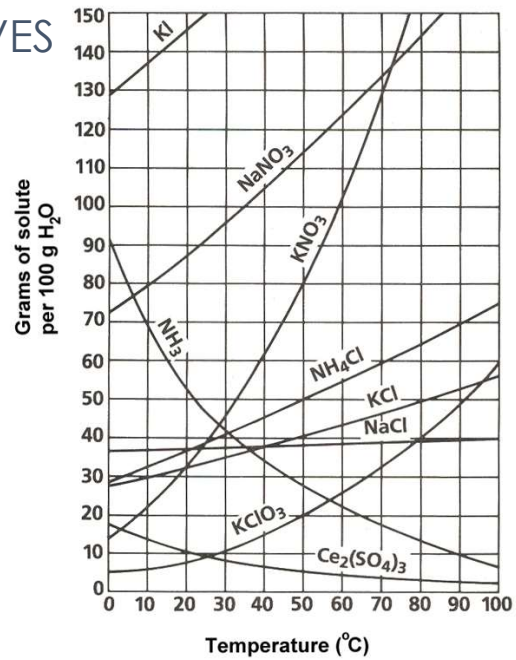


The solubility of a solution is expressed as the mass of solute required to form a saturated solution in 100 g of water at a given temperature.

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## ANALYZING SOLUBILITY CURVES

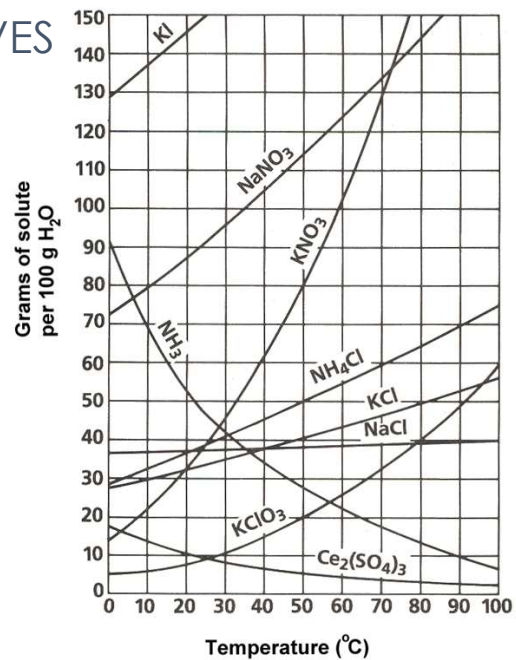
3. What **volume** of water is needed to dissolve **35.5 g** of potassium chloride at **50°C**



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## ANALYZING SOLUBILITY CURVES

4. What **mass** of ammonium chloride can be dissolved in **350.0 mL** of water at **70°C**

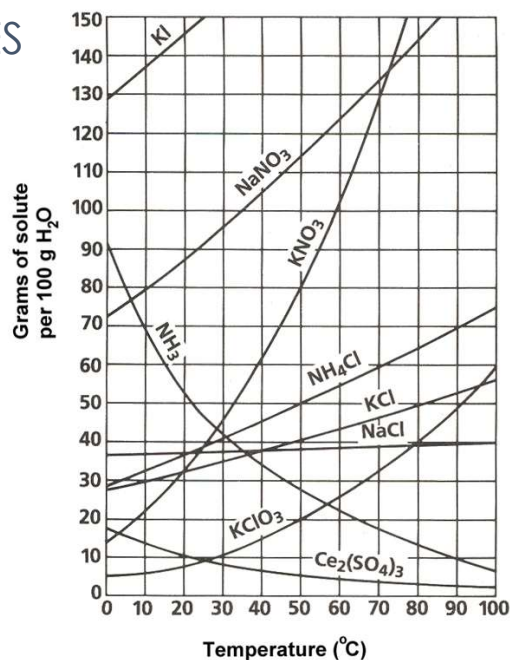


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## ANALYZING SOLUBILITY CURVES

Jim Bob dissolves 25.0 g  $\text{NaNO}_3$  in 30.0 mL of water at  $80^\circ\text{C}$ .

1. What is the **concentration** of his solution in g/100 mL  $\text{H}_2\text{O}$ ?
2. Explain why his solution is **NOT saturated**.

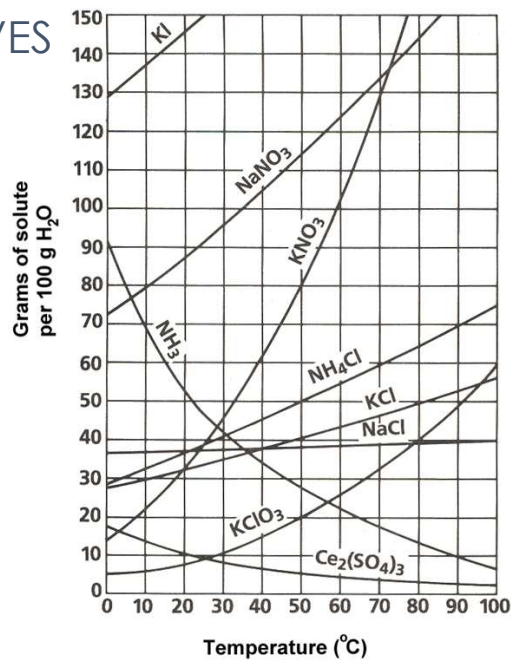


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## ANALYZING SOLUBILITY CURVES

Jim Bob dissolves 25.0 g  $\text{NaNO}_3$  in 30.0 mL of water at  $80^\circ\text{C}$ .

3. What **mass of solute** could still be dissolved in his solution?



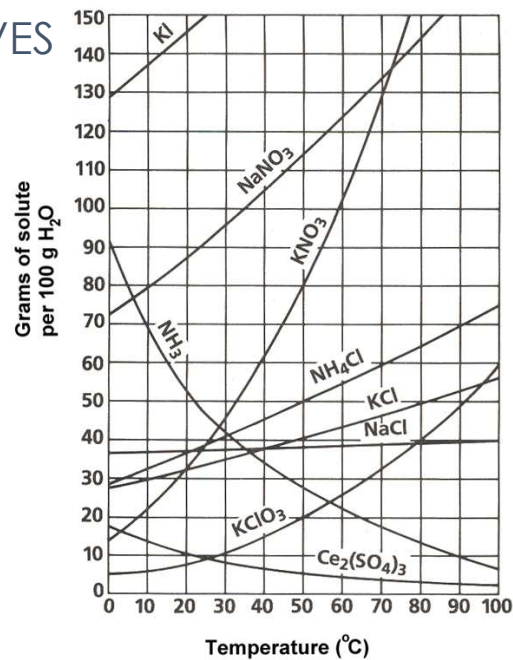
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## ANALYZING SOLUBILITY CURVES

Jim Bob dissolves 25.0 g NaNO<sub>3</sub> in 30.0 mL of water at 80°C.

4. What **volume of solvent** could be evaporated away to make it saturated?



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## SUMMARY

- The solubility of a solution is expressed as the mass of solute required to form a saturated solution in 100 g of water at a given temperature.
- Solutions may be unsaturated, saturated, or supersaturated depending on the quantity of solute they hold at a given temperature and pressure.
- A solubility curve shows the solubility of a solute in a specific solvent over a range of temperatures.
- The solubility of solids generally increases as the temperature increases, while the solubility of gases decreases.
- The solubility of a gas increases as the applied pressure increases. Pressure has no significant effect on the solubility of solids and liquids.

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