Fractional Crystallization
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• Fractional crystallization is a method of refining substances based on differences in solubility

• If a mixture of two or more substances in solution is allowed to crystallize, for example by allowing the temperature of the solution to decrease, the precipitate will contain more of the least soluble substance.
Fractional Crystallization

- https://www.youtube.com/watch?v=rWWS-yG3yuw
Fractional Crystallization

- Is it possible to separate mixtures of different ionic compounds by dissolving them in water and adjusting the temperature of the solution so that one compound crystallizes out and the other does not?

- YES!! You are given a mixture containing 80 g of $K_2SO_4(s)$ and 80 g of $KNO_3(s)$ and are asked to produce as much pure $KNO_3$ as possible. How do you do it?
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• Step 1: Dissolve salts in 100 g distilled water at 80°C.

• By looking at the solubility curves, you will see that 100 g of KNO₃ and 170 g of K₂SO₄ will dissolve at this temperature.

• Thus, everything will dissolve.
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- Step 2: Cool the solution to 0°C.
- $K_2SO_4$
  - At 0°C about 150 g of $K_2SO_4$ is soluble in 100 g of water.
  - We only dissolved 80 g of $K_2SO_4$ so NONE of it has precipitated out.

[Graph showing solubility of various compounds vs. temperature]
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- KNO$_3$
  - At 0°C only 12 g of KNO$_3$ can remain in 100 g of water.
  - We dissolved 80 g of KNO$_3$ so (80g-12g=68g) of pure KNO$_3$ precipitated from the solution.
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- A steeper solubility curve indicates that a greater mass of precipitate will form during a reduction of temperature.
- Conversely, a steeper solubility curve indicates that a greater mass of solid will dissolved during an increase of temperature.
You are given a dry mixture containing 60 g of KNO$_3$(s) and 60 g of KClO$_3$(s) and are asked to produce as much pure KClO$_3$(s) as possible. How?