

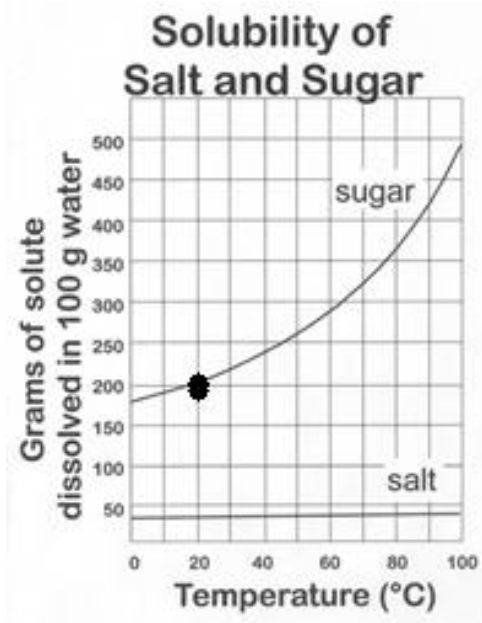
Instructions: Lab- Solubility of KNO_3

Background Info:

A **solution**, such as hot chocolate, contains a **solute** (the chocolate powder) dissolved in the **solvent** (water). How fast a solute dissolves in a solvent depends upon several factors including: the size of solute, stirring, or heating. When making hot chocolate, we stir chocolate powder into hot water. These things help the water molecules come into contact with the chocolate powder molecules more frequently and thus dissolve faster.

You may have noticed that at a certain point no matter how much you shake or stir your hot chocolate, you cannot dissolve any more chocolate powder- it's a **saturated solution**. At the **saturation point**, any excess solute you add just settles to the bottom of your container. To sweeten your hot chocolate even more, you'd have to increase the temperature of your water. The higher the temperature of the water, the more chocolate powder the solution can hold (and this is true for most solids). However, as your hot chocolate cools back down, the excess powder will re-settle on the bottom because the cooler liquid can no longer hold the same amount of solute.

The **solubility** of a substance is a measure of how well an amount of solute dissolves in a given amount of solvent at a certain temperature. Looking at the solubility graph to the right, you can see the changing solubility of sugar as temperature is increased (note that salt is fairly unaffected). For example, the maximum solubility of sugar in 100 mL of water @ 20°C is 200 g & it is said to be **saturated**. Less than 200 grams at this temperature would leave the solution **unsaturated**. Some solutions can even become **supersaturated** under certain conditions when a solution contains more solute than would normally dissolve at a certain temperature.



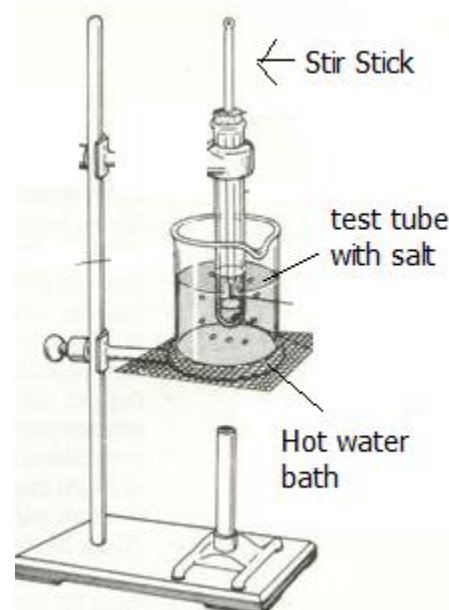
Purpose:

- Study the solubility of potassium nitrate (KNO_3) in water by:
 - Dissolving different quantities of this salt in a given amount of water at a temperature near water's boiling point.
 - Watching the solution as it cools, record the temperature at which the excess salt crystallizes out of the solution and record the temperature. (The start of **crystallization** indicates the solution has reached its **saturation point** for that temperature).
 - Creating a solubility curve for KNO_3 from our data

Procedures:

1. Determine which amount(s) of KNO_3 your lab group has been assigned to test.
2. Prepare the **hot water bath**: Fill a 400 or 600 ml beaker about 1/2 full of tap water and begin to heat up the water just below the boiling point (temperature doesn't have to be measured).

(**Water baths** help control the temperature of our KNO_3 solution and keep it a little below the boiling point of water vs. a really hot Bunsen burner).



- While the water bath is heating up, prepare the test tube(s) your lab group has been assigned to test as indicated below. Weigh out the appropriate amount of KNO_3 to your test tube(s) + 1 mL of H_2O .

(Note: you are not testing the saturation point of all the different amounts of KNO_3 , you will share data with other lab groups)

Test Tube #	Grams of KNO_3	mL of distilled H_2O
1	0.40 g	1.00 mL
2	0.60 g	1.00 mL
3	0.80 g	1.00 mL
4	1.0	1.0 mL

- Place the test tube with H_2O (l) + KNO_3 (s) into the water bath as soon as you can using a test tube holder.
- Stir the KNO_3 /water mixture with the thermometer until the KNO_3 is completely dissolved. Remove the test tube and thermometer from the hot water bath.
- Now that the solution is out of the hot water bath, keep the **warm** thermometer inside the test tube and let it cool.
- Hold the test tube up and watch for the first sign of **crystallization** (you will see a solid start to form-cloudy) in the solution. At the *instant* crystallization starts, observe and record the temperature.
- If the start of crystallization is missed, re-dissolve the salt in the hot water bath & then allow it to re-crystallize again.
- If you are testing 2 test tubes, Have one partner do steps 3 & 4 for the second test tube while their partner is watching for crystallization to occur.*

Pre-Lab Questions: (Do on Answer Document)

Data/ Observations: (gather data from other groups as needed)

Test Tube #	Grams of KNO_3 / mL of H_2O	Crystallization Temperature ($^{\circ}\text{C}$)
1	0.40 g/ 1.00 mL	Record on answer document
2	0.60 g/ 1.00	
3	0.80 g/ 1.00	
4	1.00 g/ 1.00	

Calculations/ Analysis: (see answer document)

Questions for Discussion: (see answer document)