Solubility Curves
(7/2017)

**Teacher Information:**

This experiment uses the Vernier temperature probe and interface to create a solubility curve. Students will determine the solubility of a salt at different temperatures to generate a solubility curve.

**State Standards (2016)**

C.7.1 Describe the composition and properties of solutions

C.7.2 Explain how temperature… affects the solubility of a solute

**Materials from Science Express:**

Temperature probes

Vernier interface

**Other Materials:**

You can use one of the four salts or assign different salts to different groups (adjust student procedure accordingly):

Sodium Chloride

Potassium Chloride

Ammonium Chloride

Lithium Sulfate

Distilled Water

400 mL beakers (2)

100 mL graduated cylinder

Hot plate (also available from Science Express)

Scoop

Stirring rod

Balance

Weighing papers or weighing boats

Pan with ice (a pie pan works)

You will need enough ice for each group to have 100 grams plus a pan of ice. You can store this in a cooler.

**Solubility Curves**

**Background:** Liquid solutions, which are homogeneous mixtures, are made when a solute (material being dissolved) is placed in a solvent (the liquid).Solvents are able to dissolve a limited amount of solute. As more solute is added, the solution becomes more saturated. Eventually the solvent can dissolve no more solute, and the solute will collect on the bottom of the container and remain undissolved. Solubility is the amount of solute that can be dissolved at a certain temperature. As the temperature changes, the solubility changes.

**Purpose:** In this lab you will determine the solubility of a salt at different temperatures and plot a solubility curve.

**Materials:**

Salt, as assigned by your teacher

Sodium Chloride

Potassium Chloride

Ammonium Chloride

Lithium Sulfate

Distilled Water

400 mL beakers (2)

100 mL graduated cylinder

Hot plate

Scoop

Stirring rod

Balance

Weighing papers or weighing boats

Pan with ice

**Procedure:**

1. Set up your Vernier temperature probe as instructed by your teacher.
2. Record the identity of the salt you will use in the data section.
3. Measure 200 mL of water into a 400 mL beaker
4. Using a balance, measure approximately 100 g of ice and add it to the beaker. Stir the ice/water mixture for 1 minute using a stirring rod, and then measure the temperature of the ice water. If the temperature is not 0 °C, continue to stir the mixture with your stirring rod. If all of the ice melts before you reach this temperature, add more ice to the beaker.
5. While you are waiting for the temperature to steady at 0°C, obtain a pan of ice.
6. When the temperature is steady at 0°C, pour all of the cold water into the second 400 mL beaker (not ice). Even though the volume markings on a beaker are not precise, record the volume of the water in the beaker.
7. Place this beaker in the pan of ice. Add more ice, if necessary, to surround the beaker.
8. Using the temperature probe, measure and record the temperature of the water and record it in the data table.
9. Using the balance, measure 5.0 g of salt and add it to the water in the beaker. Record the exact mass in your data table.
10. Stir the mixture until the salt dissolves. Record the temperature in the data table.
11. Repeat steps 9 and 10 until no more salt will dissolve and the solution is saturated. When you have added enough salt that the solution is saturated, indicate this point in your data table.
12. Remove the beaker from the pan and dry it off, and then place it on a hot plate.
13. Heat the solution to 20 °C. Take note of what happens to the solid on the bottom of the beaker as the solution heats up. At this point we are going to try to keep the solution at 20 °C. You will remove it then put it back on the hot plate as needed.
14. Repeat steps 9 and 10 until no more salt will dissolve and the solution is saturated again. When it is saturated, solid will remain on the bottom of the beaker.
15. We will now repeat the procedure (steps 9-14) for 50 °C and 80 °C. At this point the beaker will be hot, and you will need to handle it with beaker tongs or “hot hands” mitts. When you place the hot beaker on the lab bench, use a wire gauze or ceramic tile.
16. When you are finished, turn off the hot plate and follow your teacher’s clean up instructions. Be careful handling hot glassware.
17. When you have collected all of the data, you will make a graph, following your teacher’s instructions, of mass of salt dissolved vs. temperature.

**Data:**

Salt \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Volume of 0° C water in the beaker \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| Temperature (°C) | Mass of salt added (g) | Saturated? (yes/no) |
|  | 0 | no |
|  |  |  |
|  |  |  |
|  |  |  |

Total salt added for a saturated solution:

|  |  |
| --- | --- |
| Mass (g) | Temperature (°C) |
|  | 0 |
|  | 20 |
|  | 50 |
|  | 80 |