**Factors Affecting Solubility Lab**

**Purpose**:

To observe and understand the relationships between agitation, solute particle size, temperature and the rate of dissolving.

**Materials**:

* 4 medium test tubes
* Mortar and pestle
* 1 test tube stopper
* Hot plate
* Large beaker for water bath
* Copper (II) Sulfate pentahydrate crystals

**Procedure**:

1. You should have four test tubes on your desk. If not already done, label them A, B, C and D respectively.
2. Obtain four copper (II) sulfate pentahydrate crystals of similar size. Their masses should be within .05 grams of each other. You will be placing one crystal into each of your four test tubes.
3. Place the crystal (or pieces of crystal) into a test tube with an identical amount of water (20. mL), and do the following for the test tubes. When the tubes are completed, record your INITIAL OBSERVATIONS:
   1. Heating up crystal
   2. Shaking crystal
   3. Crushing the crystal
   4. Leaving crystal alone
4. Set up a hot water bath and set the hot plate to 6. Be sure that the water does not boil (approx. 85oC). This will be used for tube A.
5. Place the cork on top of tube B and shake continuously until crystal is completely dissolved.
6. Crush one of your crystals into small pieces using the mortar and pestle. This will be the crystal you place in tube C.
7. For Tube D, leave alone in test tube rack.
8. Record the amount of time it takes for each crystal to COMPLETELY dissolve. Each group member is responsible for this. While this is going on record your OBSERVATIONS WHILE DISSOLVING.
9. When the crystals are completed dissolved (?) record your FINAL OBSERVATIONS along with the time.
10. Clean and return all equipment to the proper places.

**Hypothesis**:

Of the four test tubes you are using, which tube do you think will dissolve the fastest? Why, on a molecular level, do you think this?

**Pre-Laboratory Questions**:

1. Test tube D is essentially left alone. Why, using scientific terminology, do we do this?
2. You are using copper (II) sulfate pentahydrate in your experiment. What is this hydrate’s formula, and what is its percent water composition? Show your work.
3. If you have a crystal that is approximately 0.36 grams. How much of this crystal would remain if the water were to be heated off? Show your work.
4. What are the three major factors that influence solubility that we have discussed in class? Why is the last factor not included in this particular experiment?
5. In this experiment, you will be heating up a hot water bath for Test Tube A. How will this affect the density of water? How do you know this?
6. Water is serving as the solvent in this experiment. What property allows water to serve as the solvent in most experiments?

**Data and Observations**:

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| --- | --- | --- | --- | --- | --- |
| Test Tube | Mass of Crystals (g) | Initial Observations | Observations While Dissolving | Final Observations | Time (min) |
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**Post-Laboratory Questions:**

1. According to your data, which factors affects solubility the most? Give a logical explanation of why this occurred?
2. For the answer you chose in the above question, how could you increase the solubility of your crystal even further? Provide a molecular explanation of why you chose this particular method.
3. Find the concentration of your solution in Test Tube A. In your response, provide the general formula for concentration.
4. Let’s say you add 20 more milliliters of water to Test Tube A. How will this affect the concentration of your solution? In your response, provide the general formula for this process.
5. Using the mass of the crystal you used in Tube B, calculate the percent, by mass, of the solution you used. The density of water is 0.96862 g/mL at 85 °C. Show your work. In your answer, clearly label the mass of water.
6. Provide the quantitative solubility data in a bar graph. Be sure to label your axes clearly.