

Name:

Partner's name(s):

## Laboratory 7: Solutions

### Lecture Notes

What are the parts of a solution?

Solute

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Solvent

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What is the process of dissolving?

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Molecular compound dissolving in water	Ionic Compound dissolving in water

What are the factors that affect solubility?

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What is concentration?

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What is a suspension?

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Examples

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What is a saturated solution?

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What is an unsaturated solution?

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What is a supersaturated solution?

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Demonstration of saturated, unsaturated and supersaturated solutions of sodium acetate

Observations:

Saturated:

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Unsaturated:

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Supersaturated:

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**Purpose:** To determine the properties of solutions.

**Procedure, Observations and Data: (To be done in groups of three)**

**A. Making a solution of  $\text{CuSO}_4$**

Using forceps, obtain four crystals of copper (II) sulfate ( $\text{CuSO}_4$ ) from the reagent bench that are about the same size and place in a clean, dry beaker. Over your burner heat a 250 ml beaker with 150-175 ml of water to be used later. Get four test tubes from your drawer. Place a single crystal into test tubes 1 and 2. Half-fill test tubes 1 and 2 with deionized water. Leave test tube 1 undisturbed. Place a cork on test tube 2 and shake vigorously. Compare the test tube 1 and test tube 2.

How did shaking affect the rate of dissolving?

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Using a mortar and pestle, grind the third crystal and place the powder into test tube 3. Half-fill test tube 3 with deionized water. Compare the test tubes.

How did grinding affect the rate of dissolving?

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Place the fourth crystal into test tube 4. Half-fill test tube 4 with deionized water. Place test tube 4 into the beaker of water you heated earlier. (Save the hot water when you are done). Compare the test tubes.

How did heating affect the rate of dissolving?

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Make observations about one of the solutions of  $\text{CuSO}_4$  after it has completely dissolved. Is the solution clear or cloudy? Is it uniform or is it darker in some parts?

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**B. Solutions of gases**

At the reagent bench half-fill a test tube with soda. Place the test tube into your water bath. Make some observations.

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What is dissolved in the soda solution? How does heating the soda affect the solubility of the solute?

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**C. Making a suspension of calcium carbonate**

In a small beaker obtain a small amount (1/8 teaspoon) of calcium carbonate or ground chalk. Half-fill the beaker with water and stir.

Make observations about the chalk and water after you have stirred it.

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Is the mixture clear or cloudy? Is it uniform?

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Hold it up to the light. What happens to the chalk? What happens to the water?

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Let it stand for a few minutes? Now observe.

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**D. Making a Crystal**

Weigh out 15.0 grams of aluminum sulfate crystals and 3.9 grams of potassium sulfate crystals onto a piece of filter paper. Pour them into a 150 ml beaker. Measure out 100 ml of de-ionized water in your graduated cylinder. Add the water to the beaker and heat the mixture until the crystals are completely dissolved. You may now remove the flame. At the reagent bench obtain thread and a wood splint. Tie the thread to the splint. The thread should be long enough to go 1/2 to 2/3 of the way to the bottom of the beaker when you lay the splint across the top of the beaker. The thread should be in the middle of the beaker, in other words, not touching the sides (You may need to force the string down into the beaker with your stirring rod). Place this in your plastic tub until next session.

### E. Ways of describing solutions and their properties

#### **Demonstration: miscibility and the nature of the solute and solvent**

Your instructor will place some iodine crystals in a test tube of a polar solvent (water) and test tube of a nonpolar solvent (cyclohexane).

In which solvent is the iodine more soluble? \_\_\_\_\_

Why?

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What was the color of the iodine in the two test tubes? \_\_\_\_\_

Your instructor will place some NaCl crystals in a test tube of a polar solvent (water) and test tube of a nonpolar solvent (cyclohexane).

In which solvent is the NaCl more soluble? \_\_\_\_\_ Why?

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#### **Demonstration: super-absorbency**

Your instructor will add a teaspoon of sodium polyacrylate to water. Make observations.

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#### **Demonstration: heat of solution**

Your instructor will add ammonium chloride to water and sodium hydroxide in water. Make observations

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If heat is given off (the temperature goes up) when a substance dissolves it is called \_\_\_\_\_.

If heat is absorbed (the temperature goes down) when a substance dissolves it is called \_\_\_\_\_.

**Calculations**

None

**Questions and Answers:**

1. What is the difference between unsaturated, saturated and supersaturated?

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2. Why does iodine dissolve in one solvent but not the other?

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3. What kind of mixture is a solution? Why?

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4. How are solutions and suspensions different?

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5. Why did the solution of  $\text{CuSO}_4$  dissolve more quickly when heated, crushed or stirred. What happened at the atomic level to explain this?

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6. What are some everyday things that are solutions? What are some everyday things that are suspensions?

Solutions	Suspensions

7. What are three things that affect how something dissolves?

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**Conclusions and Reflections**

What did you learn about solutions that you did not know before?

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What are the advantages of doing a lab like this in groups of two?

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What are the disadvantages?

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What are the advantages of doing a lab like this alone?

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What are the disadvantages of doing a lab like this alone?

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Should a lab like this be done alone, or in groups of two or three, explain?

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What are the advantages of an instructor performing demonstrations?

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What are the disadvantages of an instructor performing demonstrations?

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