

Lab Activity: Solubility Rule – Like Dissolves Like

Purpose: Students will experience the affect a substance's composition and structure has on its solubility.

Equipment & Materials:

distilled water	food coloring	apron	corn starch
vegetable oil (Canola oil)	beakers	beaker tongs	glucose
hot plate	cotton balls	ethanol	sucrose
petroleum jelly (Vaseline)	goggles	bleach (Clorox)	flasks
sodium hydroxide	stirring rod	dropper pipette	

Procedure:

Miscible and Immiscible Liquids (Similar and Dissimilar Liquids)

1. Pour 50 mL. of distilled water into a 250 mL. beaker. Then add five drops of a food coloring to it and stir. Observe and descriptively record what type of mixture results.
2. Add 50 mL. of vegetable oil, slowly, to the water. Observe and descriptively record what type of mixture results.
3. Using a dropper pipette add 50 mL. of ethanol, dropwise, to the mixture. Or, add the ethanol in a slow but constant stream down the wall of the beaker. Observe and descriptively record what type of mixture is present in the beaker.
4. Pour this mixture into another 250 mL. beaker and back into the original 250 mL. beaker. Repeat this step, three to five times, to achieve thorough mixing of all parts of the total mixture. Observe and descriptively record what type of mixture results.
5. Describe any changes that took place. Explain why the changes occurred.

Dissolving Solids in Like Liquids

1. Prepare the following solutions in different 250 mL. beaker:
 - A. Place 1 g. of glucose in 50 mL. of H₂O and gently stir. Observe and descriptively record what type of mixture results.
 - B. Repeat this step making a solution of 1 g. of sucrose in 50 mL. of H₂O and gently stir. Observe and descriptively record what type of mixture results.

Teacher Demonstration Portion – (only to be done in a fume hood)

- A. Place 0.5 g. of cellulose (cotton balls) into 100 mL. of bleach, then slowly add 100 mL. of 2.5 M. NaOH (aq) using a dropper pipette. Heat the mixture to 90 °C. Then allow to cool. Repeat this step with 1 g. of cellulose (cotton balls).
- B. Qualitatively discuss the solubility of cellulose and how its structure affects its solubility. Have students experiment with 0.5 g. of cellulose in 200 mL. of H₂O and compare their results with those received with the glucose and sucrose solutions. Students should explain their results.
- C. Place 1 g. of corn starch into 50 mL. of bleach. Heat the mixture to 90 °C. Then allow to cool. Have students repeat this step with 1 g. of corn starch in H₂O and compare their results with those received with the glucose and sucrose solutions. Students should explain their results.
- D. Place 100 mL. of vegetable oil in a 250 mL. beaker and 100 mL. of distilled H₂O in another 250 mL. beaker. Add 5 g. of petroleum jelly (Vaseline) to both beakers, stir and heat both on a hot plate to no more than 80 °C. Have students discuss the results of this experiment and explain the solubility of the petroleum jelly (Vaseline) in both liquids in light of the chemical composition and structure of oil, water and petroleum jelly (Vaseline).

Conclusion Questions:

1. What patterns of dissolution between solvents and solutes do you notice?
2. Why doesn't cellulose dissolve in pure water like glucose and sucrose?
3. Draw the structural formulas for glucose, sucrose, cellulose, a fatty acid (oleic acid) and a long straight chain hydrocarbon like decane.
4. Define the terms: saturated, unsaturated and supersaturated.
5. Describe all of the mixtures made in this activity as homogeneous or heterogeneous.

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Lesson Plan