Chemistry	Name: _____	
Section _____	SOLUTIONS	Date: _____

Solutions Lab #22

Pre-Lab Discussion:

A **solution** is a **homogeneous mixture** consisting of a **solute** (dispersed on the molecular level) and a **solvent** (in which the solute is dispersed). In simpler terms, the solvent is the substance in the *greater* amount and the solute is the substance in the *lesser* amount. Water is known as the 'universal solvent.' Why?

Three characteristics of solutions are:

1) the mixture is clear (but not necessarily colorless)
2) the solute cannot be filtered out
3) the solute will not settle out over time (it will remain uniformly dispersed)

Solutions are classified by the proportions of the solute and solvent:

- **dilute solution**: contains a relatively small amount of solute
- **concentrated solution**: contains a relatively large amount of solute
- **saturated solution**: contains all the solute the solvent can hold under current conditions
- **unsaturated solution**: contains less solute than the solvent can in given conditions
- **saturated solution**: contains more solute the solvent usually holds in given conditions

To determine the saturation level of a solution, add a small amount of solute to the solution. The solution is unsaturated if the solute dissolves, saturated if the solute remains undissolved, and supersaturated if crystals form.

It is not possible to supersaturate a saturated solution at a given temperature. The amount of solute 100 g of a solvent can hold at a given temperature is called the solubility of the solvent. To supersaturate a solution, the temperature must be raised to increase solubility, more solute added, and the temperature lowered. If the excess solute remains dissolved at the lower temperature, the solution is metastable and supersaturated. The rate of dissolution can be increased by 1) increasing the surface area of the solvent, 2) agitation, or 3) adding heat.

Liquid – liquid mixtures (such as isopropyl alcohol and water) that completely dissolve in all proportions are described as **miscible** (miss-i-ble). Liquid – liquid mixtures which do not dissolve in any discernable proportion are described as **immiscible**. The terms miscible and immiscible apply only to mixtures in which the solvent and the solute are *both* liquids.

Research Questions:

How can the solubility and characteristics of solutions and solubility be compared?

Materials:

4 test tubes	250 mL beaker	methyl alcohol, CH_3OH
test tube holder	test tube rack	potassium chlorate, $KClO_3$
micro-spatula	hotplate	sodium thiosulfate, $Na_2S_2O_3$
Beral pipete	test tube stoppers	mineral oil

Method:

1. **Advance preparation**: set up a hotplate and hot water bath as soon as lab begins. Continue with the next steps while the water heats.

Liquid – liquid solutions:

2. In a test tube, add 10 drops of distilled water and 10 drops of methyl alcohol. Shake and observe carefully. Do the liquids separate into layers? Record your observations.

   _____

   _____

3. In a clean test tube, combine 10 drops of mineral oil and 10 drops of distilled water. Observe and record the appearance before agitating the tube, after agitating the tube, and after the agitated tube has a chance to stand undisturbed for a time.

   _____

   _____

   _____

   Which liquid is more dense? Explain _____

   _____

→ Do NOT pour this mixture down the drain. Use the oil waste jar in the hood.

Solids in a liquid solutions:

4. Half fill a test tube with distilled water. Add a half micro-spatula of $KClO_3$ and shake. Observe and record. Add another small amount of $KClO_3$ and shake again. Record your observations.

   _____

   _____

   What degree of saturation is the final solution? Explain _____

   _____

   _____

5. Half fill a test tube with distilled water. a) Add four micro-spatulas of $KClO_3$ and shake. Observe and record. b) Place the test tube in the hot water bath for about one minute. Observe and record. c) Cool the tube by holding the end of the tube under cold running tap water for two minutes. Record your observations.

   a) _____

   b) _____

   c) _____

Investigating supersaturation:

6. Obtain a test tube that is half filled with $Na_2S_2O_3.5H_2O$ crystals. Place this tube in the hot water bath until all the solid dissolves. Cool the tube for about two minutes in a stream of cool tap water. Do not shake or disturb the tube during the cooling period. If no crystals have formed, have the instructor add one small crystal of the $Na_2S_2O_3.5H_2O$. Record your observations.

_____

_____

_____

→ DO NOT DISCARD THIS TUBE. Return the tube to your instructor.

Conclusions:

1. When a crystal of solute is added to a solution, describe the degree of saturation if:

   a) the crystal remains undissolved _____

   b) the crystal dissolves _____

   c) more crystals form _____

2. What degree of saturation exists when a portion of the solute remains undissolved?

   _____

3. What word describes a mixture of two liquids that dissolve each other in all proportions?

   _____

4. Give a real-world example of two immiscible liquids. How do they appear before agitation? How does shaking affect them? What can you say about their densities? (Later, you will learn that their separation depends upon their molecular polarities.)

   _____

   _____

   _____

Applications:

1. What did you personally learn from this lab?

   _____

2. Explain who in the real world might use this application and describe how that would look.

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