

Chem 130: Chemistry for Funeral Services
Problem Set 5: Due 2/28/06

Name: **KEY**

Date: _____

Each question is worth one point. Show your work wherever calculations are required.

1. Explain the difference between a solvent and a solute. Give an example of each.

A solute and solvent together form a mixture. The solute is the portion of a mixture that is present in the smaller quantity. The solvent is present in the greater quantity. In a solution of sugar dissolved in water, sugar is the solute. Water is the solvent. (many other examples are possible)

2. What is solubility? How does solubility relate to a saturated solution? Does dilute mean unsaturated? Why or why not.

Solubility is a quantity that describes how much solute can be dissolved in a solvent (at a particular temperature). A saturated solution is one where that maximum amount of solute is dissolved. Dilute does not mean unsaturated. It describes a solution of low concentration. An unsaturated solution is one where the solution can still dissolve more of the solute. That situation can happen in a dilute or a concentrated situation, especially if the solute has a high solubility in the solvent.

3. How many grams of formaldehyde are dissolved in 100 ml of a solution with an index of 32? How many grams would be dissolved in 50 ml of the same solution?

Index means grams formaldehyde/100 ml solution. This means there are 32 grams of formaldehyde in 100 ml of a solution with an index of 32. If you have only half the number of mls (50 mls instead of 100 mls), you would have half the number of grams. So 50 mls of a 32 index solution would have 16 grams of formaldehyde.

4. How many grams of calcium chloride (CaCl_2) must be dissolved in 1 liter of solution to make the concentration 1M?

**Atomic Mass Ca : 40.08 grams/mole (from the periodic table atomic weight) x 1 in molecule = 40.08
Atomic Mass Cl : 35.45 grams/mole (from the same place) x 2 in molecule = 70.90
Atomic Mass CaCl_2 = 110.98 grams/mole (sum of the atomic weights for Ca and 2 Cl)**

You would need to dissolve 110.98 g of CaCl_2 . A 1 molar solution contains the number of grams of the atomic mass of the substance.

5. What is the difference between heterogeneous and homogeneous solutions? Give an example of each.

A heterogeneous mixture is "lumpy", not uniform throughout the mixture. Homogeneous mixtures are uniform throughout. Sugar water is a homogeneous mixture. Sand and water is a heterogeneous mixture.

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6. What is meant by "like dissolves like"? Explain what is happening at the atomic level. How does this relate to polar and non-polar substances?

Polar substances dissolve polar or charged substance (e.g. Salt dissolving in water). Non-polar substances dissolve non-polar substances (e.g. Hand soap dissolving grease). On the atomic level, polar substances have a portion of their molecule that is partially positive and another that is partially negative (based on atomic electronegativity). Water is the classic example. The partially charged areas of the solvent are responsible for the solvent's ability to surround the charged or partially charged portions of ions or other polar substances. Non-polar substances don't have regions that are partially charged. Polar substances repel them.

7. What is the difference between an isotonic, a hypotonic and a hypertonic solution? What do these terms have to do with embalming? Explain. (see p. 117)

All of these terms refer to the concentration of two solutions that are separated by a semi-permeable membrane. If the two solutions are isotonic, it means that they have the same concentration of solute. If Solution A is hypotonic to Solution B, it means that Solution A is less concentrated than Solution B. Since Solution B is more concentrated than Solution A, it would be described as hypertonic to Solution A. It is important to be aware of these concentration differences while embalming because various decay processes as well as formaldehyde reactions themselves can change the concentrations between the outside of cells and the inside of cells. Procedures need to be adapted so that formaldehyde will move to the portion of the body where it is needed.

8. Explain why the salt in the potato got wet over time. Use the concept of osmosis in your explanation.

The potato acted like a large semi-permeable membrane. Water could move but the salt could not get through the cells in the potato. There was no salt in the water in the bowl and essentially 100% salt in the well of the potato. This means that the water solution outside of the potato was isotonic to the salt in the well. There was more water outside than inside so the water flowed through the "potato membrane" and into the salt well.

9. What is osmotic pressure? (Be careful! Osmotic pressure is not osmosis!)

The amount of pressure that must be exerted on a high solute concentration (low water) side of a semi-permeable membrane to prevent water from moving by osmosis from the low solute concentration (high water) side of the membrane.

10. Give three important differences between colloidal mixtures and suspensions. Give a common example of each type of mixture.

The particles in colloids are smaller than those in suspensions. The particles in colloids exhibit "Brownian motion" while suspension particles are affected by gravity. Colloid particles will move through filters. Suspension particles will not. Milk is a colloid. Flour water for gravy is a suspension.