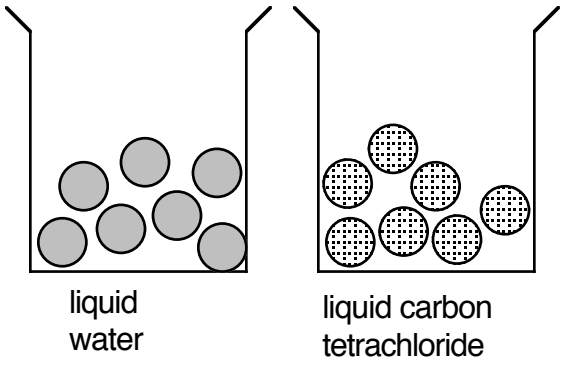
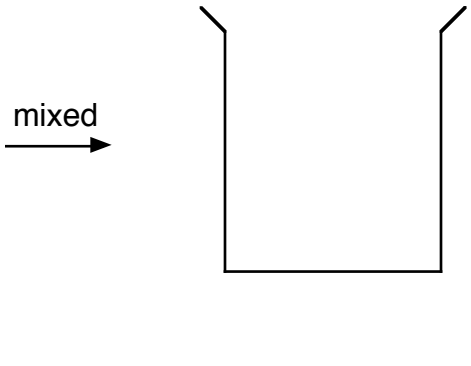
Solutions Thermodynamics DCI

Name _____ Section _____

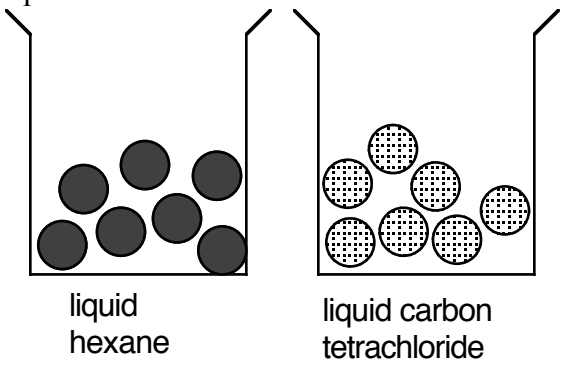
1. The three attractive interactions which are important in solution formation are; solute-solute interactions, solvent-solvent interactions, and solute-solvent interactions. Define each of these interactions and describe their importance in determining whether a particular solute-solvent pair will form a homogeneous mixture or a heterogeneous mixture.

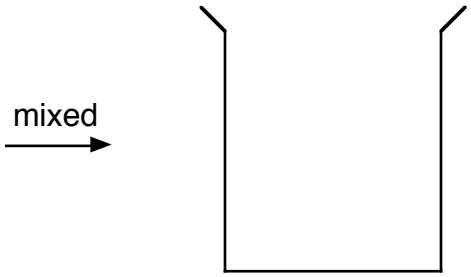
Shown below are two beakers. One contains liquid water and the other contains liquid carbon tetrachloride. For simplicity a circle is used to represent the molecule. Complete the beaker on the right to illustrate the result of mixing the two liquids.





Shown below are two beakers. One contains liquid hexane and the other contains liquid carbon tetrachloride. For simplicity a circle is used to represent the molecule. Complete the beaker on the right to illustrate the result of mixing the two liquids.





2a. In terms of the attractive interaction explain how it is the formation of a solution can be exothermic or endothermic.

b. Describe the underlying thermodynamic property which favors the formation of a solution. Explain why some combinations of chemicals do not form homogeneous mixtures.

3a. Define the following terms;

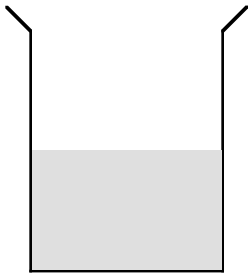
solubility

unsaturated solution

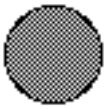
saturated solution

supersaturated solution

b. Given that the beaker to the right contains an aqueous solution of NaCl, describe a simple test to determine whether the solution is unsaturated, saturated or supersaturated. What would you expect to happen during the test if the solution were unsaturated? saturated? supersaturated?



4a. Given the representations below, sketch the orientations of a chloride ion and a several water molecules and a sodium ion and several water molecules to illustrate the ion-dipole interaction.


chloride ion


sodium ion


water

b) Briefly describe ion-dipole intermolecular attractive forces that occur when an ionic solid dissolves in water. Indicate what causes the attractive force and describe how the strength depends on the charge and the size of the ion.

5. Define the term *lattice energy* and explain its importance in the enthalpy of solution.

6. Explain how pressure, temperature and molar mass effect the solubility of a gas in a liquid.