Part I
Properties of Organic Compounds

The volatility of an organic compound is directly related to the vapor pressure of the compound. The vapor pressure is generally negatively correlated with the boiling point. In covalently bonded molecules, increases in molecular mass generally increase the boiling points of the molecular. Molecules with large dipole moments have higher boiling points. Particularly strong intermolecular forces such as hydrogen bonding can increase the boiling point. More compact molecules tend to have lower boiling points.
The water solubility of a compound is related to its polarity, the strength of its molecular dipole. Dissolution can be viewed as the intermolecular forces between the solvent and solute molecules replacing the intermolecular forces between solute molecules. Therefore, greater similarities in size, polarity, and other physical and chemical properties will increase the solubility of a compound in a solvent. It is important to note that solvent polarity and molecule polarity are separate. Solvent polarity is generally defined as the ability of a solvent to charge separate a dissolved particle while the polarity of a compound is the dipole moment. In practice, it can be very difficult to accurately predict the solubility of a compound.
Henry's Law establishes that the concentration of a gas in a liquid is directly proportional to the partial pressure of gas in equilibrium above the liquid. Henry's constant is specific to a gas, liquid, and temperature system and relates the partial pressure to the concentration in the liquid.
The water solubility term appears first order in all three phase distribution expressions, so it does not have an effect on the distribution. Henry's constant is first order in the gas phase, so increasing Henry's constant will favor distribution in the gas phase. The octanol-water partition is first order in the solid phase, so a higher k_{OW} will increase the amount in the solid phase. Generally, more polar molecules will be more soluble in water than less polar molecules.

Part II
Organic Compounds

Multiple acceptable answers for organic compounds.
Water soluble $acids \longleftrightarrow alcohols \longleftrightarrow esters \longleftrightarrow hydrocarbons$ Volatile

Part III
Cometabolism

Cometabolism is the simultaneous degradation of two compounds where the degradation of one compound depends on the presence of the other. For example, bacteria which metabolize simple hydrocarbons can also metabolize chlorinated solvents such as tri- and tetrachloroethylene. These compounds do not easily degrade, so finding bacteria which metabolize them would aid in bioremediation of contaminated areas.

Part IV
Endocrine Disruptors

Endocrine disruptors interfere with messaging in the hormone system.
We were looking for a well thought out experiment with details on how to control variables and possible sources of experimental error.