Directions: The following questions represent some of the concepts covered in sections 13.1 – 13.4. When answering the questions SHOW ALL WORK including equations and substitution with units.

1. Rank the following solutions in terms of increasing magnitude of solvent-solute interaction:
   (i) CCl_4 in benzene (C_6H_6) **(ii)** $CaCl_2$ in water **(iii)** propyl alcohol ($CH_3CH_2CH_2OH$) in water

2. When an ionic salt dissolves in water, the solute-solvent interaction is

   ○ London dispersion

   ○ ion-dipole

   ○ hydrogen bonding

   ○ ion-ion forces

   ○ dipole-dipole

3. The solubility of $Cr(NO_3)_3 \bullet 9H_2O$ in water at 15°C is 208 g per 100. mL of solution. Is a 1.22 *M* solution of $Cr(NO_3)_3 \bullet 9H_2O$ in water at 15°C saturated, supersaturated, or unsaturated?

   ○ saturated

   ○ supersaturated

   ○ unsaturated

4. Which of the following in each pair is more likely to be soluble in hexane, C_6H_{14}?
   (i) $CH_3CH_2CH_2CH_3$ or CH_3CH_2OH **(ii)** CCl_4 or $CaCl_2$ **(iii)** C_6H_6 or C_6H_5OH (phenol)

   ○ CH_3CH_2OH; $CaCl_2$; C_6H_6

   ○ $CH_3CH_2CH_2CH_3$; CCl_4; C_6H_6

   ○ CH_3CH_2OH; CCl_4; C_6H_5OH

   ○ $CH_3CH_2CH_2CH_3$; CCl_4; C_6H_5OH

   ○ CH_3CH_2OH; CCl_4; C_6H_6

5. Which one of the following substances would be the most soluble in water?

○ N_2

○ CH_4

○ PH_3

○ NaCl

○ Ar

6. Which of the following pairs is most likely to be heterogeneous?

○ hexane, $CH_3(CH_2)_4CH_3$; and octane, $CH_3(CH_2)_6CH_3$

○ potassium chloride, KCl; and carbon tetrachloride, CCl_4

○ methanol, CH_3OH; and water, H_2O

○ acetic acid CH_3COOH; and water, H_2O

○ iodine, I_2; and benzene, C_6H_6

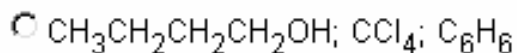7. Which of the following commercial solvents is *least* water-soluble?

○ ethyl acetate,

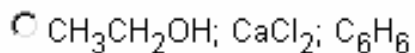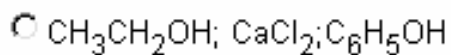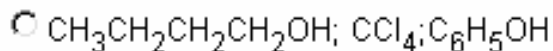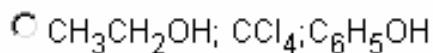○ isopropanol,

○ acetone,

○ carbon tetrachloride,

○ acetic acid,
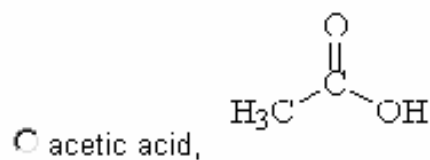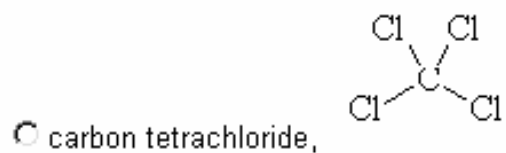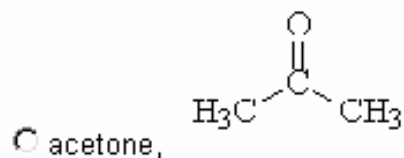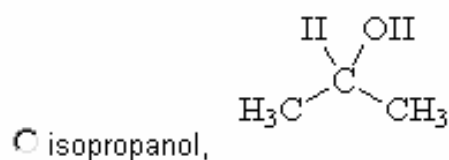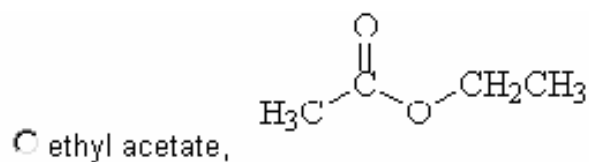
8. Consider the solubilities of the following organic compounds in water. Rank the chemicals in order of *decreasing* solubility.

1) CH_3CH_2OH

2) $CH_3(CH_2)_4CH_3$

3) $CH_3(CH_2)_5CH_2OH$

4) $CH_3(CH_2)_4CH_2OH$
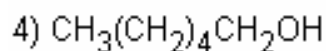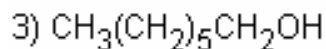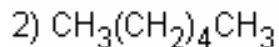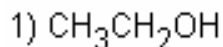
9. Which of the following in each pair is more likely to be soluble in water?
   (i) $CH_3CH_2CH_2CH_2OH$ or CH_3CH_2OH **(ii)** CCl_4 or $CaCl_2$ **(iii)** C_6H_6 or C_6H_5OH (phenol)

   ○ CH_3CH_2OH; CCl_4; C_6H_5OH

   ○ $CH_3CH_2CH_2CH_2OH$; CCl_4; C_6H_5OH

   ○ CH_3CH_2OH; $CaCl_2$; C_6H_5OH

   ○ CH_3CH_2OH; $CaCl_2$; C_6H_6

   ○ $CH_3CH_2CH_2CH_2OH$; CCl_4; C_6H_6

10. The Henry's law constant for CO_2 gas in water at 25°C is 3.1×10^{-2} M/atm; that for N_2 at 25°C is 6.8×10^{-4} M/atm. If the two gases are each present at 5.0 atm pressure, calculate the solubility of each gas.