H Chem

L.G. Additional Problems

1. \( I_2 \) = nonpolar \* Likes dissolve likes
   \( H_2O \) = polar
   \( CS_2 \) = nonpolar
   \( \text{S=C=S} \)

2. Ethanol is polar, cyclohexane is nonpolar

3. \% mass = \( \frac{g \text{ solute}}{g \text{ solution}} \)
   Given:
   0.44 g \( C_{10}H_8 \) (solute; smaller amount)
   80.1 g \( C_6H_{16} \) (Solvent; greater amount)
   \( g \) soln = \( g \) solute + \( g \) solvent
   0.44 g \( C_{10}H_8 \) + 80.1 g \( C_6H_{16} \) = 80.5 g soln
   \% mass = \( \frac{0.44 g \ C_{10}H_8}{80.5 g \ soln} \times 100 = 7.45\% \)

4. Benzene = nonpolar \* \( C_{6}H_{10} \) \( \frac{1}{3} \) \( P_4 \)
(5) \[ M = \frac{\text{mol solute}}{\text{L soln}} \]

\[
\frac{30.0\text{gNH}_3}{1\text{mol NH}_3} = \frac{1.76\text{mol}}{17.04\text{gNH}_3} = \text{mol solute} \]

\[ 9\text{g soln} = 9\text{g solute} + 9\text{g solvent} \]

\[
\frac{30.0\text{g NH}_3 + 70.0\text{g H}_2\text{O}}{100.0\text{g soln}} = 1.76\text{mol NH}_3 \]

\[
\frac{0.982\text{g soln}}{1\text{L soln}} \]

\[ 1000\text{mL soln} = 17.3\text{M solution} \]

(6) H\(_2\)O is polar; CH\(_3\)OH is also polar, but has a nonpolar region (the CH\(_3\)). As the nonpolar carbon chain gets longer, the solubility in water decreases.

(7) Find: 9 H\(_2\)O (solvent)

a) Given: 5.00g (NH\(_3\))\(_2\)CO (solute); 16.2% m/m solution

\[ 16.2\% = \frac{5.00\text{g (NH}_3\text{)}_2\text{CO}}{X\text{g solution}} \times 100 \]

\[ X = 30.9\text{g soln} \]

\[ 30.9\text{g soln} = 500\text{g solute} + X\text{g solvent} \]

\[ X = 25.9\text{g H}_2\text{O} \]

b) Given: 20.2g MgCl\(_2\); 1.5% m/m soln

\[ 1.5\% = \frac{20.2\text{g MgCl}_2}{X\text{g soln}} \times 100. X = 1700\text{g soln} \]

\[ 1700\text{g soln} - 20.2\text{g MgCl}_2 = 1679.8\text{g H}_2\text{O} \]
8. a) I₂ = nonpolar :: CH₃CH₂CH₂CH₂CH₂OH (most nonpolar)

   b) KBr = ionic :: CH₃OH (most polar)

   c) C₅H₁₂ = nonpolar :: CH₃CH₂CH₂CH₂CH₂OH (most nonpolar)

9. \[ \frac{3.20 \text{ g salt}}{9.10 \text{ g H}_2\text{O}} \rightarrow \text{saturated soln} @ 25^\circ \text{C} \rightarrow \text{Solubility} \]

   \[ \text{Solubility} \]

   \[ \frac{35.2 \text{ g salt}}{100 \text{ g H}_2\text{O}} \]

   \[ x = 35.2 \text{ g salt} \]

10. \[ S_1 = \frac{155 \text{ g KNO}_3}{100.0 \text{ g H}_2\text{O}} \]

    \[ S_2 = \frac{38.0 \text{ g KNO}_3}{100.0 \text{ g H}_2\text{O}} \]

    total g soln = 155 g solute + 100.0 g solvent = 255 g soln

    for 255 g soln 117 g KNO₃ will crystallize out of soln when cooled from 75°C to 25°C

    \[ \frac{117 \text{ g KNO}_3}{255 \text{ g soln}} = \frac{x \text{ g KNO}_3}{100.0 \text{ g soln}} \]

    \[ x = 45.9 \text{ g KNO}_3 \]

11. NO, the bubbles @ 30°C are dissolved air being released, where the bubbles @ 100°C are H₂O(g) (water vapor) since 100°C is water's boiling point
12. Boiling the water removed much if not all of the dissolved oxygen and the quick cooling didn't allow for much oxygen to get dissolved again, so the fish died due to lack of oxygen.

13. At high pressure (low altitude) the CO₂ would remain dissolved in the drink so you wouldn't "taste" bubbles. As he went up in altitude, the pressure decreases allowing the CO₂ to be released by the drink.

14. As the vapor pressure of a liquid goes down (assuming closed system) the liquid would have a chance.

15. \[i = \frac{\text{actual # of particles in soln after dissociation}}{\text{# of formula units initially dissolved in soln}}\]

*measure of the effect of a solute upon colligative properties

16. a) i = 2  b) i = 3  c) i = 3  d) i = 2  e) i = 2

17. 0.35 m CaCl₂ \[\text{[CaCl}_2\text{]} = 0.35 m \times 3 = 1.05 m\]
0.90 m \((\text{NH}_2)_2\text{CO}\) \[\text{[\text{NH}_2}_2\text{CO]} = 0.90 m \times 1 = 0.90 m\]

18. a) CaCl₂  b) \((\text{NH}_2)_2\text{CO}\)  c) CaCl₂

HCl strong electrolyte
NaCl strong electrolyte
Glucose nonelectrolyte

19. Dec/freezing point (least affected to most affected) (all same concentration)
   - only look @ i
   - 0.50 m glucose > 0.50 m acetic acid > 0.50 m HCl
Sodium chloride and calcium chloride are ionic compounds. When dissolved in water, they will dissociate completely into ions. Sucrose and urea will not because they're non-electrolytes.

Boiling point-temp @ which the vapor pressure of a liquid is equal to external pressure. If external pressure was to change, the boiling point would change. External pressure and boiling point are directly related.

Molar heat of vaporization tells you the strength of a molecule's IMF's. They're directly related.

#21-23 Same as w/s phase diagram's... Jomy