1. Both precipitation and crystallization describe the separation of excess solid substance from a supersaturated solution. However, solids formed by the two processes differ in appearance; we normally think of ppt as being made up of small particles, whereas crystals may be large and well-formed.

2. When one substance (the solute) dissolves in another (the solvent), particles of the solute disperse throughout the solvent. The solute particles occupy positions that are normally taken by solvent molecules. The ease in which a solute particle replaces a solvent molecule depends on the relative strengths of 3 types of interactions:
   - solvent-solvent interaction
   - solute-solute interaction
   - solute-solvent interaction

For simplicity we imagine the process taking place in 3 steps. Step 1 - separation of solvent molecule; Step 2 - Sep of solute molecule (both step 1 & 2 = endothermic); Step 3 - solute & solvent mix (endo or exo)

\[
\Delta H_{\text{soln}} = \Delta H_1 + \Delta H_2 + \Delta H_3
\]

heat nrg associated w/step 1

Figure 12.2

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3. Solvation is the process in which an ion or molecule is surrounded by solvent molecules, arranged in a specific manner. IMFs of solute-solvent and solute-solvent (e.g., ion-dipole) is hydration of NaCl(s).

4. If the solute-solvent attraction is stronger than solvent-solvent attractions and solute-solute attraction, the solution process is favorable or exothermic ($\Delta H_{\text{soln}} < 0$).

5. If the solute-solvent attraction is weaker than the solute-solute attractions and solvent-solvent attractions, the solution process is endothermic; $\Delta H_{\text{soln}} > 0$.

6. Two liquids are said to be miscible if they are completely soluble in each other in all proportions.

7. Iodine is NP so CS$_2$

8. $\text{CuH}_{10}$ and P$_4$

9. Methanol is polar with H-bonds.
   Cyclohexane is nonpolar.
10. The longer the C-C chain, the more the molecule "looks like" a hydrocarbon. & the less important the -OH group becomes. Hence, as the C-C chain length increases, the molecule becomes less polar. Since "likes dissolve likes" as the molecule becomes more nonpolar, the solubility in polar water decreases. The -OH group of the alcohols can form strong H-bonds w/ water, but this property decreases as the chain length increases.

11. a) \( \frac{5.50 \text{g NaBr} \times 100}{78.2 \text{g soln}} = 7.03\% \)
   
   b) \( \frac{3.0 \text{ g KCl}}{(31.0 + 15.2) \text{g soln}} \times 100 = 16.9\% \)
   
   c) \( \frac{4.5 \text{ g toluene}}{(4.5 + 29) \text{g soln}} \times 100 = 13\% \)

12. a) \( \frac{16.2\% = 5.00 \text{g urea}}{5.00 \text{g urea} + \text{mass of water}} \times 100 \)
   
   \( \text{H}_2\text{O} = 25.9 \text{ g} \)

   b) \( \frac{1.5\% = 26.29 \text{MgCl}_2}{26.29 \text{MgCl}_2 + \text{g H}_2\text{O}} \times 100 \)
   
   \( \text{g} = 1.72 \times 10^3 \text{ g H}_2\text{O} \)
13. Find the volume of ethanol in 1.00L of 75 proof gin, then use density to find mass.

75 proof means \( \frac{75}{2} \)% = 37.5% ethanol

1.00L bottle is 37.5% is ethanol, that's ~ 0.38L or 3.8 \times 10^2 \text{ mL}

\[
\frac{3.8 \times 10^2 \text{ mL}}{1 \text{ mL}} \times 0.798 \text{ g} = 3.0 \times 10^2 \text{ g}
\]

14. \[
M = \frac{\text{mol}}{L} = \frac{30.0 \text{ g NH}_3}{17.03 \text{ g NH}_3} \times \frac{1 \text{ mol NH}_3}{17.16 \text{ mol}} = \frac{1.76 \text{ mol}}{0.102 \text{ L soln}} = 17.3 \text{ M}
\]

mass of soln = 30.0gNH₃ + 70.0gH₂O = 100.0g soln

\[
\frac{100.0 \text{ g soln}}{0.982 \text{ g}} \times 1000 \text{ mL} = 0.102 \text{ L}
\]

15. Octane has the lowest density and is immiscible with both H₂O and methanol. Octane will layer on top of the miscible mixture of water and methanol. Correct pic = C

16. a) Iodine is NP, so alcohol with longest carbon chain is most "NP" (5 carbons)

b) Methanol (CH₃OH) is most polar and is best for an ionic solid like KBr

c) Same as a