Solutions Review Questions

1. If a solution has a solubility of 14.3g/100mL, what mass of solute is required to make a 750mL of saturated solution? **(107g)**
2. At a molecular level, what is different between an unsaturated solution of sugar dissolved in water and a saturated solution of sugar dissolved in water with some undissolved sugar at the bottom of the container?
3. Define equilibrium.
4. A dissolving reaction that is endothermic only involves bonds breaking because breaking bonds require energy. Is this statement true or false? Explain.
5. Brass is a copper- zinc alloy. If the concentration of zinc is relatively low, the brass has a gold color and is often used for inexpensive jewelry. If a brass sample contains 1.7g of zinc and 33.3g of copper, what is the percentage by mass of zinc in this brass sample? **(4.9%)**
6. Suppose your company makes hydrogen peroxide solution with a generic label for drugstores in your area. Calculate the mass of pure hydrogen peroxide needed to make 1000 bottles, each containing 250mL of 3.0 % hydrogen peroxide. (7.5x103 g or 7.5 kg)
7. Formaldehyde, CH2O(g), is an indoor air pollutant that is found in synthetic materials and cigarette smoke. Formaldehyde is a carcinogen and is considered dangerous at a concentration of 5.4 ppm.
   1. If an indoor air sample with a mass of 0.59kg is collected, what is the minimum mass of formaldehyde dissolved in the air sample to be considered dangerous? Express your answer in grams. **(3.2x10-3g)**
   2. Express 5.4 ppm in percent by mass. **(5.4x10-4 %)**
8. A household ammonia solution (ex. window cleaner) has a molar concentration of 1.24mol/L. How many moles of ammonia are present in a 130mL sample? (0.161 mol)
9. What mass of sodium hydroxide (lye) must be added to 1.50 L of water in order to prepare a solution with a concentration of 0.0750 mol/L? (4.50g)
10. What volume of 0.700 mol/L brush cleaning solution can be prepared from 126 g of sodium phosphate, Na3PO4(s)? (1.10L)
11. Calculate the ion concentrations in a 0.090 mol/L solution of Na3PO4. ([Na+(aq)] = 0.270 mol/L & [PO43- (aq)] = 0.090 mol/L)
12. Calculate the ion concentrations in a solution prepared by dissolving 800 g of zinc chloride in 4.50 L of water. ([Zn2+(aq) = 1.30mol/L & [Cl-(aq)] = 2.60mol/L)
13. Calculate the concentration of dissolved K2Cr2O7 necessary to give a 0.600 mol/L K+ (aq) concentration. (0.300mol/L)
14. Ammonium carbonate, (NH4)2CO3(s) is a suitable replacement for the aqueous solution of ammonia as a household cleaning agent. Determine the mass of ammonium carbonate required to prepare 2.00 L of a 0.450 mol/L solution of ammonium carbonate. (86.5 g)
15. What volume of 14.8 mol/L ammonia is required to prepare 2.0 L of a 1.0 mol/L solution? (0.14 L)
16. What is the molar concentration of household ammonia solution if 7.5 mL are diluted to 0.250 L to make a 0.021 mol/L solution? (0.70 mol/L)

**Answers:**

2. An unsaturated solution of sugar will have the sugar molecules dispersed evenly throughout the solvent (ie. the sugar is dissolved) as explained by the equation C12H22O11(s) → C12H22O11(aq). A saturated solution with sugar still remaining on the bottom of the container still have the dissolving process taking place at the same rate as the dissolved sugar particles crystallize back into the solid form. So even though everything appears to have stopped dissolving, both the dissolving and crystallization process continually occur at the molecular level as shown by the equation C12H22O11(s) ↔ C12H22O11(aq).

3. Equilibrium occurs when the forward and the reverse reactions are taking place at the same rate.

4. This statement is false because every reaction involves bonds breaking and bonds making. An endothermic reaction overall requires energy because the energy required for bond breaking is greater than the energy released from bond making.