1. Using the periodic table, calculate the percent water in CuSO$_4$·5H$_2$O.

2. 4.50g of a hydrated compound is dehydrated by heating to constant mass. The mass of the sample after heating is 1.98 g. What is the percent water in the compound?

3. Assign oxidation numbers to each element in the following species.
   - NaOCl, HClO$_3$, SO$_4^{2-}$, KMnO$_4$, Cr$_2$O$_7^{2-}$, H$_2$O$_2$, Fe$_2$O$_3$

4. The active ingredient in bleach is NaOCl. The amount of NaOCl can be determined by titration with S$_2$O$_3^{2-}$.
   
   \[
   \text{NaOCl} + 2\text{H}^+ + 2\text{S}_2\text{O}_3^{2-} \rightarrow \text{Cl}^- + \text{H}_2\text{O} + \text{Na}^+ + \text{S}_4\text{O}_6^{2-}.
   \]

   9.19 mL of 0.0769 M S$_2$O$_3^{2-}$ is required to titrated 0.505 g of bleach solution. Calculate the percentage of NaOCl in the bleach solution. The molar mass for NaOCl is 74.5 g.

5. A 0.350 g sample of a large biomolecule was dissolved in 15.0 g of chloroform. The freezing point of the solution was -63.74°C. The freezing point of pure chloroform is -63.50°C. K$_f$ for chloroform is 4.70°C.Kg/mol. Calculate the molar mass of the biomolecule.

\[
\Delta T_f = K_f m
\]

6. Arrange the following in order of increasing freezing point.
   - 0.2 m KBr, 0.2 m C$_2$H$_6$O$_2$, 0.2 m AlCl$_3$

7. For the following reaction, assign oxidation numbers to each element and indicate which element is oxidized and which is reduced.
   
   \[
   2\text{Fe} + 6\text{HCl} \rightarrow 3\text{H}_2 + 2\text{FeCl}_3
   \]

8. For the following single replacement reaction, complete and balance the molecular equation. Also, write the complete and net ionic equations.
   
   \[
   \text{Zn(s)} + \text{Co(NO}_3)_3\text{(aq)} \rightarrow
   \]

9. An aqueous solution is saturated with Bi$_2$S$_3$. The concentration of S$^{2-}$ was determined to be 3.0 x 10$^{-15}$ mole S$^{2-}$/L. What is Ksp for Bi$_2$S$_3$?

10. Ksp for Cu(IO$_3$)$_2$ is 1.4 x 10$^{-7}$. How many grams of Cu(IO$_3$)$_2$ will dissolve in 500 mL of H$_2$O? The molar mass of Cu(IO$_3$)$_2$ is 413 g.

11. Which is the stronger acid HBrO (Ka = 2.6 x 10$^{-9}$) or HCN (Ka = 5.8 x 10$^{-10}$).
12. Determine whether solutions of the following salts will be acidic, basic, or neutral. For those that produce an acidic or basic solution, write the equation representing the reaction with water.

SrBr₂, FeSO₄, KNO₂

13. A 0.1 M solution of HBrO has a pH of 4.79. What is Ka?

14. A 0.1 M solution of NaF has a pH of 8.07. What is Kb?

Answers
1. 36%
2. 56%
3. NaOCl, Na⁺¹, O²⁻, Cl⁻¹
   HClO₃, H⁺¹, Cl⁻⁵, O²⁻
   SO₄²⁻, S⁶⁺, O²⁻
   KMnO₄, K¹⁺, Mn⁷⁺, O²⁻
   Cr₂O₇²⁻, Cr⁶⁺, O²⁻
   H₂O₂, H¹⁺, O¹⁻
   Fe₂O₃, Fe³⁺, O²⁻
4. 5.21%
5. 4.6 x 10⁻² g/mol
6. AlCl₃ < KBr < C₂H₆O₂
7. 0 +1-1 0 +3 -1
   2Fe + 6HCl \rightarrow 3H₂ + 2FeCl₃
   Fe is oxidized, H is reduced.
8. 3Zn(s) + 2Co(NO₃)₃(aq) \rightarrow 3Zn(NO₃)₂ + 2Co
   3Zn(s) + 2Co³⁺ + 6NO₃⁻ \rightarrow 3Zn²⁺ + 6NO₃⁻ + 2Co(s)
   3Zn(s) + 2Co³⁺ \rightarrow 3Zn²⁺ + 2Co(s)
9. Ksp = 1.1 x 10⁻⁷³
10. 0.68 g
11. HBrO since it has the large Ka.
12. SrBr₂ neutral
   FeSO₄ acidic, Fe²⁺ + 4H₂O \rightarrow [Fe(H₂O)₅OH]⁺ + H⁺
   KNO₂ basic, NO₂⁻ + H₂O \rightarrow HNO₂ + OH⁻
13. 2.63 x 10⁻⁹
14. 1.38 x 10⁻¹¹