

AP Chemistry – Mr. Montero – Problem Set

1) Convert 10.49 g/ml to lb/in³ (ans: 0.3791 lb/in³)

2) Hemoglobin (C₂₉₅₂H₄₆₆₄N₈₁₂O₈₃₂S₈Fe₄) is the oxygen carrier in blood.

(a) Calculate the molar mass of hemoglobin (6.53x10⁴ g/mol)

(b) An average adult has about 5.0 L of blood. Every milliliter of blood has approximately 5.0x10⁹ erythrocytes, or red blood cells, and every red blood cell has about 2.8x10⁸ hemoglobin molecules. Calculate the mass of hemoglobin molecules in grams in an average adult (ans: 7.6x10² g)

3) The density of an acid solution is 1.321 g/cm³. The solution is 29.9% acid by mass (that means there are 29.9 g of acid for every 100 g of solution). What volume of the solution contains 100.0 g of pure acid? (ans: 253 mL)

4) The total volume of seawater is 1.5 x 10²¹ L. Assume that sea water contains 3.1 percent sodium chloride by mass and that its density is 1.03 g/mL. Calculate the total mass of sodium chloride in the ocean in tons (1 ton = 2000 lb; 1 lb = 453.6 g) (ans: 5.3x10¹⁶ tons)

5) An aqueous solution of oxalic acid (H₂C₂O₄) is 0.568 M and has a density of 1.022 g/mL. What is the molality of the solution? (ans: 0.585 m)

6) What is the molarity of a solution prepared by diluting 25.0 mL of 0.400 M potassium hydroxide (KOH) to 2.67 L? (ans: 3.75x10⁻³ M)

7) What would be the molarity of a solution obtained when 275 mL of 6.00 M sodium hydroxide (NaOH) solution is mixed with each of the following?

a) 3.245 L of H₂O (ans: 0.469 M)

b) 125 mL of 6.00 M NaOH solution (ans: 6.00 M)

8) A solution is prepared by dissolving 1.00 g of CuSO₄ • 5 H₂O (Copper Sulfate pentahydrate) in enough water to make 10.00 mL of solution. A 1.00 mL portion of this solution is then diluted to a final volume of 10.00 mL. What is the molarity of the final CuSO₄ solution? (ans: 4.01x10⁻² M)

9) 500 ml of a Sulfuric Acid (H₂SO₄), is prepared using 100 ml of the Stock Solution. The Stock Solution has a density of 1.84 g/mL and a concentration of 98% (m/m). What is the molarity of the solution? (ans: 3.7 M)

10) Hematite, Fe₂O₃, is the most common iron ore. How many moles of hematite are in an ore sample that contains 355 g of iron? Assume hematite is the only source of iron in this ore. (Ans: 3.18 mol)

11) What is the molarity of the chloride ion in 250 mL of a solution containing 1.90 g of MgCl₂? (The molar mass of MgCl₂ is 95.2 g mol⁻¹) (ans: 0.160 M)

12) For each solution, identify the ions that exist in aqueous solution & specify the concentration of each.

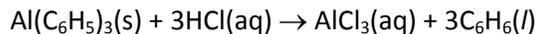
a) 0.25 M (NH₄)₂SO₄ (ans: [NH₄⁺] = 0.50M, [SO₄²⁻] = 0.25M) b) 0.123 M Na₂CO₃ ([Na⁺] = 0.246 M, [CO₃²⁻] = 0.123M)

- 13) I. $2 \text{Mn}^{2+} + 4 \text{OH}^- + \text{O}_2(g) \rightarrow 2 \text{MnO}_2(s) + 2 \text{H}_2\text{O}$
- II. $\text{MnO}_2(s) + 2 \text{I}^- + 4 \text{H}^+ \rightarrow \text{Mn}^{2+} + \text{I}_2(aq) + 2 \text{H}_2\text{O}$
- III. $2 \text{S}_2\text{O}_3^{2-} + \text{I}_2(aq) \rightarrow \text{S}_4\text{O}_6^{2-} + 2 \text{I}^-$

The reactions above occur in order. The product of the first reaction, MnO_2 reacts with iodide to form I_2 . The iodine reacts with thiosulfate to form $\text{S}_4\text{O}_6^{2-}$.

- (a) According to the equation above, how many moles of $\text{S}_2\text{O}_3^{2-}$ are required to react with 1.00 mole of O_2 ? (ans: 4 moles $\text{S}_2\text{O}_3^{2-}$)
- (b) If 4.86 milliliters of a 0.0112-molar $\text{Na}_2\text{S}_2\text{O}_3$ solution completely reacts in reaction III, what is the number of moles of O_2 that reacted? (ans: 1.36×10^{-5} mol O_2)

- 14) A 1.25-g sample contains some of the very reactive compound $\text{Al}(\text{C}_6\text{H}_5)_3$. On treating the compound with aqueous HCl, 0.951 g of C_6H_6 is obtained.



Assuming that $\text{Al}(\text{C}_6\text{H}_5)_3$ was converted completely to products, what is the weight percent of $\text{Al}(\text{C}_6\text{H}_5)_3$ in original 1.25-g sample? (ans: 83.9%)

- 15) In the photographic developing process, silver bromide is dissolved by adding sodium thiosulfate:



If you want to dissolve 0.250 g of AgBr, what volume of 0.0138 M $\text{Na}_2\text{S}_2\text{O}_3$, in milliliters, should be used? (ans: 193 mL)

- 16) Chlorine is used to disinfect swimming pools. The accepted concentration for this purpose is 1 ppm chlorine, or 1 g of chlorine per million grams of water. Calculate the volume of a chlorine solution (in milliliters) a home owner should add to her swimming pool if the solution contains 6.0 percent chlorine by mass (6 g of chlorine per 100 g of solution) and there are 2.0×10^4 gallons of water in the pool. (1 gallon = 3.79 L; density of all liquids = 1.0 g/mL.) (ans = 1.3×10^3 mL.)

- 17) Tums is a popular remedy for acid indigestion. A typical Tums tablet contains calcium carbonate plus some inert substances. When ingested, it reacts with the gastric juice (hydrochloric acid) in the stomach to give off carbon dioxide gas. When a 1.328 g tablet reacted with 40.00 mL of hydrochloric acid (density = 1.140 g/mL), carbon dioxide gas was given off and the resulting solution weighed 46.699 g. Calculate the number of liters of carbon dioxide gas released if its density is 1.81 g/L. (ans = 0.13 L)