

Complete each of the following problems. Each problem will be graded out of 5 points and the total divided by 2 so that the maximum on the quiz is 10 points. For numerical problems, you must show your work in order to possibly earn full credit. Be diligent with significant figures.

1. Ammonia (NH₃) reacts with oxygen (O₂) to produce nitric acid (HNO₃) and water. Write the balanced reaction for this process and calculate the mass of nitric acid that can be produced from 549 g of ammonia.



$$549 \text{ g-NH}_3 \times \frac{1 \text{ mol NH}_3}{17.03 \text{ g-NH}_3} = 32.23 \text{ mol NH}_3$$

$$32.23 \text{ mol-NH}_3 \times \frac{1 \text{ mol HNO}_3}{1 \text{ mol-NH}_3} = 32.23 \text{ mol HNO}_3$$

$$32.23 \text{ mol HNO}_3 \times \frac{63.01 \text{ g HNO}_3}{1 \text{ mol HNO}_3} = 2031 \text{ g HNO}_3 = \mathbf{2030 \text{ g HNO}_3 \text{ (3 sig figs)}}$$

2. What volume of 0.222 M sulfuric acid contains 11.6 grams of sulfuric acid (H₂SO₄)?

$$11.6 \text{ g-H}_2\text{SO}_4 \times \frac{1 \text{ mol H}_2\text{SO}_4}{98.08 \text{ g-H}_2\text{SO}_4} = 0.1183 \text{ mol H}_2\text{SO}_4$$

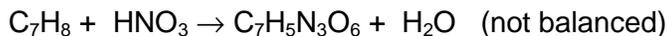
$$0.1183 \text{ mol H}_2\text{SO}_4 \times \frac{1 \text{ L}}{0.222 \text{ mol H}_2\text{SO}_4} = \mathbf{0.533 \text{ L or } 533 \text{ mL (3 sig figs)}}$$

3. How would you prepare 250 g of an aqueous solution that 4.50% glucose by mass? (The formula for glucose is $C_6H_{12}O_6$)

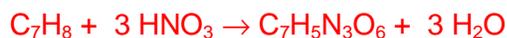
$$\frac{4.50 \text{ g glucose}}{100 \text{ g solution}} \times 250 \text{ g solution} = 11.25 \text{ g glucose} = 11 \text{ g glucose (2 sig figs)}$$

Therefore, dissolve 11 g glucose into $(250 \text{ g} - 11 \text{ g}) = 239$ grams of water to make a 4.5% glucose solution.

4. Toluene (C_7H_8) can react with nitric acid (HNO_3) to produce the explosive TNT ($C_7H_5N_3O_6$) and water by the balanced reaction below. What mass of TNT can be made from 829 g of toluene?



First balance the reaction:



Now tackle the stoichiometry

$$829 \text{ g } C_7H_8 \times \frac{1 \text{ mol } C_7H_8}{92.14 \text{ g } C_7H_8} = 8.997 \text{ mol } C_7H_8$$

$$8.997 \text{ mol } C_7H_8 \times \frac{1 \text{ mol } C_7H_5N_3O_6}{1 \text{ mol } C_7H_8} = 8.997 \text{ mol } C_7H_5N_3O_6$$

$$8.997 \text{ mol } C_7H_5N_3O_6 \times \frac{227.13 \text{ g } C_7H_5N_3O_6}{1 \text{ mol } C_7H_5N_3O_6} = \mathbf{2040 \text{ g } C_7H_5N_3O_6 (3 \text{ sig figs})}$$