

NAME

KEY

(Also Print your name on the back at the top.)

CHMY 121 EXAM #3 (CH 6) FALL 2009

For all of the following problems, **SHOW ALL YOUR WORK** and **CIRCLE YOUR FINAL ANSWER**. No credit will be given if no work is shown even if the answer is correct!!

1. Adrenaline, also known as epinephrine, is the hormone responsible for our "fight or flight" response. The formula for adrenaline is $C_9H_{13}NO_3$.

a. Calculate the formula weight of adrenaline. (6 pts)

$$9(12.01) + 13(1.008) + 14.01 + 3(16.00) = 183.20 \text{ g}$$

b. How many molecules of adrenaline are in a 0.10 g sample of adrenaline? (7 pts)

$$? \text{ molecules A} = (0.10 \text{ g A}) \left(\frac{1 \text{ mole A}}{183.20 \text{ g A}} \right) \left(\frac{6.02 \times 10^{23} \text{ molecules A}}{1 \text{ mole A}} \right) = 3.3 \times 10^{20} \text{ molecules}$$

c. How many grams of carbon are in a 0.10 g sample of adrenaline? (7 pts)

$$? \text{ g C} = (0.10 \text{ g A}) \left(\frac{1 \text{ mole A}}{183.20 \text{ g A}} \right) \left(\frac{9 \text{ mole C}}{1 \text{ mole A}} \right) \left(\frac{12.01 \text{ g C}}{1 \text{ mole C}} \right) = 5.9 \times 10^{-2} \text{ g C}$$

d. What is the mass of 25 molecules of adrenaline? (7 pts)

$$? \text{ g} = (25 \text{ molecules A}) \left(\frac{1 \text{ mole A}}{6.02 \times 10^{23} \text{ molecules A}} \right) \left(\frac{183.20 \text{ g A}}{1 \text{ mole A}} \right) = 7.6 \times 10^{-21} \text{ g}$$

2. The compound 1-propanethiol, C_3H_7S , is the eye irritant that is released when fresh onions are chopped up. If 0.550 mL of 1-propanethiol is released from one small onion and the density of 1-propanethiol is 0.852 g/mL, how many molecules of 1-propanethiol have been released? (15 pts)

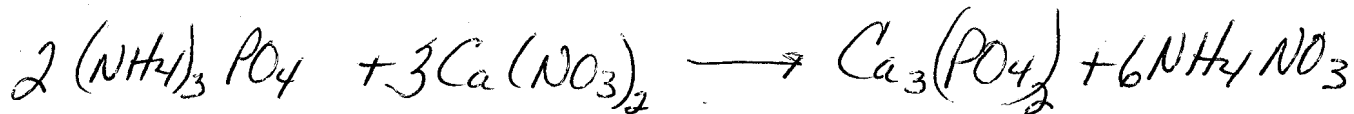
$$? \text{ molecules} = (0.550 \text{ mL}) \left(\frac{0.852 \text{ g}}{1 \text{ mL}} \right) \left(\frac{1 \text{ mole}}{76.15 \text{ g}} \right) \left(\frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mole}} \right) =$$

$$3.70 \times 10^{21} \text{ molecules}$$

$$3(12.01) + 8(1.008) + 32.06 = 76.15 \text{ g}$$

3. When ammonium phosphate reacts with calcium nitrate, calcium phosphate and ammonium nitrate are produced.

a. Write and balance the equation. (8 pts)



b. How many grams of ammonium nitrate can be produced from 10.25 g of calcium nitrate? (10 pts)

$$7 \text{ g NH}_4\text{NO}_3 = (10.25 \text{ g Ca}(\text{NO}_3)_2) \left(\frac{1 \text{ mole Ca}(\text{NO}_3)_2}{164.10 \text{ g Ca}(\text{NO}_3)_2} \right) \left(\frac{6 \text{ mole NH}_4\text{NO}_3}{3 \text{ mole Ca}(\text{NO}_3)_2} \right) \left(\frac{80.05 \text{ g NH}_4\text{NO}_3}{1 \text{ mole NH}_4\text{NO}_3} \right)$$

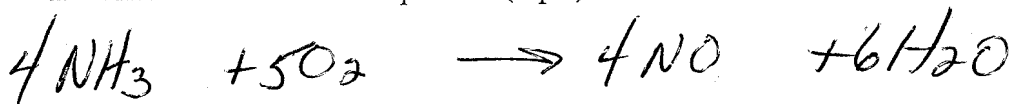
$$\text{NH}_4\text{NO}_3 = 2(14.01) + 4(1.008) + 3(16.00) = 80.05 \text{ g}$$

$$\text{Ca}(\text{NO}_3)_2 = 40.08 + 2(14.01) + 6(16.00) = 164.10 \text{ g}$$

$$= 9.982 \text{ g NH}_4\text{NO}_3$$

4. Ammonia reacts with oxygen to produce nitrogen monoxide and water. 15.0 g of ammonia is reacted with 15.0 g of oxygen and 6.54 g of water is produced.

a. Write and balance the equation. (8 pts)



b. What is the limiting reagent? (8 pts)

$$\text{NH}_3 \left(\frac{15 \text{ g NH}_3}{17.03 \text{ g NH}_3} \right) \left(\frac{6 \text{ mole H}_2\text{O}}{4 \text{ mole NH}_3} \right) = 1.32 \text{ mole H}_2\text{O}$$

$$\text{O}_2 \left(\frac{15 \text{ g O}_2}{32.00 \text{ g O}_2} \right) \left(\frac{6 \text{ mole H}_2\text{O}}{5 \text{ mole O}_2} \right) = 0.563 \text{ mole H}_2\text{O}$$

50
O₂
is
L.R.

c. What is the theoretical yield? (8 pts)

$$(0.563 \text{ mole H}_2\text{O}) \left(\frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mole H}_2\text{O}} \right) = 10.1 \text{ g H}_2\text{O}$$

d. What is the % yield? (8 pts)

$$\% \text{ Y} = \frac{\text{actual Y}}{\text{theor. Y}} \times 100 = \frac{6.54 \text{ g H}_2\text{O}}{10.1 \text{ g H}_2\text{O}} \times 100 = 64.8\%$$

5. Define oxidation and reduction. (4 pts)

oxidation is loss of electrons
reduction is gain of electrons

6. The reaction in question #4 is a redox reaction. (4 pts)

a. what is being oxidized? N

b. what is being reduced? O_2