**Exercise 7**

**Chem 1013 Intro to Chem**

**Spring 2014 Alfred State College**

Limiting Yield calculations answers

**Sample reaction 1**



**+ 3HNO3 🡪 + 3H2O**

**(toluene) (TNT)**

**MW 92 63 165 18**

**1) 2 moles of toluene and 5 moles of HNO3 are combined.**

**a) what is the limiting reagent ?**

**2 moles toluene => 2 moles TNT produced**

**5 moles HNO3=> 1/3 \* 5 mol HNO3 =1.6666 mol TNT produced . Lower => limiting**

**b) what is the theoretical yield of TNT ?**

**1.666 mol = 1.6666\*165=175 g**

**=1.6666\*6.02\*1023 = 10\*1023 molecules**

**2) 0.557 g of toluene and 3.054 g HNO3 are cautiously combined to produce TNT.**

**How many grams of TNT can in theory form ?**

**0.557 g toluene = 0.006054 mol toluene => 0.006054 moles TNT produced (limiting)**

**92 g/mol**

**3.054 g HNO3 = 0.04848 mol HNO3 => 0.04848 \*1/3 = 0.0161 mol TNT produced**

**63 g/mol**

**The toluene limits since it predicts a lower amount of TNT mol production**

**∴grams TNT = 0.006054\*165= 1.0 g TNT**

**3) 3.130 g HNO3 and 2.292 g toluene combine. How many TNT molecules can form in theory?**

**3.130 g HNO3 = 0.0497 mol HNO3=> 0.0497/3 mol TNT =0.016566 mol TNT (limiting)**

**63 g/mol**

**2.292 g toluene=0.0249 mol toluene => 0.0249 mol TNT**

**92 g/mol**

**Molecules TNT= 0.016566\*6.02\*1023~ 1022 molecules TNT**

**4) The weight ratio of toluene to HNO3 has been adjusted at a commercial explosive plant to**

**3:1 toluene:HNO3 . Which is limiting, toluene or HNO3 ?**

**Stoichiometric requirement is 1:3 = toluene: HNO3**

**Since toluene:HNO3 given is 3:1, there is an excess of toluene so HNO3 is limiting**