Example Calculations For Stoichiometry

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The steps to calculate stoichiometry problems highlighted in **[Stoichiometry Notes Handout]** will be used in the following problem.

How many grams of nitrogen gas is produced if I react 32.5 grams of ammonia gas (NH_3) using the following equation?

$$4\ NH_3\ (g) + 6\ NO(g) \rightarrow 6\ H_2O(g) + 5\ N_2\ (g)$$

step 1: Balanced chemical rxn; get/see from problem

step 2: grams NH_3 → mole NH_3: use molar mass

molar mass NH_3: $1(14g) + 3(1g) = \frac{17g\ NH_3}{1\ mole\ NH_3}$

step 3: mole NH_3 (known) → mole N_2 (unknown) use molar ratio

- For molar ~~mass~~ ratio, use actual coefficient numbers from balanced chemical rxn. DO NOT REDUCE/SIMPLIFY this numbers

step 4: mole N_2 → g N_2: use molar mass

molar mass N_2: $2(14g) = \frac{28g\ N_2}{1\ mole\ N_2}$

Actual work (excluding molar mass calculation from above):

$$(32.5g\ NH_3)\left(\frac{1\ mole\ NH_3}{17g\ NH_3}\right)\left(\frac{5\ mole\ N_2}{4\ mole\ NH_3}\right)\left(\frac{28g\ N_2}{1\ mole\ N_2}\right) = 66.91g\ N_2$$

$$= \boxed{66.9g\ N_2}$$

(STOICHIOMETRY BY EQUATION, ON BACK)

Example Calculation for Stoichiometry By Equation

Step 1 Balanced chem rxn

$$4\,NH_{3(g)} + 6\,NO_{(g)} \rightarrow 6\,H_2O_{(g)} + 5\,N_{2(g)}$$

$32.5\,g\,NH_3$ $\qquad$ $?\,g\,N_2$

Step 2: $\#\,m.u = \dfrac{\#\,g}{\left(\frac{\#\,g}{m.u}\right)}$

$mm\,NH_3: 1(14_g) + 3(1_g) = \dfrac{17\,g\,NH_3}{1\,m.u\,NH_3}$

$$= \frac{32.5\,g\,NH_3}{\left(\frac{17\,g\,NH_3}{1\,m.u\,NH_3}\right)} = 1.911\,m.u\,NH_3$$

Step 3: $(1.911\,m.u\,NH_3)\left(\dfrac{5\,m.u\,N_2}{4\,m.u\,NH_3}\right) = 2.388\,m.u\,N_2$

Step 4: $\#\,m.u = \dfrac{\#\,g}{\left(\frac{\#\,g}{m.u}\right)} \Rightarrow \#\,g = (\#\,m.u)\left(\dfrac{\#\,g}{m.u}\right)$

$mm\,N_2: 2(14_g) = \dfrac{28\,g\,N_2}{1\,m.u\,N_2}$ $\qquad$ $= (2.388\,m.u\,N_2)\left(\dfrac{28\,g\,N_2}{1\,m.u\,N_2}\right)$

$$= 66.86\,g\,N_2$$

$$= \boxed{66.9\,g\,N_2}$$