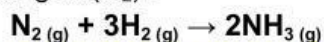Problem 1: What volume of nitrogen gas (N_2) would be completely consumed in the reaction with 30.80 g of hydrogen gas (H_2)?

$$N_{2\,(g)} + 3H_{2\,(g)} \rightarrow 2NH_{3\,(g)}$$

Step 1: Based on the units in the problems, select the correct conversion factor(s) that must be used to solve the problem.

1 mol N_2 = 3 mol H_2	1 mol N_2 = 2 mol NH_3	3 mol H_2 = 2 mol NH_3
1 mol N_2 = 28.01 g N_2	1 mol H_2 = 2.016 g H_2	1 mol NH_3 = 17.034 g NH_3
1 mol N_2 = 6.022*10^{23} molecules N_2		1 mol H_2 = 6.022*10^{23} molecules H_2
1 mol N_2 = 22.4 Liters N_2		1 mol H_2 = 22.4 Liters H_2

Step 2: Plug in the correct conversion factors into the T-chart so that the units along the diagonal cancel.

30.80 g H_2

Step 3: Use desmos to obtain your final answer.

ANSWER:

Problem 2: How many moles of hydrogen gas (H_2) are required to react completely with 0.75 moles of nitrogen gas (N_2)?

$$N_{2\,(g)} + 3H_{2\,(g)} \rightarrow 2NH_{3\,(g)}$$

Step 1: Based on the units in the problems, select the correct conversion factor(s) that must be used to solve the problem.

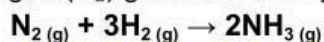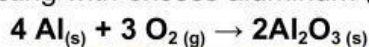| 1 mol N_2 = 3 mol H_2	1 mol N_2 = 2 mol NH_3	3 mol H_2 = 2 mol NH_3
1 mol N_2 = 28.01 g N_2	1 mol H_2 = 2.016 g H_2	1 mol NH_3 = 17.034 g NH_3
1 mol N_2 = 6.022*10^{23} molecules N_2		1 mol H_2 = 6.022*10^{23} molecules H_2
1 mol N_2 = 22.4 Liters N_2		1 mol H_2 = 22.4 Liters H_2

Step 2: Plug in the correct conversion factors into the T-chart so that the units along the diagonal cancel.

0.75 mol N_2

Step 3: Use desmos to obtain your final answer.

ANSWER:

Problem 3: How many moles of ammonia (NH_3) would be produced from the reaction of 2.56×10^{23} molecules of nitrogen gas (N_2) given excess hydrogen gas (H_2)?

$$N_{2\,(g)} + 3H_{2\,(g)} \rightarrow 2NH_{3\,(g)}$$

Step 1: Based on the units in the problems, select the correct conversion factor(s) that must be used to solve the problem.

1 mol N_2 = 3 mol H_2	1 mol N_2 = 2 mol NH_3	3 mol H_2 = 2 mol NH_3
1 mol N_2 = 28.01 g N_2	1 mol H_2 = 2.016 g H_2	1 mol NH_3 = 17.034 g NH_3
1 mol NH_3 = 6.022×10^{23} molecules NH_3		1 mol N_2 = 6.022×10^{23} molecules N_2
1 mol NH_3 = 22.4 Liters NH_3		1 mol N_2 = 22.4 Liters N_2

Step 2: Plug in the correct conversion factors into the T-chart so that the units along the diagonal cancel.

2.56×10^{23} molecules N_2

Step 3: Use desmos to obtain your final answer.

ANSWER:

Problem 4: How many moles of aluminum oxide (Al_2O_3) can be produced from 12.8 moles of oxygen gas (O_2) reacting with excess aluminum (Al)?

$$4\,Al_{(s)} + 3\,O_{2\,(g)} \rightarrow 2Al_2O_{3\,(s)}$$

Step 1: Based on the units in the problems, select the correct conversion factor(s) that must be used to solve the problem.

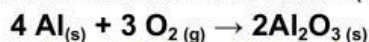| 4 mol Al= 3 mol O_2	4 mol Al= 2 mol Al_2O_3	3 mol O_2= 2 mol Al_2O_3
1 mol Al = 26.98 g Al	1 mol O_2 = 32 g O_2	1 mol Al_2O_3= 101.96 g Al_2O_3
1 mol O_2 = 6.022×10^{23} molecules O_2		1 mol Al_2O_3 = 6.022×10^{23} particles of Al_2O_3
1 mol NH_3 = 22.4 Liters O_2		1 mol Al= 6.022×10^{23} atoms of Al

Step 2: Plug in the correct conversion factors into the T-chart so that the units along the diagonal cancel.

12.8 mol O_2

Step 3: Use desmos to obtain your final answer.

ANSWER:

Problem 5: What volume of oxygen gas (O_2) would be required to react with excess aluminum (Al) to produce 1.35 moles of aluminum oxide (Al_2O_3)?

$$4\ Al_{(s)} + 3\ O_{2\ (g)} \rightarrow 2Al_2O_{3\ (s)}$$

Step 1: Based on the units in the problems, select the correct conversion factor(s) that must be used to solve the problem.

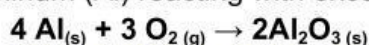| 4 mol Al= 3 mol O_2	4 mol Al= 2 mol Al_2O_3	3 mol O_2= 2 mol Al_2O_3
1 mol Al = 26.98 g Al	1 mol O_2 = 32 g O_2	1 mol Al_2O_3= 101.96 g Al_2O_3
1 mol O_2 = 6.022*10^{23} molecules O_2		1 mol Al_2O_3 = 6.022*10^{23} particles of Al_2O_3
1 mol O_2 = 22.4 Liters O_2		1 mol Al= 6.022*10^{23} atoms of Al

Step 2: Plug in the correct conversion factors into the T-chart so that the units along the diagonal cancel.

1.35 mol Al_2O_3

Step 3: Use desmos to obtain your final answer.

ANSWER:

Problem 6: How many grams of aluminum oxide (Al_2O_3) would be produced from the reaction of 0.25 grams of aluminum (Al) reacting with excess oxygen gas (O_2)?

$$4\ Al_{(s)} + 3\ O_{2\ (g)} \rightarrow 2Al_2O_{3\ (s)}$$

Step 1: Based on the units in the problems, select the correct conversion factor(s) that must be used to solve the problem.

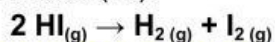| 4 mol Al= 3 mol O_2	4 mol Al= 2 mol Al_2O_3	3 mol O_2= 2 mol Al_2O_3
1 mol Al = 26.98 g Al	1 mol O_2 = 32 g O_2	1 mol Al_2O_3= 101.96 g Al_2O_3
1 mol O_2 = 6.022*10^{23} molecules O_2		1 mol Al_2O_3 = 6.022*10^{23} particles of Al_2O_3
1 mol O_2 = 22.4 Liters O_2		1 mol Al= 6.022*10^{23} atoms of Al

Step 2: Plug in the correct conversion factors into the T-chart so that the units along the diagonal cancel.

0.25 g Al

Step 3: Use desmos to obtain your final answer.

ANSWER:

Problem 7: How many grams of iodine gas (I_2) would be produced from the complete combustion of 8.76 L of hydrogen iodide (HI)?

$$2 \; HI_{(g)} \rightarrow H_{2 \, (g)} + I_{2 \, (g)}$$

Step 1: Based on the units in the problems, select the correct conversion factor(s) that must be used to solve the problem.

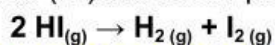| 2 mol HI= 1 mol H_2	2 mol Hi= 1 mol I_2	1 mol H_2 = 1 mole I_2
1 mol HI= 127.908 g HI	1 mol H_2 = 2.016 g O_2	1 mol I_2= 253.8 g I_2
1 mol HI = 6.022*10^{23} molecules HI		1 mol I_2= 6.022*10^{23} molecules I_2
1 mol HI = 22.4 Liters HI		1 mol I_2 = 22.4 L I_2

Step 2: Plug in the correct conversion factors into the T-chart so that the units along the diagonal cancel.

8.76 L HI

Step 3: Use desmos to obtain your final answer.

ANSWER:

Problem 8: How many moles of hydrogen gas (H_2) will be produced in this reaction when 34.5 moles of hydrogen iodide (HI) are decomposed?

$$2 \; HI_{(g)} \rightarrow H_{2 \, (g)} + I_{2 \, (g)}$$

Step 1: Based on the units in the problems, select the correct conversion factor(s) that must be used to solve the problem.

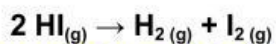| 2 mol HI= 1 mol H_2	2 mol Hi= 1 mol I_2	1 mol H_2 = 1 mole I_2
1 mol HI= 127.908 g HI	1 mol H_2 = 2.016 g O_2	1 mol I_2= 253.8 g I_2
1 mol HI = 6.022*10^{23} molecules HI		1 mol I_2= 6.022*10^{23} molecules I_2
1 mol HI = 22.4 Liters HI		1 mol I_2 = 22.4 L I_2

Step 2: Plug in the correct conversion factors into the T-chart so that the units along the diagonal cancel.

34.5 mol HI

Step 3: Use desmos to obtain your final answer.

ANSWER:

Problem 9: How many moles of hydrogen iodide (HI) are required to produce 13.5 L of hydrogen gas (H_2)

$$2 \, HI_{(g)} \rightarrow H_{2 \, (g)} + I_{2 \, (g)}$$

2 mol HI= 1 mol H_2	2 mol Hi= 1 mol I_2	1 mol H_2 = 1 mole I_2
1 mol HI= 127.908 g HI	1 mol H_2 = 2.016 g O_2	1 mol I_2= 253.8 g I_2
1 mol HI = 6.022*10^{23} molecules HI		1 mol I_2= 6.022*10^{23} molecules I_2
1 mol HI = 22.4 Liters HI		1 mol H_2 = 22.4 L H_2

Step 2: Plug in the correct conversion factors into the T-chart so that the units along the diagonal cancel.

13.5 L H_2

Step 3: Use desmos to obtain your final answer.

ANSWER: