Question was:

Given, $3\ H_2 + N_2 \rightarrow 2\ NH_3$

If 11.2 L of H_2 and 11.2 L of N_2 are mixed, what's the most NH_3 that can be produced? Which gas will be in excess, and how many liters will be in excess?

<u>Solution:</u>

<u>Longer Method</u>

11.2 L of an ideal gas is 0.500 moles at STP

So we have 0.500 moles of hydrogen and 0.500 moles of nitrogen.

$3\ H_2 + N_2 \rightarrow 2\ NH_3$

If you assume that 0.500 moles of N_2 react, then according to the ratio , you would need 3*0.500 =1.500 moles of hydrogen. But we only have 0.500, so the N_2 can't all be reacting.

If we assume that all 0.500 moles of H_2 react, then only 0.500/3 moles of N_2 react, which means that there will be 0.500 – 0.500/3 leftover moles of N_2 = 0.333..moles = 7.47 L leftover nitrogen.

Since all 0.500 moles of H_2 react, according to the ratio, 2/3(0.500) moles of NH_3 are produced = 0.333..moles = 7.47 L of $NH_{3.}$

<u>Shorter Method(L of ideal gases are proportional to moles at same T,P (avogadro's Hypothesis))</u>

We have 11.2 L of hydrogen and 11.2 L of nitrogen.

$3\ H_2 + N_2 \rightarrow 2\ NH_3$

If you assume that 11.2 L of nitrogen of N_2 react, then according to the ratio , you would need 3*11.2 L =33.6 L of hydrogen. But we only have 11.2 L, so the N_2 can't all be reacting.

If we assume that all 11.2 L of H_2 react, then only 11.2 L/3 moles of N_2 react, which means that there will be 11.2 – 11.2/3= 7.47 L leftover nitrogen.

Since all 11.2 L of H_2 react, according to the ratio, 2/3(11.2 L) = 7.47 L of $NH_{3.}$