Answer on Question#40493-Chemistry-Other

Question

Nitrogen and hydrogen combine at high temperature, in the presence of a catalyst, to produce ammonia: $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

Assume 0.140 mol of N_2 and 0.460 mol of H_2 are present initially.

1) After complete reaction, how many moles of ammonia are produced?

2) How many moles of H_2 remain?

3) How many moles of N_2 remain?

4) What is the limiting reactant?

Solution

As is clear from the chemical equation, the molar ratio $H_2/N_2 = 3/1$.

$n(H_2)/n(N_2) = 0.460 / 0.140 \approx 3.286$, i.e. H_2 was taken in excess and some part of it remains unreacted. **N_2 is limiting reactant**, it reacts completely and **0 moles of N_2 remains** unreacted.

Number of moles of NH_3 produced may be calculated from the proportion:

1 mol (N_2) – 2 mol (NH_3) (according to the chemical equation)

0.140 mol (N_2) – X mol (NH_3)

$X = 0.140 \cdot 2 / 1 =$ **0.280 mol of ammonia are produced**.

Number of moles of H_2 reacted:

1 mol (N_2) – 3 mol (H_2) (according to the chemical equation)

0.140 mol (N_2) – Y mol (H_2)

$Y = 0.140 \cdot 3 / 1 = 0.420$ mol

Number of moles of H_2 remained:

$0.460 – 0.420 =$ **0.040 mol of H_2 remains**

Answers:

1) 0.280 moles

2) 0.040 moles

3) 0 moles

4) N_2