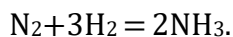


### Answer on Question # 73221 - Chemistry - General Chemistry

A 1.0 liter vessel at 400°C contains the following equilibrium concentrations:  $N_2=1.00M$ ,  $H_2=0.500M$ ,  $NH_3=0.500M$ . How many mole of hydrogen must be removed from the vessel to get a new equilibrium concentration of nitrogen at 1.20M?

#### Solution

The reaction proceeding in the vessel is as follows:



The value of equilibrium constant ( $K_c$ ) for the given reaction at 400°C is

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3},$$

$$K_c = 0.500^2 / (1.00 \cdot 0.500^3) = 2.$$

Since the volume is 1L, the molarities and number of moles are the same. In order to get a new equilibrium concentration of nitrogen at 1.20M, we must gain additional  $1.20 - 1.00 = 0.20$  M of nitrogen, corresponding to the removal of  $(2 \times 0.20) = 0.40$  M of  $NH_3$ . Therefore, the equilibrium concentration of  $NH_3$  is  $0.50 - 0.40 = 0.10$  M. Solving the equilibrium constant equation for the equilibrium concentration of  $H_2$ :

$$[H_2] = \frac{[NH_3]^2}{[N_2]K_c} = \frac{[0.10]^2}{(2 \cdot 1.20)} = 0.161 \text{ M}.$$

The amount of hydrogen to be removed is  $0.500 - 0.161 = 0.339$  M, or 0.339 moles.

**Answer: 0.339 moles.**