Answer on Question #71206 – Chemistry – General Chemistry
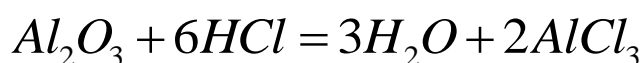
Task:

How many moles of aluminum chloride can be formed by the reaction of 0.75 moles of aluminum oxide with 2.40 moles of hydrochloric acid?

Solution:

Chemical reaction equation:

$$Al_2O_3 + 6HCl = 3H_2O + 2AlCl_3$$

If we pretend that Al2O3 is the limiting reagent, we would calculate the required amount of HCl as follows:

$$moles\ HCl = 0.75\,mol\ Al_2O_3 * \frac{6\,mol\ HCl}{1\,mol\ Al_2O_3} = 4.5\,mol\ HCl.$$

Based on this calculation, we would need 4.5 moles of HCl if Al2O3 is actually the limiting reagent. Since we have 2.4 moles of HCl which is less than our calculation tells us that we would run out of HCl before we fully reacted all of the Al2O3. Therefore, HCl is our limiting reagent.

Then,

$$\frac{n(HCl)}{6} = \frac{n(AlCl_3)}{2};$$
$$n(AlCl_3) = \frac{2*n(HCl)}{6} = \frac{2*2.4}{6} = 0.8\,moles$$

Answer: 0.8 moles of $AlCl_3$