Answer on question #61160, Chemistry / General Chemistry

Strontium Hydride solid reacts with water to form strontium hydroxide and hydrogen gas: SrH2(s) + H2O(L) -> Sr(OH)2(s) + H2(g).
How many grams of H2O and SrH2 are required to produce 500 grams of Sr(OH)2? Also, find the volume of hydrogen gas that will be produced from the reaction? Assume the condition is at STP.

Solution:

$SrH_2(s) + 2H_2O(L) \rightarrow Sr(OH)_2(s) + 2H_2(g)$

$M(SrH_2) = 89.6$ g/mol;

$M(H_2O) = 18 \times 2 = 36$ g/mol (because 2 mol H_2O).;

$M(Sr(OH)_2) = 121.6$ g/mol;

$M(H_2) = 2 \times 2 = 4$ g/mol (because 2 mol H_2).

We draw up proportion:

x (g) : 89.6 (g/mol) = 500 (g) : 121,6 (g/mol)

Where x - the mass of SrH_2.

$$x = \frac{89.6\ (\frac{\text{g}}{\text{mol}}) \times 500\ (\text{g})}{121.6\ (\frac{\text{g}}{\text{mol}})} = 368.42\ g$$

$m(SrH_2) = 368.42$ (g).

x (g) : 36 (g/mol) = 500 (g) : 121.6 (g/mol)

Where x - the mass of H_2O.

$$x = \frac{36\ (\frac{\text{g}}{\text{mol}}) \times 500\ (\text{g})}{121.6\ (\frac{\text{g}}{\text{mol}})} = 148.02\ g$$

$m(H_2O) = 148.02$ (g).

We find how many grams of H_2 can be produced in the reaction.

Using the limiting reactant's value of SrH_2, because of H_2O can produce a larger quantity of H_2 than of SrH_2

$$x = \frac{4\ (\frac{\text{g}}{\text{mol}}) \times 368.33\ (\text{g})}{89.6\ (\frac{\text{g}}{\text{mol}})} = 16.44\ g$$

Find the volume of H_2.

Mass of 1 mole of hydrogen is 2 g. One mole of any gas will occupy a volume of 22.4 liters at STP.

We draw up proportion:

2 (g) : 22.4 (L) = 16.44 (g) : x (L),

Where x - the volume of H_2.

$$x = \frac{22.4\ (\mathrm{L}) \times 16.44\ (\mathrm{g})}{2\ (\mathrm{g})} = 184.128\ L$$

$V(H_2)$ = 184.128 (L).

Answer: $m(SrH_2)$ = 368.42 (g); $m(H_2O)$ = 148.02 (g); $V(H_2)$ = 184.128 (L)