Answer on Question #51553 - Chemistry – Other

Question

If you have 100 g of NaOH and 100 g of Al to perform the reaction, how many grams of H_2 will you produce?

$6NaOH(aq) + 2Al(s) = 2NA_3AlO_3(s) + 3H_2(g)$

Answer:

Molar masses of the reactants equal:

M(NaOH) = 40 g/mol, M(Al) = 27 g/mol

Number of moles of the reactants are:

$$n(Al) = \frac{m(Al)}{M(Al)} = \frac{100}{27} = 3.7\ mol$$

$$n(NaOH) = \frac{m(NaOH)}{M(NaOH)} = \frac{100}{40} = 2.5\ mol$$

Then we make a proportion:

2 moles of Al react with 6 moles of NaOH

3.7 moles of Al – *x* moles of NaOH

$$x = \frac{3.7 \cdot 6}{2} = 11.1\ moles\ of\ NaOH\ should\ react\ with\ 3.7\ moles\ of\ Al$$

There are only 2.5 moles of sodium hydroxide, therefore it is the limiting reactant.

We need to make another proportion to calculate the mass of H_2 that could be produced by the chemical reaction:

6 moles of NaOH produce 3 moles of H_2

2.5 moles of NaOH – *x* moles of H_2

$$x = \frac{2.5 \cdot 3}{6} = 1.25\ moles\ of\ H_2\ could\ be\ produced$$

The mass of H_2 equals:

$$m(H_2) = n(H_2) \cdot M(H_2) = 1.25 \cdot 2 = 2.5\ g$$

Answer: 2.5 g of H_2