Answer on Question #41188-Chemistry-Inorganic Chemistry

Question:

Calculate the volume ,mass and number of molecules of hydrogen liberated when 299 g of sodium react with excess of water at STP.

Solution:

Reaction equation

$$2Na + 2H_2O \rightarrow 2NaOH + H_2 \uparrow$$

Amount of substance of sodium is:

$$\nu(Na) = \frac{m(Na)}{Ar(Na)} = \frac{299g}{22.98\ mol/g} = 13\ mol$$

From reaction equation:

$$\frac{\nu(Na)}{\nu(H_2)} = \frac{2}{1}$$

Thus,

$$\nu(H_2) = 13 * 2 = 26\ mol$$

For STP:

$$V = V_m * \nu$$

Calculation:

$$V(H_2) = 22.4\frac{L}{mol} * 26\ mol = \mathbf{582.4\ L}$$

Calculation mass from amount of substance:

$$m(H_2) = \nu(H_2) * Mr(\ H_2) = 26\ mol * 2\frac{g}{mol} = \mathbf{52\ g}$$

Calculating number of molecules using Avogadro's number:

$$N = N_A * \nu(H_2) = 6.02 * 10^{23} mol^{-1} * 26\ mol = \ \mathbf{1.56 * 10^{25}}$$