

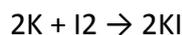
Answer on Question #57246 - Chemistry - Other

Question:

If 100 grams of potassium (K) reacts with 260 grams of iodine (I₂) to form potassium iodide (KI), which is the limiting reactant? If the percent yield is 80% how much KI is produced?

Answer:

The reaction equation of potassium and iodine is



Then, one can see that 2 moles of potassium react with 1 mole of iodine. Let's calculate the number of the moles of potassium and iodine given in the task:

$$n(K) = \frac{m(K)}{M(K)} = \frac{100}{39.1} = 2.56 \text{ mol}$$

$$n(I_2) = \frac{m(I_2)}{M(I_2)} = \frac{260}{253.8} = 1.02 \text{ mol}$$

According to reaction:

$$n(I_2) = \frac{n(K)}{2}$$

Then, if one compares $2.56/2 = 1.28$ and 1.02 mol, one can see that iodine is the limiting reactant.

The percent yield is the ratio of the mass of KI produced to the theoretical value:

$$\eta = \frac{m(KI) - \text{produced}}{m(KI) - \text{theoretical}} \cdot 100\%$$

The theoretical value can be calculated from the limiting reactant quantity:

$$n(I_2) = \frac{n(KI)}{2}, \quad n(KI) = 2n(I_2)$$

$$n(KI) = 2 * 1.02 = 2.04 \text{ mol}, m(KI) = n(KI) \cdot M(KI) = 2.04 \cdot 166.0 = 340.1 \text{ g}$$

This mass is the theoretical value. Then, we use the percent yield to calculate the mass of potassium iodide produced:

$$m(KI - \text{exp}) = \eta \cdot m(KI - \text{theor})/100\% = 0.8 \cdot 340.1 = \mathbf{272.1 \text{ g}}$$

