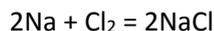


If 0.230 g of sodium(Na) metal reacts with 0.355 g of chlorine gas(Cl₂), what is the mass of sodium chloride(NaCl) produced?

Solution:

1. Chemical reaction



2. Calculation of the molecular weight of NaCl

To calculate the molecular weight (Mw) of substance DxEy we will use such formula:

$MW(DxEy) = x \cdot A(D) + y \cdot A(E)$, where A(E) is the atomic weight of element E.

Atomic weights of elements are: A(Na) = 22.990; A(Cl) = 35.453;

$Mw[\text{NaCl}] = 22.990 + 35.453 = 58.443 \text{ g/mol}$;

3. We count how many moles of Na and Cl₂ we have

$\gamma = m / Mw$, where m is mass of substance, g; γ is quantity of substance, mole;

$\gamma(\text{Na}) = 0.230 / 22.990 = 0.010$ moles

$\gamma(\text{Cl}_2) = 0.355 / (35.453 \cdot 2) = 0.005$ moles

4. We count which compound is in excess and which is in need (or they react completely).

Two moles of Na interaction with one mole of Cl₂

We suppose that all Na react with Cl₂. Then we will get:

2 moles of Na react with 1 mole of Cl₂

0.010 moles of Na react with X moles of Cl₂

Then $X = 0.010 \cdot 1/2 = 0.005$ moles;

We calculate that 0.005 moles of Cl₂ react in this chemical reaction. And in the condition of this task is said that mass of Cl₂ is 0.355 g. It means that all substances react completely.

5. We count how many moles of produced sodium chloride.

From 2 mole of Na we get 2 moles of NaCl

From 0.010 moles of Na we get Y moles of NaCl

Then $Y = 2 \cdot 0.010 / 2 = 0.010$ moles

6. We count the mass of produced sodium chloride.

$\gamma = m / Mw$, then $m = \gamma \cdot Mw$

$m(\text{NaCl}) = 0.010 \cdot 58.443 = 0.584 \text{ g}$

Mass of NaCl is 0.584 g.