Methane CH_4 burns in oxygen to produce carbon dioxide and water. How much water was produced if a mixture of 0.550 mol of methane was burned in 4.25 mol of oxygen in a sealed steel vessel?

Solution:

Methane burns in oxygen according to equation:

$CH_4 + 2O_2 = CO_2 + 2H_2O$;

For complete burning of 0.55 moles of methane we need double amount of oxygen (according to stoichiometric coefficients, each mole of methane reacts with 2 moles of oxygen to produce 1 mole of carbon dioxide and 2 moles of water). Then:

$n(O_2) = 2n(CH_4) = 2*0.55 \text{ mol} = 1.1 \text{ mol}$

According to task, we have 4,25 moles of oxygen, while for complete burning of methane we need 0.11 moles. It means that in our case oxygen is in excess. So we are calculating amount of water using number of moles of burned methane.

$n(H_2O) = 2n(CH_4) = 2*0.55 \text{ mol} = 1.1 \text{ mol}$ (according to stoichiometric coefficients, amount of moles of water is two times more than amount of methane).

As we know amount of moles of water and its molar mass, we can calculate mass of water:

$m(H_2O) = n(H_2O)*M(H_2O) = 0.11 \text{ mol} * (1+1+16) \text{ g/mol} = 1.1 * 18 \text{ g/mol} =$ **19.8 g**

Answer:

After burning of 0.55 moles of methane will be produced **19.8 g** of water.