Task:
How many liters of water vapor can be produced if 8.9 liters of methane gas (CH4) are combusted, if all measurements are taken at the same temperature and pressure?

Solution:
The chemical equation for the combustion reaction is
$CH_4 + 2O_2 = CO_2 + 2H_2O$

If the measurements are taken at STP (T=273 K, p = 1 atm), the number of moles of CH_4 is
$n(mol) = V(L) / V_0(L)$

n- number of moles of methane
V – volume of CH_4, (L)
V_0 – molar volume of the gas at STP, (L)
$n(CH_4) = V(CH_4) / V_0 = 8.9 / 22.4 = 0.397$ mol

According to the chemical equation the number of moles of water vapor is twice the number of moles of methane.
$n(H_2O) = 2n(CH_4) = 2 \cdot 0.397 = 0.794$ mol

The volume of water vapor is
$V(H_2O) = n(mol) \cdot V_0(L) = 0.794 \cdot 22.4 = 17.8$ L

Answer: $V(H_2O) = 17.8$ L