Steam separator 4

A saturated mixture with a quality of 75% and a mass flow of $\dot{m}_{mix} = 160$ kg/s enters a liquid - steam separator. It is separated in the liquid – steam separator and leaves as a saturated liquid and a saturated vapor.

What is the mass flow of the saturated vapor?

Answer: 120 kg/s

Explanation: A quality of 75%, $x = 0.75$ means that 75% of the mass of the mixture is a saturated vapor and 25% a saturated liquid. If the liquid and vapor are separated the mass flow rate of the saturated vapor is: $\dot{m}_{sat.vapor} = x \cdot \dot{m}_{mix} = 0.75 \cdot 160 = 120$ kg/s. The mass flow rate of the saturated liquid is $\dot{m}_{sat.liquid} = (1 - x) \cdot \dot{m}_{mix} = 0.25 \cdot 160 = 40$ kg/s. Note that both mass flow rates together should be the mass flow rate of the saturated mixture entering: $\dot{m}_{sat.vapor} + \dot{m}_{sat.liquid} = x \cdot \dot{m}_{mix} + (1 - x) \cdot \dot{m}_{mix} = \dot{m}_{mix} \rightarrow 120 + 40 = 160$ kg/s correct.