Question #70930

The latent heat of fusion for water is 33.5×10^4 J/kg, while the latent heat of vaporization is 22.6×10^5 J/kg. What mass m of water at 0 °C must be frozen in order to release the amount of heat that 2.99 kg of steam at 100 °C releases when it condenses?

Solution

As the amounts of heat released by condensation and fusion are equal we may say that:

$Lm_1=\lambda m_2$, where

L -- the latent heat of vaporization for water;

λ -- the latent heat of fusion for water;

m_1 – mass of water condensed;

m_2 – mass of water must be frozen.

$$m_2 = \frac{Lm_1}{\lambda}$$

$$m_2 = \frac{2.99 \times 22.6 \times 10^5}{33.5 \times 10^4} = 20.17 \text{ (kg)}$$

Answer

20.17 kg of water at 0 °C must be frozen in order to release the amount of heat that 2.99 kg of steam at 100 °C releases when it condenses