

Answer on Question #64022, Physics / Molecular Physics | Thermodynamics

Question:

How many kilograms of water can be evaporated at 100 degrees Celsius by the combustion of 470 litres of fuel oil whose heat of combustion is 37 MJ/Litre?

Solution:

First, let's determine the heat generated during fuel's combustion:

$Q_c = V \cdot H_c$, where V — fuel's volume, and H_c — fuel's heat of combustion.

Now we must calculate the energy required for evaporation.

$Q_e = m \cdot H_v$, where m is the mass of water, and H_v — water's heat of vaporization.

$Q_e = Q_c$ that is $m \cdot H_v = V \cdot H_c$, and therefore $m = \frac{V \cdot H_c}{H_v}$.

$$V = 470 \text{ L}$$

$$H_c = 37 \text{ MJ/L} = 3.7 \cdot 10^7 \text{ J/L}$$

$$H_v = 2260 \text{ KJ/kg} = 2.26 \cdot 10^3 \text{ J/kg}$$

$$\text{Hence } m = \frac{470 \cdot 3.7 \cdot 10^7}{2.26 \cdot 10^3} = 7.69 \cdot 10^6 \text{ kg}$$

Answer:

$$7.69 \cdot 10^6 \text{ kg}$$

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