# Question #29216, Physics, Other

A 1.00kg block of copper at 20 degrees C is dropped into a large vessel of liquid nitrogen a -196 degrees C. How many kilograms of nitrogen boil away by the time the copper reaches -196 degrees C? The specific heat capacity of copper is 0.385kJ/g degrees C and the heat of vaporization of nitrogen is 5.57 kJ/mol.

**Solution.**

Find the heat quantity which need take from copper:

$$Q = m(Cu) \cdot C(Cu) \cdot (T_1 - T_2) = 1.00 \cdot 0.385 \cdot (20 - (-196)) = 83.16 \text{ kJ};$$

where $m(Cu)$ – mass of the copper block, kg;

$C(Cu) = 0.385$ kJ/(kg*C) is the specific heat capacity of copper;

This heat is equal to the heat of nitrogen vaporization:

$$Q = \lambda(N_2) \cdot \frac{m(N_2)}{M(N_2)};$$

where $\lambda(N_2) = 5.57$ kJ/mol, is the heat of one mole nitrogen vaporization.

$m(N_2)$ - nitrogen mass , kg;

$M(N_2) = 0.028$ kg/mol – nitrogen molar mass;

Find the mass of nitrogen:

$$m(N_2) = \frac{Q \cdot M(N_2)}{\lambda(N_2)} = \frac{83.16 \cdot 0.028}{5.57} = 0.418 \text{ kg};$$

**Answer:** the mass of nitrogen is **0.418 kg**.