Question #54863, Physics / Other |

The resulting temperature when 1kg of ice at 0 degrees Celcius is mixed with 9kg of water at 50 degress Celcius is ---------- to the nearest whole number. The specific capacity of water is 4200J/kg/K,the specific latent heat of fusion of ice is 330 000J/kg

Answer:

The heat needed to melt an ice equals:

$Q_1 = C_f m_i$, where C_f – the specific latent heat of fusion of ice, m_i – the mass of ice.

The heating of water formed from ice is defined:

$Q_2 = C_w m_i \Delta T = C_w m_i (0\ ^oC + T)$, where C_w - specific capacity of water and ΔT – the change of temperature (T – the final temperature).

The cooling of hot water is also described by the same equation:

$Q_3 = C_w m_w \Delta T = C_w m(50\ ^oC - T)$, where m_w – the mass of hot water.

According to the law of Conservation of energy it should be written:

$Q_1 + Q_2 - Q_3 = 0$

Thus,

$C_f m_i + C_w m_i (0\ ^oC + T) - C_w m(50\ ^oC - T) = 0$

After substitution of all known variables the following equation is obtained:

$330\ kJ + 4.2 \frac{kJ}{^oC}(T) - 37.8 \frac{kJ}{^oC}(50 - T) = 0$

$330\ kJ + 4.2\frac{kJ}{^oC}(T) - 1890\ kJ + 37.8\frac{kJ}{^oC}(T) = 0$

$42 \frac{kJ}{^oC}(T) = 1560\ kJ$

$T = 37.14\ ^oC \approx 37\ ^oC$

The resulting temperature is 37 ^oC.