Answer on Question #48540 – Physics – Molecular Physics | Thermodynamics

1. A copper cup holds some cold water at 4 C. The copper cup weighs 140g while the water weighs 80g. If 100g of hot water, at 90 C is added, what will be the final temperature of the water?

Solution. $T_0 = 4^0 C = 277 K$ The cold water and the cup will neated, while the hot water will cool. We $m_0 = 140 g = 0.14 kg$ can write the heat balance equation: m = 80 g = 0.08 kg $m_0c_1(T-T_0) + mc(T-T_0) = m_1c_1(T_1-T).$ $m_1 = 100g = 0.1kg$ $T_1 = 90^0 C = 363 K$ Here, c and c_1 are specific heat of water and cooper, respectively. $c_1 = 385 \frac{J}{kg \cdot K}$ One can find the final temperature: $T = \frac{m_1 c_1 T_1 + (m_0 c_1 + m_c) T_0}{(m_1 + m_0) c_1 + m_c}$ $c = 4200 \frac{J}{kg \cdot K}$ T - ?Let check the dimension: $[T] = \frac{kg \cdot \frac{J}{kg \cdot K} \cdot K}{kg \cdot \frac{J}{kg \cdot K}} = K$.

Let evaluate the quantity:

 $T = \frac{0.1 \cdot 385 \cdot 363 + (0.14 \cdot 385 + .08 \cdot 4200) \cdot 277}{(0.1 + 0.14) \cdot 385 + 0.08 \cdot 4200} = 284.7 (K) = 11.7 (^{\circ}C).$

Answer: $11.7 \ {}^{0}C$.