Answer Question #64823 – Physics – Astronomy – Astrophysics

A copper piece of mass 140 g and of temperature 240◦C is placed into 360 g of water at temperature 25◦C. Find the final equilibrium temperature. Neglect the heatlosses to the environment.?

Solution. Since there is no heat loss to the external environment, the amount of heat received by the water equals the amount of heat given to the copper.

Specific heat capacities provide a means of mathematically relating the amount of thermal energy gained (or lost) by a sample of any substance to the sample's mass and its resulting temperature change. The relationship between these four quantities is often expressed by the following equation.

$$Q = Cm\Delta T$$

where Q is the quantity of heat transferred to or from the object, m is the mass of the object, C is the specific heat capacity of the material the object is composed of, and ΔT is the resulting temperature change of the object.[1]

Let t^* – the final equilibrium temperature. The amount of heat given to the copper $Q_1 = C_1 m_1 (240 - t^*)$, where $C_1 = 385 \frac{J}{kg \cdot K}$, $m_1 = 0.14kg$. The amount of heat received by the water $Q_2 = C_2 m_2 (t^* - 25)$, where $C_2 = 4180 \frac{J}{kg \cdot K}$, $m_2 = 0.36kg$. $Q_1 = Q_2$ hence

$$0.14 \cdot 385(240 - t^*) = 0.36 \cdot 4180 \cdot (t^* - 25)$$
$$12936 - 53.9t^* = 1504.t^* - 37620$$
$$1558.7t^* = 50556$$
$$t^* = 32.4^0 C$$

Answer. $32.4^0 C$

1. http://www.physicsclassroom.com/class/thermalP/Lesson-2/Measuring-the-Quantity-of-Heat