Answer on Question #41189, Physics, Molecular Physics | Thermodynamics

When a hot iron piece of 50 g at 80°C is dropped into 150 g calorimeter with 100g water its temperature raised by 10°C calculate the equilibrium temperature in the specific heat capacity of iron is 0.46 J / g °C and of calorimeter is 0.034 J/g °C.

Solution:

We start by calling the final, ending temperature 'x'.

The energy amount going out of the warm iron is equal to the energy amount going into the cool calorimeter and water. This means:

$$Q_1 = Q_2 + Q_3$$

The specific heat is the amount of heat per unit mass required to raise the temperature by one degree Celsius. The relationship between heat and temperature change is usually expressed in the form shown below where c is the specific heat.

$$Q = cm\Delta T$$

Given:

$m_1 = 50\ \text{g}$,

$T_1 = 80℃$,

$c_1 = 0.46\ \text{J / g °C}$,

$m_2 = 150\ \text{g}$,

$c_2 = 0.034\ \text{J / g °C}$,

$\Delta T_2 = 10℃$,

$m_3 = 100\ \text{g}$,

$c_3 = 4.2\ \text{J / g °C}$, (specific heat capacity of water)

$T_x = ?$

Thus,

$$Q_1 = c_1 m_1 \Delta T_1 = c_1 m_1 (T_1 - T_x)$$
$$Q_2 = c_2 m_2 \Delta T_2$$
$$Q_3 = c_3 m_3 \Delta T_2$$

$$c_1 m_1 (T_1 - T_x) = (c_2 m_2 + c_3 m_3)\Delta T_2$$

So,

$$T_x = T_1 - \frac{(c_2 m_2 + c_3 m_3)\Delta T_2}{c_1 m_1} = 80 - \frac{(0.034 \cdot 150 + 4.2 \cdot 100) \cdot 10}{0.46 \cdot 50} = 80 - 184.8 = -104.8℃$$

This is nonphysical answer.

Answer. ***Please correct the question conditions.***