Answer on Question #49017 – Physics – Mechanics | Kinematics | Dynamics

1. A 14 g block of metal (Cs = 126) heated to 78 is plunged into 405 g of water at 24 degree C. What is the equilibrium temperature? Cs of water is 4190 Jkg-1K-1. Give your answer to 1 decimal place.

$m_1 = 0.014\,kg$
$T_1 = 351.1\,K$
$c_1 = 126\,\frac{J}{kg \cdot K}$
$m_2 = 0.405\,kg$
$T_2 = 297.1\,K$
$c_2 = 4190\,\frac{J}{kg \cdot K}$

$T - ?$

Solution.

The metal block will be cooled, while the cold water will be heated. We can write the heat balance equation:

$$m_1 c_1 (T_1 - T) = m_2 c_2 (T - T_2).$$

Here, c_1 and c_2 are specific heat of metal and water, respectively.

One can find the final temperature:

$$\boxed{T = \frac{m_1 c_1 T_1 - m_2 c_2 T_2}{m_1 c_1 - m_2 c_2}}$$

Let check the dimension: $[T] = \dfrac{kg \cdot \frac{J}{kg \cdot K} \cdot K}{kg \cdot \frac{J}{kg \cdot K}} = K$.

Let evaluate the quantity:

$$T = \frac{0.014 \cdot 126 \cdot 351.1 - 0.405 \cdot 4190 \cdot 297.1}{0.014 \cdot 126 - 0.405 \cdot 4190} = 297.0(K) = 23.9\left(^0C\right).$$

Answer: $23.9\ ^0C$.

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