Given:
A 50 kg iron block at 80°C is dropped into an insulated tank that contains $0.5\ m^3$ of liquid water at 25°C.

$m_{fe} := 50\ kg$ $\quad T_{1fe} := 80\ °C = 353.2\ K$ $\quad V_w := 0.5\ m^3$ $\quad T_{1w} := 25\ °C = 298.2\ K$

Required:
Determine the temperature when thermal equilibrium is reached.

Solution:
Using the hint given, the following is true.

$$\Delta U_{fe} + \Delta U_w = 0$$

$$m_{fe} \cdot \left(u_{2fe} - u_{1fe}\right) + m_w \cdot \left(u_{2w} - u_{1w}\right) = 0$$

Assuming the specific heat value of both the iron and water remain constant over the temperature range of this process, the expression becomes

$$m_{fe} \cdot c_{fe} \cdot \left(T_{2fe} - T_{1fe}\right) + m_w \cdot c_w \cdot \left(T_{2w} - T_{1w}\right) = 0$$

If the final state is in thermal equilibrium, then the final temperature of the iron and water will be the same so

$T_{2fe} = T_{2w} = T_2$ thus $m_{fe} \cdot c_{fe} \cdot \left(T_2 - T_{1fe}\right) + m_w \cdot c_w \cdot \left(T_2 - T_{1w}\right) = 0$

Solving for the final temperature yields

$$T_2 = \frac{m_{fe} \cdot c_{fe} \cdot T_{1fe} + m_w \cdot c_w \cdot T_{1w}}{m_{fe} \cdot c_{fe} + m_w \cdot c_w}$$

Assuming the density of water is $1000\ \frac{kg}{m^3}$, the mass of the water may be found by

$$m_w := 1000\ \frac{kg}{m^3} \cdot V_w = 500\ kg$$

Going to Table A-3(a) @ water at 25°C shows

$$c_w := 4.18 \cdot \frac{kJ}{kg\ K}$$

Going to Table A-3(b) @ iron shows

$$c_{fe} := 0.45 \cdot \frac{kJ}{kg\ K}$$

The final temperature is then

$$\boxed{T_2 := \frac{m_{fe} \cdot c_{fe} \cdot T_{1fe} + m_w \cdot c_w \cdot T_{1w}}{m_{fe} \cdot c_{fe} + m_w \cdot c_w} = 298.7\ K}$$

$$\boxed{T_2 = 25.6\ °C}$$