17. (II) An old way of heating cider in the winter was to put a hot iron poker from the fireplace into a ceramic mug containing the cider. Suppose we have half a liter of cider (assume water) initially at 15°C and an effective mass of iron of 0.55 kg initially at 700°C. If we assume that the entire heat transfer takes place between the poker and the cider—that is, the effect of the mug and the air in the room surrounding the cider can be neglected—what will be the final temperature of the cider?

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Ch. 14 #17 Conserve energy:

$$m_i c_i \Delta T_i + m_c c_c \Delta T_c = 0$$

iron: $\begin{cases} m_i = 0.55\text{ kg} \\ c_i = 450\text{ J/kg K} \\ \Delta T_i = 700°C - T_{eq} \end{cases}$

cider: $\begin{cases} m_c = (0.5\text{ L})(1\text{ kg/L}) = 0.5\text{ kg} \\ c_c = 4186\text{ J/kg K} \\ \Delta T_c = 15°C - T_{eq} \end{cases}$

T_{eq} = final equilibrium temperature.

$$m_i c_i (700 - T_{eq}) + m_c c_c (15 - T_{eq}) = 0$$

$$m_i c_i 700 + m_c c_c 15 = (m_i c_i + m_c c_c) T_{eq}$$

$$(0.55)(450)(700) + (0.5)(4186)(15) = [(.55)(450) + (.5)(4186)] T_{eq}$$

$$204{,}645 = 2340\ T_{eq}$$

$$\boxed{87.4°C = T_{eq}}$$