Chapter 17 Problem 52 [†]

Given
$m_p = 16\ kg$
$T_p = 25\ ^\circ C$
$T_f = 0\ ^\circ C$
$L_f = 334\ kJ/kg$
$c_p = 4.184\ kJ/kg \cdot K$

Solution
Find the amount of ice to cool the punch to $0\ ^\circ C$.

As the ice is added, the heat will from from the punch to the ice.

$$\Delta Q_{ice} + \Delta Q_p = 0$$

Since the ice is melting, it is gaining energy.

$$m_{ice} L_f + m_p c_p (T_f - T_i) = 0$$

Solving for the mass of ice gives us

$$m_{ice} = \frac{-m_p c_p (T_f - T_i)}{L_f}$$

Substituting in the given values we have

$$m_{ice} = \frac{-(16\ kg)(4.184\ kJ/kg \cdot K)(0 - 25^\circ C)}{(334\ kJ/kg)}$$

$$m_{ice} = 5.01\ kg$$

[†]Problem from Essential University Physics, Wolfson