Answer on Question #64873-Physics-Other

Calculate how many grams of ice at 0°C would be melted by 100 g of 100°C steam. Hint: heat will be transferred from the steam to the ice in two processes: (a) the steam will condense into liquid, and (b) that liquid will transfer heat until it is at the freezing point of water. Note that for water: Lf = 80 cal/g, and Lv = 540 cal/g

Solution

Heat will be transferred from the steam to the ice in two processes: (a) the steam will condense into liquid, and (b) that liquid will transfer heat until it is at the freezing point of water.

$$Q_{ice} = Q_a + Q_b$$

$$m_{ice}L_f = m_{water}L_v + m_{water}c_{water}\Delta T$$

$$m_{ice} = \frac{m_{water}}{L_f}(c_{water}\Delta T + L_v) = \frac{100g}{80\,\frac{\text{cal}}{\text{g}}}\left(540\frac{cal}{g} + 1\,\frac{\text{cal}}{\text{g°C}}(100-0)°\text{C}\right) = 800\ g.$$

Answer: $\mathbf{800\ g}$.