

### Answer on Question #41180 – Physics – Molecular Physics | Thermodynamics

In an energy recycling process X gram of steam at  $100^{\circ}\text{C}$  becomes water at  $100^{\circ}\text{C}$  which converts Y gram of ice at  $0^{\circ}\text{C}$  into water at  $100^{\circ}\text{C}$ . The ratio of X and Y will be

**Solution:**

$\lambda = 334 \frac{\text{kJ}}{\text{g}}$  – heat of fusion for the water;

$q = 2260 \frac{\text{kJ}}{\text{g}}$  – heat of evaporation for the water;

$c = 4180 \frac{\text{J}}{\text{g} \cdot ^{\circ}\text{C}}$  – heat capacity of water;

$\Delta T = 100^{\circ}\text{C}$  – change in temperature;

$$Q_{\text{lost}} = Q_{\text{gain}} \quad (1)$$

The amount of heat lost by steam:

$$Q_{\text{lost}} = q \cdot X \quad (2)$$

The amount of heat gained by ice:

$$Q_{\text{gain}} = Y \cdot \lambda + cY\Delta T \quad (3)$$

(3) and (2) in (1)

$$q \cdot X = Y \cdot \lambda + cY\Delta T$$

$$q \cdot X = Y(\lambda + c\Delta T)$$

$$\frac{Y}{X} = \frac{\lambda + c\Delta T}{q} = \frac{2260 \frac{\text{kJ}}{\text{g}}}{334 \frac{\text{kJ}}{\text{g}} + 4180 \frac{\text{J}}{\text{g} \cdot ^{\circ}\text{C}} \cdot 100^{\circ}\text{C}} = 3$$

$$Y = 3X$$

**Answer:** The ratio of X and Y will be:  $Y = 3X$ .

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