

**Given:**  $\text{kJ} := 1000\text{J}$

A heat source at 800 K loses 2000 kJ of heat to a sink at 500 K and at 750 K.

**Required:**

Determine which heat transfer process is more irreversible.

**Solution:**

The temperature of the source is defined as

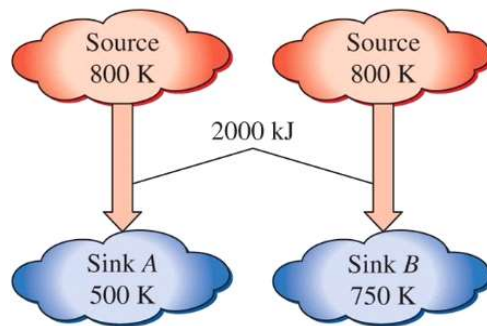
$$T_H := 800\text{K}$$

The heat lost by the source is defined as

$$Q_H := 2000\text{kJ}$$

The temperatures of the two sinks are defined as

$$T_A := 500\text{K} \quad T_B := 750\text{K}$$



Both processes involve heat transfer through a finite temperature difference so both are irreversible processes. The change in entropy due to the source is found by

$$\Delta S_{\text{source}} := \frac{-Q_H}{T_H} = -2.5 \cdot \frac{\text{kJ}}{\text{K}}$$

The change in entropy due to the two sinks are found by

$$\Delta S_A := \frac{Q_H}{T_A} = 4 \cdot \frac{\text{kJ}}{\text{K}} \quad \Delta S_B := \frac{Q_H}{T_B} = 2.667 \cdot \frac{\text{kJ}}{\text{K}}$$

Thus the entropy generated by the two sinks are found by

$$S_{\text{gen,A}} := \Delta S_{\text{source}} + \Delta S_A = 1.5 \cdot \frac{\text{kJ}}{\text{K}}$$

$$S_{\text{gen,B}} := \Delta S_{\text{source}} + \Delta S_B = 0.167 \cdot \frac{\text{kJ}}{\text{K}}$$

Since,  $S_{\text{gen,B}} < S_{\text{gen,A}}$  the sink A is more irreversible than sink B.