Preflight LECT 28

Consider a hypothetical device that takes 1000 J of heat from a hot reservoir at 300K, ejects 200 J of heat to a cold reservoir at 100K, and produces 800 J of work.

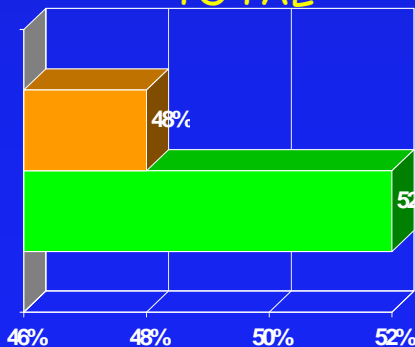Does this device violate the second law of thermodynamics ?

1. Yes ⟵ correct

2. No

total entropy decreases.

$\Delta S_H = Q_H/T_H = (-1000 \text{ J}) / (300 \text{ K}) = -3.33 \text{ J/K}$

$\Delta S_C = +Q_C/T_C = (+200 \text{ J}) / (100 \text{ K}) = +2 \text{ J/K}$

$\Delta S_{TOTAL} = \Delta S_H + \Delta S_C = -1.33 \text{ J/K}$ ➔ (violates 2nd law)

48%

52%

46%   48%   50%   52%

- W (800) = Q_{hot} (1000) - Q_{cold} (200)
- Efficiency = W/Q_{hot} = 800/1000 = 80%
- Max eff = $1 - T_c/T_h$ = 1 - 100/300 = 67%