1200K

$Q_H = 100 J$ $T_b = 1200K$

HE $\rightarrow W = 75 J$

$Q_L = 25$ $T_b = 300K$

300K

$$\eta_c = 1 - \frac{T_L}{T_H} = 1 - \frac{300}{1200} = 0.75$$

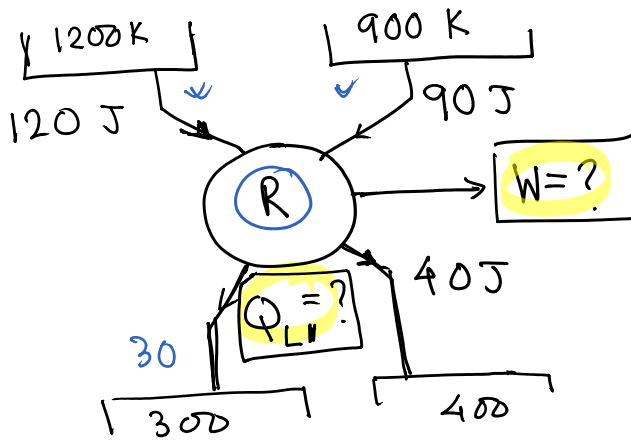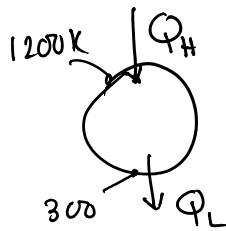$$\oint \left(\frac{\delta Q}{T_b} \right) \leq 0$$

R
I

PMM 2

1200K Q_H

300   Q_L

$=$ For Rev.

$<$ For Irrev.

$$\frac{Q_H}{T_{bH}} + \frac{-Q_L}{T_{bL}} = \frac{100}{1200} - \frac{25}{300} = 0$$

$\Rightarrow$ Rev

γ 1200K   900 K

120 J   90 J

R   W = ?

$Q_L = ?$ 40 J

30

300   400

$$\boxed{W = 170 - 30 = 140 J}$$

1st Law

$$120 + 90 + (-Q_{LI}) + (-40) = W$$

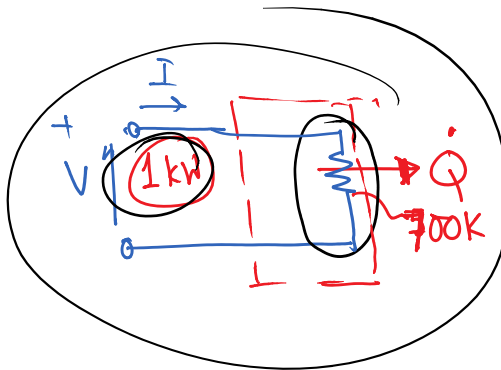or $\boxed{170 - Q_{LI} = W}$ ──①

2nd Law $\oint \left(\frac{\delta Q}{T_b} \right) = 0$

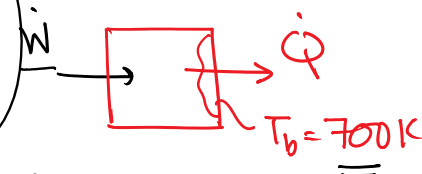$$\frac{120}{1200} + \frac{90}{900} + \frac{-Q_L}{300} + \frac{-40}{400} = 0$$

$$\Rightarrow \frac{Q_{LI}}{T_b} = 0.1 + 0.1 - 0.1 = 0.1$$

$$\Rightarrow Q_{LI} = 30$$

I

+
V   1kW $\dot{Q}$
700K
−

$\dot{W} = V \times I$

$\dot{W}$ $\dot{Q}$
$T_b = 700K$

Clausius inequality

$$\boxed{\oint \left(\frac{\delta \dot{Q}}{T_b} \right) = \frac{-1000}{700} < 0}$$

$$\oint \frac{\delta Q}{dt} = \oint \frac{\delta W}{dt}$$

$$\dot{Q} = \dot{W} = -1 kW$$

$$\dot{Q} = \dot{W} = -1 kW$$

$$300K$$
$$Q_H = 7 kJ$$
$$W = 2 kJ$$
$$Q_L = 5 kJ$$
$$250 K$$
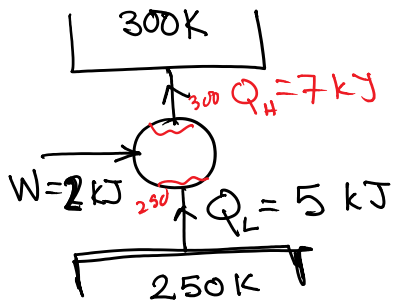
$$(COP)_R = \frac{250}{300-250} = \boxed{5.}$$

$$W_R = 1 \ kJ$$

$$COP = \frac{Q_L}{W}$$

$$\oint \left(\frac{\delta Q}{T_b} \right) = \frac{+5}{250} + \frac{-7}{300} = -3.33 \ J/K$$

$$\Rightarrow \boxed{\text{Irrev. Refrigerator}}$$