

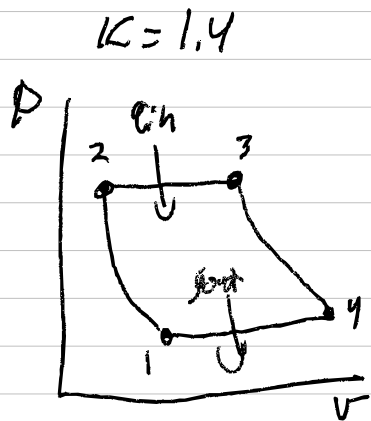
$$85) \quad T_1 = 27^\circ\text{C} + 273 = 300\text{K}$$

$$T_3 = 727^\circ\text{C} + 273 = 1000\text{K}$$

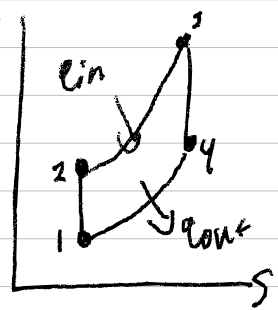
$$P_{\text{max}} = 2000 \text{ kPa}$$

$$P_1 = 100 \text{ kPa}$$

$$P_2 = W_{\text{net}} \text{ and } n^{\text{th}}$$



$$\frac{P_2}{P_1} = \frac{2000}{100} = 20 \text{ kPa}$$



$$T_2 = T_1 \left(\frac{P_2}{P_1} \right)^{\frac{(k-1)}{k}}$$

$$T_2 = (300) / (20)^{\frac{(1.4-1)}{1.4}} = 706.06 \text{ K}$$

$$T_4 = T_3 \frac{1}{\left(\frac{P_2}{P_1} \right)^{(k-1)/k}} = \frac{1000}{(20)^{\frac{(1.4-1)}{1.4}}} = 424.89 \text{ K}$$

$$C_p = 1.005$$

$$W_c = C_p (T_2 - T_1) = 1.005 (706.06 - 300)$$

$$W_c = 408.0903 \frac{\text{kJ}}{\text{kg}}$$

$$W_f = 1.005 (1000 - 424.89) = 577.99 \frac{\text{kJ}}{\text{kg}}$$

$$W_{\text{net}} = 577.99 - 408.0903 = \boxed{169.9 \frac{\text{kJ}}{\text{kg}}}$$

$$q_{\text{in}} = C_p (T_3 - T_2) = 1.005 (1000 - 706.06)$$

$$q_{\text{in}} = 1.005 (1000 - 706.06)$$

$$q_{\text{in}} = 295.41 \frac{\text{kJ}}{\text{kg}}$$

$$\eta = \frac{169.9}{295.41} = 0.58 \cdot 100 = \boxed{58\%}$$

99) It increases thermal efficiency
by heating up the turbine
which means less fuel to
heat up the turbine

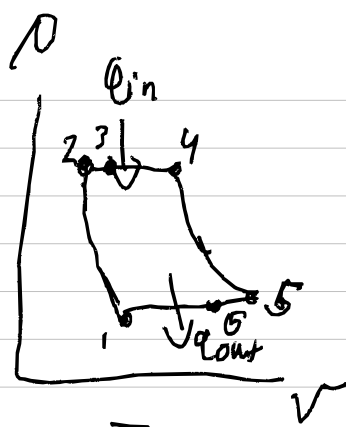
107)

$$p_1 = 100 \text{ kPa}$$

$$r = 7$$

$$k = 1.4$$

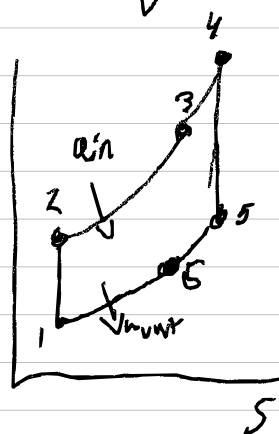
$$T_1 = 20^\circ\text{C} + 273 = 293 \text{ K}$$



$$T_4 = 727^\circ\text{C} = 1000 \text{ K}$$

$$T_2 = T_1 r^{(k-1)/k} = 293 (7)^{\frac{1.4-1}{1.4}}$$

$$T_2 = 510.89 \text{ K}$$



$$T_5 = \frac{T_4}{r^{(k-1)/k}} = \frac{1000}{(7)^{\frac{1.4-1}{1.4}}} = 573.51 \text{ K}$$

$$T_3 = T_5 - \delta = 573.51 - 6 = 567.51 \text{ K}$$

$$T_6 = T_2 + (T_5 - T_3) = 510.89 + (573.51 - 567.51)$$

$$T_6 = 515.89$$

$$Q_{in} = c_p (T_4 - T_3) = (1.005) (1000 - 567.51)$$

$$Q_{in} = 434.65 \frac{\text{kJ}}{\text{kg}}$$

$$W_{net} = c_p ((T_4 - T_5) - (T_2 - T_1))$$

$$= 1.005 ((1000 - 573.51) - (510.89 - 293))$$

$$W_{net} = 209.64$$

$$\eta = \frac{W_{net}}{Q_{in}} = \frac{209.64}{434.65} = 0.482 \cdot 100 = 48.2\%$$

11/9) a: $w_c = c_p (T_2 - T_1)$

$$T_{mult} < T_{single}$$

Therefore the work for the compressor will decrease.

b: $\text{Back ratio} = \frac{w_c}{w_t}$

Since the work for the compressor will go down, the back work ratio will decrease.

c: Since T_2 will decrease

in $q_{in} = c_p (T_3 - T_2)$, q_{in} will then increase which then, $\eta = \frac{w_{net}}{q_{in}}$,

η will decrease

121)

a: Intercooling $\rightarrow W_c$ decreases

Reheating $\rightarrow W_t$ increases

therefore, $W_{net} = W_t - W_c$, the W_{net} will increase.

b: with W_c decreasing and with

W_t increasing, Back ratio = $\frac{W_c}{W_t}$

therefor the back work ratio will decrease

c: with intercooling and Reheating

the q_{in} increases. Therefore,

$\eta = \frac{W_{net}}{q_{in}}$, the thermal efficiency

will decrease.

D: With Intercooling and Reheating

the temperature will be higher

during the heat addition.

Therefore, $q_{out} = C_p(T_2 - T_1)$, the

q_{out} will increase