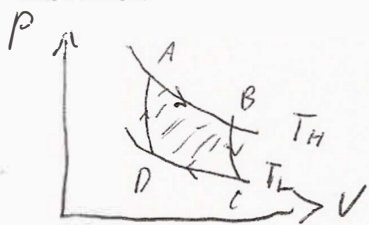**Worksheet** #7 (Total number of points you can get is **3 pts**)

1. a) Draw a Carnot cycle in a PV diagram, and indicate in the diagram the work done by the Carnot engine, and which processes are isothermal or adiabatic.

Shaded Area: work done in cycle

isothermal: A→B and C→D

adiabatic: B→C and D→A

   b)   Indicate in which process the engine absorbs or releases heat, and write down the amount of heat absorbed or released.

$A \rightarrow B$: absorbes heat $Q_{A \rightarrow B} = R T_H \ln \frac{V_B}{V_A} > 0$

$C \rightarrow D$: releases heat $Q_{C \rightarrow D} = R T_C \ln \frac{V_D}{V_C} < 0$

   c)   What is the change in entropy in a Carnot cycle? What is the change in internal energy?

$$\oint dS = 0 \qquad\qquad \Delta U = 0$$

2. A Carnot engine operates between temperatures T_H=1000 K and T_C=100 K. How much heat needs to be put into the engine at T_H in order to obtain W=3000 J of work from the engine?

$$\eta = 1 - \frac{T_C}{T_H} = 1 - \frac{100}{1000} = 0.9$$

$$= \left| \frac{W}{Q_{H}} \right| \implies Q_H = \frac{3000}{0.9} J = 3333.3 J$$

3. How does the entropy changes during a spontaneous process in an isolated system?

$$\Delta S > 0$$