Gas laws: (for math problems)

$(P_1V_1)/T_1 = (P_2V_2)/T_2$

$P_1V_1^n = P_2V_2^n$

*For adiabatic ($Q = 0$) and frictionless (i.e. **isentropic process**) process, $n = \gamma = 1.4$*

$P_1V_1^\gamma = P_2V_2^\gamma$

$P_2/P_1 = (V_1/V_2)^\gamma$

$T_2/T_1 = (V_1/V_2)^{\gamma-1}$

$T_2/T_1 = (P_2/P_1)^{(\gamma-1)/\gamma}$

$PV = mRT$

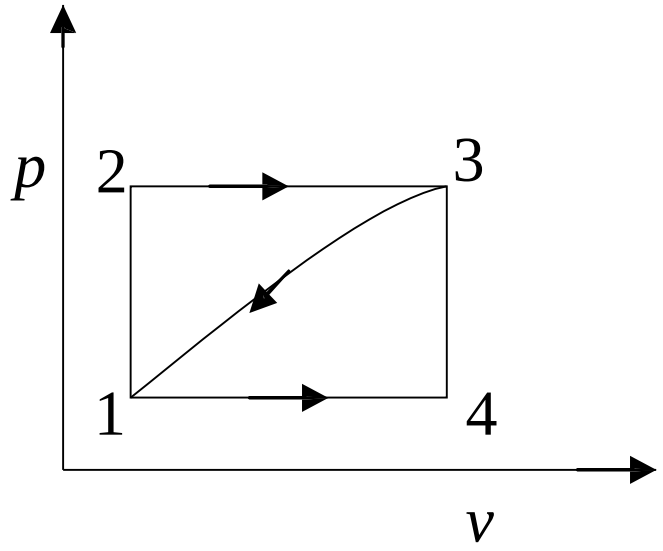
$P = \rho RT$

Math Problem-01

Consider a cyclic process in a closed system which includes three heat interactions, namely Q_1 = 20 kJ, Q_2 = -6 kJ, and Q_3 = -4 kJ and two work interactions for which W_1 = 4500 N-m. Compute the magnitude of the second work interaction W_2.

Math Problem-02

When the state of a system changes from state 1 to state 3 along the path 1-2-3 as shown in figure, 80 kJ of heat flows into the system and the system does 30 kJ of work. (a) How much heat flows into the system along the path 1-4-3 if work done by the system is 10 kJ (b) when the state of the system is returned from state 3 to state 1 along the curved path, the work done on the system is 20 kJ. Does the system absorb or liberate heat? Find its magnitude. (c) If $U_1 = 0$ and $U_4 = 40$kJ, find the heat absorbed in the process 1-4 and 4-3 respectively.



Math Problem-03

A closed system undergoes an ***isochoric*** process in which 85 kJ of heat is supplied to it. The system then undergoes an ***isobaric*** process in which 90 kJ of heat is rejected by the system and 15 kJ of work is done on it. Finally the system is brought back to its original state by an ***adiabatic*** process. Determine the work involved in the adiabatic process and the energy of the system at all end states if the energy at the initial state is 100 kJ.

Math Problem-06

A piston cylinder contains 1 kg water at 20 °C with volume 0.1 m^3. The piston is locked to prevent it from moving. Water is heated to produce saturated vapor. Find the final temperature and the amount of heat transfer process.