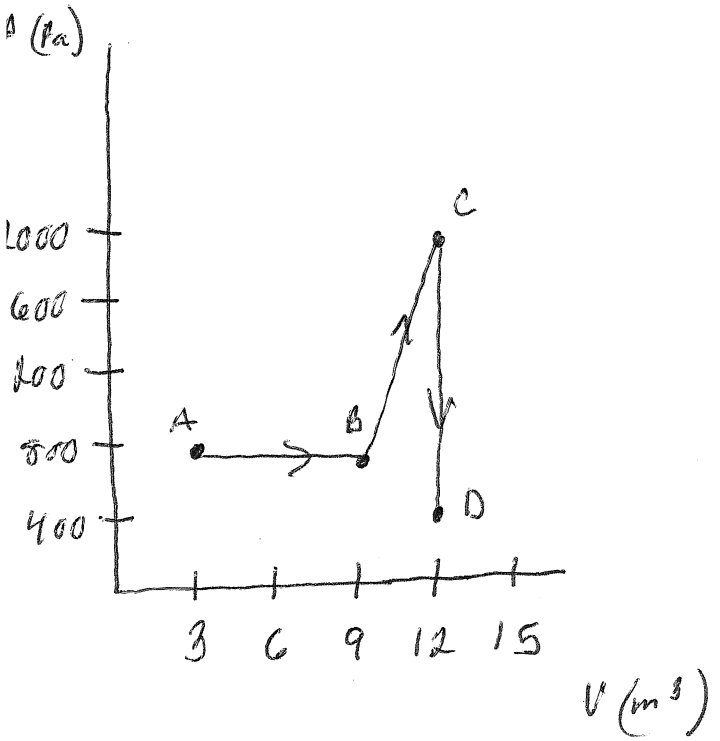

1) Determine the work done from A to D.

2) If $T_A = 210K$ find T_D.

3) Determine Q for the process A → D

(1) Work = Area under Curve

$$W_{A-B} = -800\,Pa\,(6\,m^3) = -4.8E3\,J$$

$$W_{B-C} = -\tfrac{1}{2}(3\,m^3)(400\,Pa) + -3\,m^3(800\,Pa) = -3.0E3\,J$$

$$W_{C-D} = 0\,J$$

$$W_{total} = \boxed{-7.8E3\,J}$$

work is done by the gas

(2)

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{(800\,Pa)\,3.0\,m^3}{210\,K} = \frac{400\,Pa\,(12\,m^3)}{T_2}$$

$$T_2 = \frac{400\,Pa\,(12\,m^3)\,210\,K}{800\,Pa\;3.0\,m^3} = \boxed{420\,K}$$

(3)

$$\Delta U = \Delta Q + W$$

$$\Delta U = \frac{3}{2} n R \Delta T \quad \text{(monatomic ideal gas)}$$

$$\Delta Q = \Delta U - W$$

$$n = \frac{PV}{RT_i} = \frac{(800\,Pa)(3\,m^3)}{\left(8.31\frac{J}{mol\,K}\right)(210K)} = 1.375\,mol$$

$$\Delta U = \frac{3}{2}(1.375\,mol)\left(8.31\frac{J}{mol\,K}\right)210K$$

$$\Delta T = 420K - 210K = 210K$$

$$\Delta U = 3.60\,E3\,J$$

$$\Delta Q = 3.60\,E3\,J - (-7.8\,E3\,J)$$

$$= \boxed{1.14\,E4\,J}$$