KING FAHD UNIVERSITY OF PERTOLEUM & MINERALS
PHYSICS DEPARTMENT
QUIZ #4- CHAPTER 19

NAME: Key ID# SECTION#

Two moles of an ideal monatomic gas expands adiabatically.

(a) If the initial temperature is 500 K and is three times the final temperature, by what factor does the volume change?

$$T_i V_i^{\gamma-1} = T_f V_f^{\gamma-1} \qquad \gamma = \frac{C_p}{C_V} = \frac{5}{3} = 1.67$$

$$T_i = 500K \qquad T_f = \frac{T_i}{3} = 165\,K$$

$$\frac{V_f}{V_i} = \left(\frac{T_i}{T_f}\right)^{\frac{1}{\gamma-1}} = (3)^{\frac{1}{0.67}} = 5.15$$

(b) What is the work done by the gas?

$$W = -\Delta E_{int} = -n C_V \Delta T$$

$$= -2 \times \frac{3}{2} R (T_f - T_i)$$

$$= -3 \times 8.31 \times (165 - 500)$$

$$W = 8310\ J$$

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Two moles of hydrogen (diatomic) gas are heated from 100 ^{0}C to 400 K. How much heat is transferred to the gas if the process is

(a) isobaric?

$$Q = n C_p \Delta T = n \frac{7}{2} R (T_f - T_i)$$

$$= 2 \times \frac{7}{2} \times 8.31 (400 - 373) = 1570 J$$

(b) isochoric?

$$Q = n C_v \Delta T = n \frac{5}{2} R (T_f - T_i)$$

$$= 2 \times \frac{5}{2} \times 8.31 \times (400 - 373) = 1122 J$$

(c) adiabatic?

$$Q = 0$$

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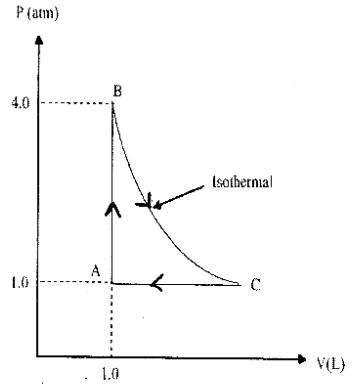
One mole of an ideal diatomic gas undergoes the thermodynamic process shown in the figure.

(a) If the process BC is isothermal, what is the heat transferred during this process?



$\Delta E_{int} = Q - W = 0$

$Q = W = nRT \ln\left(\frac{V_f}{V_i}\right)$

$Q = nRT_B \ln\left(\frac{V_C}{V_B}\right)$

$Q = 4 \times 101 \times \ln(4) = \boxed{560\,J}$

$P_B V_B = P_C V_C$

$\frac{V_C}{V_B} = \frac{P_B}{P_C} = 4$

$nRT_B = P_B V_B = 4 \times 101$

(b) What is the change in internal energy for this isothermal process?

$\Delta E_{int} = 0$ since the process is isothermal