

1.34) In order to get U , which is a function of T alone, we use $PV = nRT$. Since $U = \frac{5}{2} nRT$ for a diatomic gas, we have $U = \frac{5}{2} PV$.

(a) The work done in a given step $W = -\int P dV$, on the gas. Q can then be determined from $\Delta U = Q + W$. Define $(P_2 - P_1)$ to be ΔP , and $(V_2 - V_1)$ to be ΔV .

<u>Step</u>	<u>ΔU</u>	<u>W</u>	<u>$Q = (\Delta U - W)$</u>
A	$(5/2)(\Delta P) V_1$	0	$(5/2)(\Delta P) V_1$
B	$(5/2) P_2 (\Delta V)$	$-P_2 \Delta V$	$(7/2) P_2 (\Delta V)$
C	$-(5/2)(\Delta P) V_2$	0	$-(5/2)(\Delta P) V_2$
D	$-(5/2) P_1 (\Delta V)$	$P_1 \Delta V$	$-(7/2) P_1 (\Delta V)$
<u>Net</u>	<u>Zero</u>	<u>$-(\Delta P)(\Delta V)$</u>	<u>$+(\Delta P)(\Delta V)$</u>

(b) In step A we heat the gas keeping the piston fixed, while in step C we cool the gas keeping the piston fixed again. In step B the gas does work (expands) at fixed pressure and also gets hotter. In step D the gas cools even as work is done on it.

(c) As expected $\Delta U = 0$ over a complete cycle since U is a state variable. The heat added to the gas, $(\Delta P)(\Delta V)$ does emerge as work done by the gas: $(\Delta P)(\Delta V)$.