CONSERVATION OF ENERGY

FIRST LAW OF THERMODYNAMICS

$\Delta E = q + w$

Equations

$\Delta E = Cv\,\Delta T = q$ (when V constant)

$\Delta H = Cp\,\Delta T = q$ (when P constant)

$w = -P\Delta V = -q$ (when T constant)

$\Delta T = T_{final} - T_{initial}$

$\Delta V = V_{final} - V_{initial}$

for P, use P_{final}

Constants

$R = 8.314 \times 10^{-3}$ kJ • mol^{-1} • K^{-1}

or

$R = 1.987 \times 10^{-3}$ kcal • mol^{-1} • K^{-1}

or

$R = 0.08206$ L•atm • mol^{-1} • K^{-1}

$T(K) = {}^{o}C + 273.15$

Heat capacities

Ideal Gas

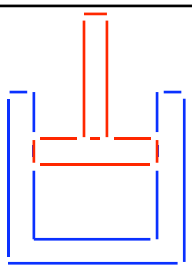
$C_v = \frac{3}{2} R$ $C_p = \frac{5}{2} R$

Solids or Liquids

$C_v = C_p$

System

Ideal gas in a cylinder with movable piston.



Calculate ΔE, ΔH, q, and w for the process of an ideal gas going from state 1 to state 2.

	State 1	State 2
a)	P= 2.50 atm V=8.97 L T= 273.15 K	P= 2.50 atm V=15.5 L T= 473.15 K
b)	P= 2.50 atm V=15.5 L T= 473.15 K	P= 1.45 atm V=15.5 L T= 273.15 K
c)	P= 1.45 atm V=15.5 L T= 273.15 K	P= 2.50 atm V=8.97 L T= 273.15 K
d)	P= 1.25 atm V=18.0 L T= 273.15 K	P= 1.70 atm V=18.0 L T= 373.15 K
e)	P= 3.00 atm V=8.84 L T= 323.15 K	P= 1.52 atm V=17.5 L T= 323.15 K
f)	P= 1.70 atm V=22.8 L T= 473.15 K	P= 1.70 atm V=15.6 L T= 323.15 K
g)	P= 5.30 atm V=5.00 L T= 323.15 K	P= 5.30 atm V=5.78 L T= 373.15 K