P #8

Ch 12 - pg 383

Find P:

F = Weight of the piston
= m · g
= (8.00 kg)(9.8 m/s²)

F = 78.4 N

$A = 5.00\ cm^2 \cdot \left(\frac{1\ m}{100\ cm}\right)^2 = 5 \times 10^{-4}\ m^2$

$P_{mass} = \frac{F}{A} = \frac{78.4\ N}{(5 \times 10^{-4}\ m^2)}$

$P_{mass} = 156{,}800\ N/m^2$

$P_{total} = 156{,}800 + 100{,}000\ Pa$
$= 256{,}800\ Pa$

Find V_1 and V_2

P = 256,800 Pa
n = .200 moles
R = 8.31 J/mol·K

$T_1 = 20°C = 293\ K$
$T_2 = 300°C = 573\ K$

$P \cdot V = n \cdot R \cdot T$

$(256{,}800\ Pa) \cdot V_1 = (.2\ mol)(8.31\ J/mol \cdot K)(293\ K)$
$V_1 = .0019\ m^3$

$(256{,}800\ Pa) \cdot V_2 = (.2\ mol)(8.31\ J/mol \cdot K)(573\ K)$
$V_2 = .0037\ m^3$

$W = -P \cdot \Delta V = -P(V_2 - V_1)$

$= -(256{,}800\ Pa)(.0037\ m^3 - .0019\ m^3)$

$\boxed{W = -465\ J}$