P # Q

Ch. 12

$P_1 = 1.02 \times 10^5$ Pa
$V_1 = 1.500 \times 10^{-3}$ m^3
$T_1 = 273$ K

To find P_2: $\Delta P = \frac{F}{A} = \frac{(5\text{ kg} \times 9.8\text{ m/s}^2)}{(1.2 \times 10^{-2}\text{ m}^2)} = 4083$ Pa

$P_2 = P_1 + \Delta P = (1.02 \times 10^5\text{ Pa}) + (4083\text{ Pa})$
$P_2 = 1.06 \times 10^5$ Pa
$V_2 = 1.460 \times 10^{-3}$ m^3

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

$\frac{(1.02 \times 10^5\text{ Pa} \times 1.5 \times 10^{-3}\text{ m}^3)}{(273\text{ K})} = \frac{(1.06 \times 10^5\text{ Pa} \times 1.46 \times 10^{-}}{T_2}$

$\boxed{T_2 = 276.4\text{ K}}$

b) $\Delta U = U_f - U_i = \frac{3}{2} \cdot (P \cdot V)_f - \frac{3}{2} \cdot (P \cdot V)_i$

$= \frac{3}{2} \cdot (1.06 \times 10^5\text{ Pa} \times 1.46 \times 10^{-3}\text{ m}^3) -$
$3/2 \cdot (1.02 \times 10^5\text{ Pa} \times 1.5 \times 10^{-3}\text{ m}^3)$

$\boxed{\Delta U = +2.8\text{ J}}$

c) $Q = 0$ by definition (adiabatic process)
$\Delta U = +2.8$ J

$\Delta U = Q + W$
$+2.8\text{ J} = 0 + W$

$\boxed{W = +2.8\text{ J}}$