Phys 344.

Assignment 4.

3.1, 3, 10, 13, 14.
31, 32.

Tutorial 4.

Problem 3.12. $Q \approx 10\ kW \times 24 \times 3600\ sec = 8.64 \times 10^8\ J$.

$T_{inside} = 22^\circ C = 295\ K = const.$

$T_{outside} = 0^\circ C = 273\ K = const.$

$$\Delta S_{inside} = \frac{-Q}{T_{inside}} = \frac{-8.64 \times 10^8\ J}{295\ K} = -2.93 \times 10^6\ J/K.$$

$$\Delta S_{outside} = \frac{Q}{T_{outside}} = \frac{8.64 \times 10^8\ J}{273\ K} = 3.16 \times 10^6\ J/K.$$

$$\Delta S = \Delta S_{inside} + \Delta S_{outside}$$

$$= -2.93 \times 10^6 + 3.16 \times 10^6$$

$$= 2.3 \times 10^5\ J/K.$$

Phys 344.

Tutorial 5.

e.g. Initially:

Valve — closed.

$V_i = 2 \times 10^{-3}\ m^3$

$n = 2$ mol.

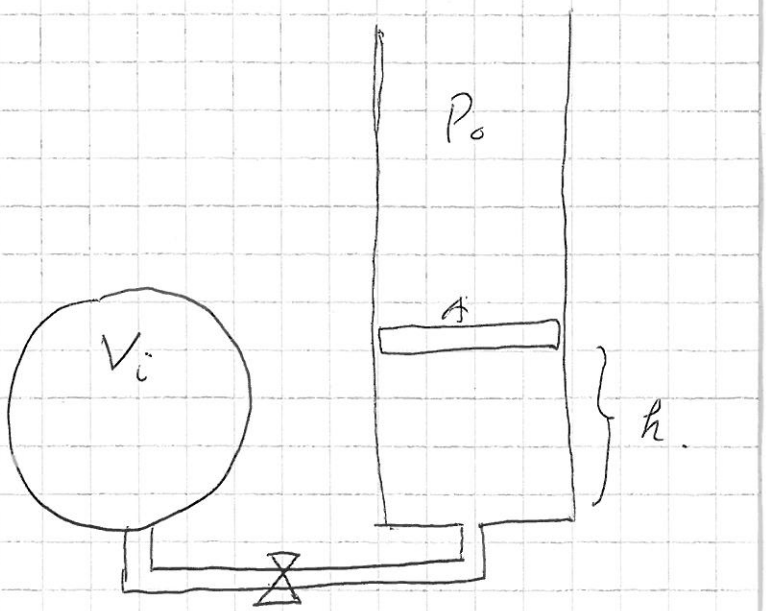
monatomic ideal gas.

piston: $m = 400$ kg.

$mg = 4000\ N$.

$A = 0.01\ m^2$

$P_o = 10^5$ Pa.



The valve is opened and the gas is slowly admitted to the cylinder.

$T_f = 300$ K eventually.

a). $h_f = ?$

b). $W = ?$ $Q = ?$

a) $P_f V_f = nRT$. $\quad P_f = P_0 + mg/A$. $\quad n = 2$.

$$V_f = \frac{nRT}{P_f}$$

$$= \frac{2 \times 8.31 \times 300}{5 \times 10^5}$$

$$= 9.97 \times 10^{-3} \ m^3.$$

$$P_f = 10^5 + \frac{4000}{0.01}$$

$$= 5 \times 10^5 \ Pa.$$

$$= V_i + Ah.$$

$$h = \frac{V_f - V_i}{A} = \frac{9.97 \times 10^{-3} - 2 \times 10^{-3}}{0.01} = 7.97 \times 10^{-1} = 0.80 \ m.$$

b) $W = -\int P_{ext} \, dV$

$$= - P_{ext} \cdot \Delta V$$

$$= - P_f \cdot \Delta V$$

$$= -5 \times 10^5 \left(9.97 \times 10^{-3} - 2 \times 10^{-3}\right)$$

$$= -4.0 \times 10^3 \ J.$$

$Q = \Delta U - W$ $\quad \Delta U = 0$ since $T_i = T_f$.

$$= -W$$

$$= 4.0 \times 10^3 \ J.$$