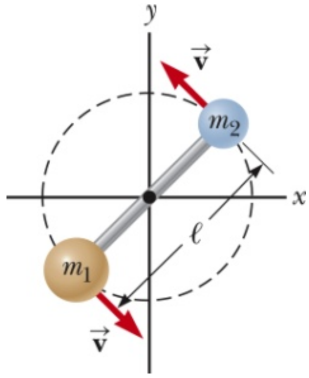
國立東華大學
Department of Physics
National Dong Hwa University, 1, Sec. 2,
Da Hsueh Rd., Shou-Feng, Hualien, 974, Taiwan

General Physics I, Final 1s
PHYS10400, Class year 100
01-12-2012

Solution:

1.

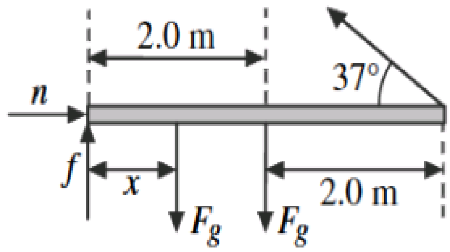


$$L = \sum m_i v_i r_i = m_1 v(l/2) + m_2 v(l/2)$$
$$= (4.okg)(5.0m/s)(0.5m) + (3.0kg)(5.0m/s)(0.5m)$$
$$L = 17.5 kg \cdot m^2/s$$
$$\vec{L} = (17.5 kg \cdot m^2/s)\vec{k}$$

2.

When $x = x_{\min}$, the rod is on the verge of slipping, so

$$f = (f_s)_{\max} = \mu_s n = 0.50n$$



ANS FIG. P12.23

From $\sum F_x = 0, n - T\cos 37° = 0,$

or $n = 0.799T$.

Thus, $f = 0.50(0.799T) = 0.399T$

From $\sum F_y = 0, f + T\sin 37° - 2F_g = 0$,

or $0.399T - 0.602T - 2F_g = 0$, giving $T = 2.00F_g$

Using $\sum \tau = 0$ for an axis perpendicular to the page and through the left end of the beam

gives $-F_g \cdot x_{\min} - F_g(2.0 \text{ m}) + \left[(2F_g)\sin 37°\right](4.0 \text{ m}) = 0$, which reduces to $x_{\min} = \boxed{2.81 \text{ m}}$

3.

We use the tabulated values for C_P and C_V

(a) $Q = nC_P\Delta T =$ 1.00 mol(28.8 J/mol·K)(420-300) K = $\boxed{3.46 \text{ kJ}}$

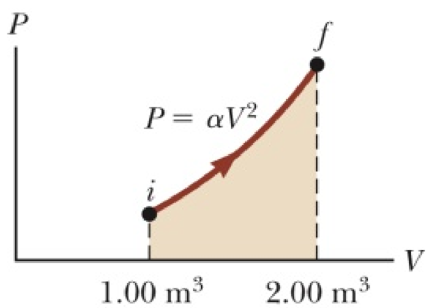
(b) $\Delta E_{\text{int}} = nC_V\Delta T =$ 1.00 mol (20.4 J/mol·K) (120 K) = $\boxed{2.45 \text{ kJ}}$

(C) $W = -Q + \Delta E_{\text{int}} = -3.46$ kJ + 2.45 kJ = $\boxed{-1.01 \text{ kJ}}$

$\boxed{4}$

$$W = -\int_i^f P dV$$

The work done on the gas is the negative of the area under the curve $P = \alpha V^2$



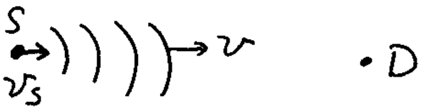
$$W = -\int_i^f \alpha V^2 dV = -\frac{1}{3}\alpha\left(V_f^3 - V_i^3\right)$$

$$V_f = 2V_i = 2\left(1.00 \text{ m}^3\right) = 2.00 \text{ m}^3$$

=

$$W = -\frac{1}{3}\left[\left(5.00 \text{ atm/m}^6\right)\left(1.013\times10^5 \text{ Pa/atm}\right)\right]\left[\left(2.00 \text{ m}^3\right)^3 - \left(1.00 \text{ m}^3\right)^3\right] = \boxed{-1.18 \text{ MJ}}$$

5.



When source moves towards the detector @ a speed V_s

Wave front moves vT during a period of time T (W_1)

Source moves $V_s T$ during a period of time T (W_2)

the distance between W_1 and W_2 is the detected wave length λ'

$$\lambda' = vT - v_s T$$

$$f' = \frac{v}{\lambda'} = \frac{v}{vT - v_s T} = \frac{v}{\frac{v}{f} - \frac{v_s}{f}} = f \frac{v}{v - v_s}$$