〈9장〉 #7.

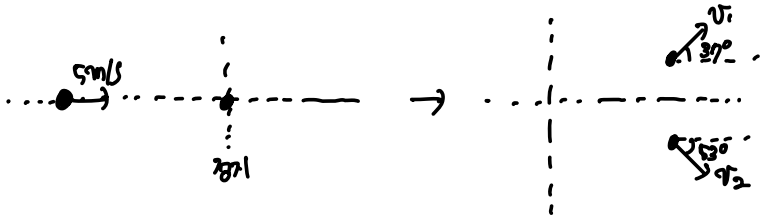
(a) $I = (1+5) \times \frac{1}{2} \times 4 = 12\,N\cdot S \quad \therefore I = 12N\cdot S$

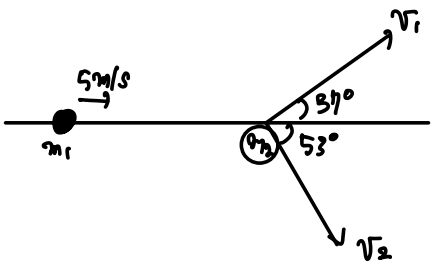
(b) $12 = \Delta p = pf - pi = pf = 2.50k\cdot Vf \quad \therefore Vf = 4.8\,m/s$

(c) $12 = \Delta p = pf - pi = 2.50kg \times Vf - 2.50kg \times (-2m/s) \quad \therefore Vf = 2.8\,m/s$

(d) $I = \bar{F}\cdot t \quad F_{평균} = \frac{12N}{5S} = 2.4N \quad \therefore F_{평균} = 2.4N$

#2





(v_1 : m_1의 나중속력
v_2 : m_2의 나중속력)

($\because m_1 = m_2$)

운동량보존 : $\begin{cases} 5m_1 = m_1 v_1 \cos 37^\circ + m_2 v_2 \cos 53^\circ \longrightarrow \times \sin 37^\circ \\ 0 = m_1 v_1 \sin 37^\circ - m_2 v_2 \sin 53^\circ \longrightarrow \times \cos 37^\circ \end{cases}$ ⊖ 연립

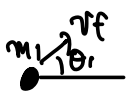
$5\sin 37^\circ = v_1 \cos 37^\circ \sin 37^\circ + v_2 \cos 53^\circ \sin 37^\circ - v_1 \sin 37^\circ \cdot \cos 37^\circ + v_2 \sin 53^\circ \cdot \cos 37^\circ$

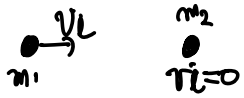
$5\sin 37^\circ = v_2 \cos 53^\circ \cdot \sin 37^\circ + v_2 \sin 53^\circ \cdot \cos 37^\circ$

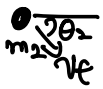
$5\sin 37^\circ = v_2 \sin(53^\circ + 37^\circ) = v_2 \sin 90^\circ = v_2$

$\therefore v_2 = 3.01\,m/s \,,\; v_1 = 3.99\,m/s$ ■

#3







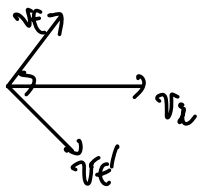
① $m_1 = m_2$

x성분 : $m_1 v_i = m_1 v_f \cos\theta_1 + m_2 v_f' \cos\theta_2$

y성분 : $0 = m_1 v_f \sin\theta_1 + m_2 v_f' \sin\theta_2$

운동에너지보존 : $\frac{1}{2} m_1 v_i^2 = \frac{1}{2} m_1 v_f^2 + \frac{1}{2} m_2 v_f'^2$

$v_i^2 = v_f^2 + v_f'^2$



② $m_1 < m_2$

$m_1 v_i = m_1 v_f \cos\theta_1 + m_2 v_f' \cos\theta_2$

$v_i = v_f \cos\theta_1 + \frac{m_2}{m_1} v_f' \cos\theta_2$

$\frac{m_2}{m_1} v_f' = v_1$ 로 하면

$\frac{1}{2} m_1 v_i^2 = \frac{1}{2} m_1 v_f^2 + \frac{1}{2} m_2 v_f'^2$

$v_i^2 = v_f^2 + v_1^2$

$v_f' < v_1$ 이면

$v_i^2 > v_i^2 + v_f^2$ 들어간다. ($90°$보다 크다)

③ $m_1 > m_2$

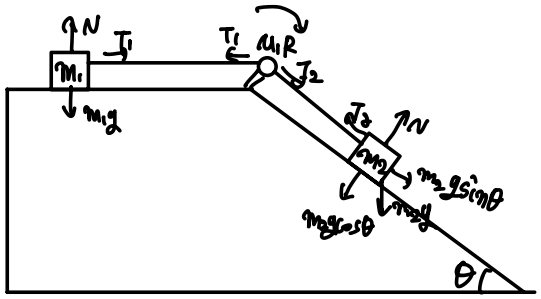
$m_1 v_i = m_1 v_f \cos\theta_1 + m_2 v_f' \cos\theta_2$

$v_i = v_f \cos\theta_1 + \frac{m_2}{m_1} v_f' \cos\theta_2$

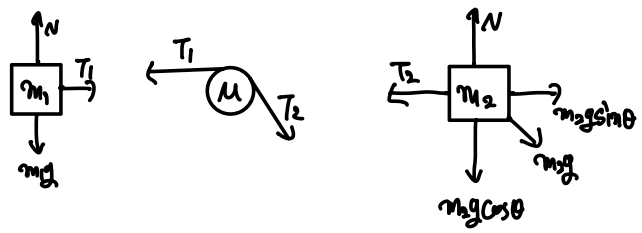
$\frac{m_2}{m_1} v_f' = v_1$ 이라하면, $\frac{1}{2} m_1 v_i^2 = \frac{1}{2} m_1 v_f^2 + \frac{1}{2} m_2 v_f'^2$

$v_i^2 = v_f^2 + v_2^2$ 이다. $v_f' > v_2$ 이므로 $v_i^2 < v_f^2 + v_f'^2$ 이다.

〈10장〉 #1 $m_1 = 2.00\text{kg}$ $m_2 = 6.00\text{kg}$ $R = 0.250\text{m}$ $M = 10.0\text{kg}$
$\theta = 30.0°$ $\mu_K = 0.360$ $g = 9.8\text{m/s}^2$



(a) free-body diagram



(b)

① $T_1 - \mu_K m_1 g = m_1 a$

② $m_2 g\sin\theta - \mu_K m_2 g\cos\theta - T_2 = m_2 a$

③ $R(T_2 - T_1) = \frac{1}{2} MR^2 \cdot \frac{a}{R} \rightarrow T_2 - T_1 = \frac{1}{2} Ma$

①+②+③ $m_2 g\sin\theta - (\mu_K m_1 g + \mu_K m_2 g\cos\theta) = (m_1 + m_2 + \frac{1}{2} M)\, a$

$6 \times 9.8 \times \sin 30° - 0.360(1 \times 9.8 + 6 \times \cos 30° \times 9.8) = (2 + 6 + \frac{1}{2} \times 10) \times a$

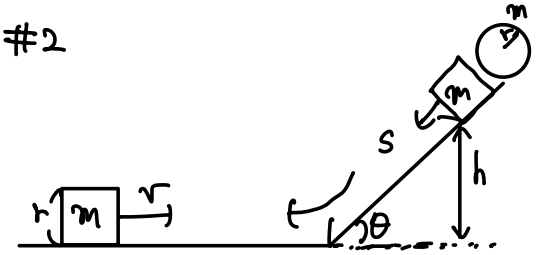
$\therefore a = 0.309\text{m/s}^2$

(c) $T_1 = m_1 a + \mu_K m_1 g = 0.668 + 7.056 = 7.674N$

$T_2 = m_2 g \sin\theta - \mu_K m_2 g \cos\theta - m_2 a = 29.4 - 18.3 - 1.854 = 9.246N$

$\therefore T_1 = 7.674N$, $T_2 = 9.246N$

#2



상자 : $\frac{1}{2}mv^2 = mgh = mg\frac{s}{\sin\theta}$ $\quad \therefore s = \frac{v^2}{2g}\sin\theta$

원통 : $\frac{1}{2}mv^2 + \frac{1}{2}Iw^2 = mgh' = mg\frac{s'}{\sin\theta}$

$I = \frac{1}{2}mr^2$, $w = \frac{v}{r}$

$\therefore \frac{1}{2}mv^2 + \frac{1}{2}\cdot\frac{1}{2}\cdot mr^2\cdot\frac{v^2}{r^2} = \frac{4}{3}mv^2 = mg\frac{s'}{\sin\theta}$

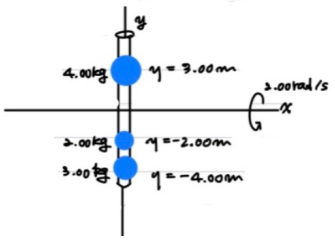
$\therefore s' = \frac{3v^2}{4g}\sin\theta$

(a) 원통이 더 멀리까지 간다.

(b) $\frac{v^2}{4g}\sin\theta$

(c) 원통의 회전운동E

#3



(a) $I = 4 \cdot 3^2 + 2(-2)^2 + 3 \cdot (-4)^2 = 94 kg \cdot m^2$

(b) $\frac{1}{2} \times 94 \times 2^2 = 184 J$

(c) 4kg : $3 \times 2 = 6$ m/s
2kg : $2 \times 2 = 4$ m/s
3kg : $4 \times 2 = 8$ m/s

(d) 4kg : $\frac{1}{2} \times 4 \times 36 = 72 J$
2kg : $\frac{1}{2} \times 2 \times 16 = 16 J$
3kg : $\frac{1}{2} \times 3 \times 64 = 96 J$
$E_k = 72 + 16 + 96 = 184 J$

(e) (b)와 (d)의 결과는 같다.