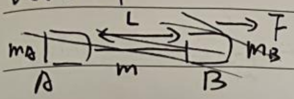
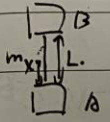
68. 1-34



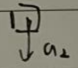


$$F - F_T = (m_B + \frac{L-x}{L} m)a$$

$$F_T = (m_A + \frac{x}{L} m)a$$

$$\Rightarrow F_T = 96 + 24x$$

68. 1-35



$\cancel{F - m_2 g = -m_2 a_2 \Rightarrow F = m_2 g\ m_2(g-a_2)}$

$\cancel{F - m_1 g = m_1 a_1 \Rightarrow a_1 = \frac{m_2}{m_1}(g-a_2) - g}$

向上为+，设绳相对地面为a_1 ① ~~绳子~~ m_1向上走.

$$\therefore \begin{cases} m_2 g - F = m_2(a_1 + a_2) \\ F - m_1 g = m_1 a_1 \end{cases} \Rightarrow \begin{cases} F = \frac{m_1 m_2}{m_1 + m_2}(2g - a_2) \quad \cancel{方向} \\ a_1 = \frac{(m_2 - m_1)g - m_2 a_2}{m_1 + m_2} \end{cases}$$

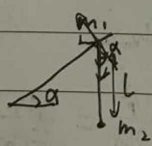
$$a_{环} = a_1 + a_2 = \frac{(m_2 - m_1)g + m_1 a_2}{m_1 + m_2}$$

② m_1向下走

$$\begin{cases} m_2 g - F = m_2(a_2 - a_1) \\ \cancel{F - m_1 g =} m_1 g - F = m_1 a_1 \end{cases} \Rightarrow \begin{cases} F = \frac{m_1 m_2 (2g - a_2)}{m_1 + m_2} \\ a_1 = \frac{m_2 a_2 - (m_2 - m_1)g}{m_1 + m_2} \end{cases}$$

$$a_{环} = a_2 - a_1 = \frac{m_1 a_2 + (m_2 - m_1)g}{m_1 + m_2}$$

1-38.

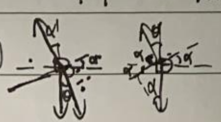


(1)

$\cancel{(F_T + m_1 g)\cdot \sin\alpha = m_1 a}$ $F_{Na} = (F_T + m_1 g)\cos\alpha$

$$\begin{cases} F_T + m_1 g - F_{Na}\cdot\cos\alpha = m_1 a \\ \cancel{F_T - m}\ m_2 g - F_T = m_2 a \end{cases} \Rightarrow F_T = \frac{g m_1 m_2 \cos^2\alpha}{m_1 + m_2 \sin^2\alpha}$$

(2)



$$\frac{F_T\cdot\cos(\frac{\pi}{2}+\alpha-\theta) + m_2 g\cdot\sin\alpha}{m_2} = \frac{m_1 g\sin\alpha + F_T\cdot\cos(\frac{\pi}{2}+\alpha-\theta)}{m_1}$$

$$\Rightarrow \theta = \alpha$$

19. 1-41

(1) $F = -\frac{kv^2}{m} = \frac{dv}{dt} \Rightarrow -\frac{k}{m}t + C = -\frac{1}{v} \Rightarrow v = \frac{1}{\frac{k}{m}t + C}$

$t=0$ 时 $v = v_0$ $\therefore C = \frac{1}{v_0}$ $v = \frac{mv_0}{v_0kt + m}$

(2) $x = \int v\,dt = \frac{m}{k}\ln\left(\frac{v_0k}{m}t + 1\right)$

(3) $e^x = \left(\frac{v_0kt}{m} + 1\right)^{\frac{m}{k}} \Rightarrow \frac{v_0kt}{m} + 1 = e^{\frac{kx}{m}} \Rightarrow v = v_0 \cdot e^{-\frac{kx}{m}}$

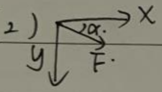
$= v_0 \cdot e^{-k'x}$

69. 1-42

速度是已知.

(1) $F = -kv^2 = ma \Rightarrow \frac{dv}{dt} = -\frac{k}{m}v^2 \Rightarrow v = v_0 e^{-\frac{k}{m}x}$

$x = l_0$ 时. $v_p = v_0 e^{-\frac{k}{m}l_0}$

(2) 

$\vec{F} = F\cdot\cos\alpha\,\vec{i} + F\cdot\sin\alpha\,\vec{j} - kv_p^2\,\vec{i}$

$= (F\cdot\cos\alpha - kv_0^2 e^{-\frac{2k}{m}l_0})\vec{i} + F\cdot\sin\alpha\,\vec{j}$

$\Sigma F = |F| = \sqrt{F_x^2 + F_y^2} = ma \Rightarrow a = \sqrt{F^2 - 2Fkv_0^2 e^{-\frac{2k}{m}l_0}\cos\alpha + k^2v_0^4 e^{-\frac{4k}{m}l_0}} \times \frac{1}{m}$.

~~$a_\tau = \frac{d^2s}{dt^2} = \frac{dv}{dt} =$~~

~~$\vec{v} = \frac{dx}{dt} \cdot \frac{1}{m}$~~ $\vec{v} = \int \frac{1}{m}\vec{F}\,dt = \frac{1}{m}\left[(F_x t + v_p)\vec{i} + tF_y\vec{j}\right]$

$\therefore v = \frac{1}{m}\sqrt{F_x^2t^2 + 2F_xtv_p + v_p^2 + t^2F_y^2} = \sqrt{F^2t^2 + 2F_xtv_p + v_p^2}\,\frac{1}{m}$

$\therefore a_\tau = \frac{dv}{dt} = \frac{1}{m}\frac{2F^2t + 2F_xv_p}{2\sqrt{F^2t^2 + 2F_xtv_p + v_p^2}}$ $t=0$ 时.

$a_\tau = \frac{F_x}{m} = \frac{1}{m}(F\cos\alpha - kv_0^2 e^{-\frac{2k}{m}l_0})$.

$a_n = \sqrt{a^2 - a_\tau^2} = \frac{1}{\rho}v^2 \Rightarrow \rho = \frac{v_p^2}{a_n} = \frac{m}{F\sin\alpha}v_0^2 e^{-\frac{2k}{m}l_0}$

完了.题目看错了.看成 $F = -kv^2$. 修正后答案如下.

(1) $v = v_0 - \frac{k}{m}x$ $v_p = v_0 - \frac{k}{m}l_0$

(2). $a_\tau = \frac{1}{m}(F\cos\alpha - kv_0 + \frac{k^2}{m}l_0)$.

$\rho = \frac{m}{F\sin\alpha}(v_0 - \frac{k}{m}l_0)^2$

69.1-43

(1) $\vec{F} = -kv\vec{i} = m\frac{d\vec{v}}{dt} \Rightarrow \frac{d\vec{v}}{dt} = -\frac{k}{m}\vec{v} \Rightarrow \frac{1}{v}d\vec{v} = -\frac{k}{m}dt$

$t=0$时，$v=v_0 \Rightarrow \vec{v} = v_0 e^{-\frac{k}{m}t}\vec{i}$ $\qquad \Rightarrow \ln v = -\frac{k}{m}t + C$

(2) $\frac{dv}{dt} = -\frac{k}{m}v \Rightarrow \frac{dv}{dx}v = -\frac{k}{m}v \Rightarrow v = -\frac{k}{m}x + C \Rightarrow v = -\frac{k}{m}x + v_0$

$\Rightarrow x_{max} = \frac{m}{k}v_0$

~~69.1-44~~

~~$F = ma = m\omega^2 \ldots$~~

~~绳末端 $T = m\omega^2 L$~~

~~距O r处~~的dl有 $m' = \frac{dl}{L}M$. $F = ma = \frac{dl}{L}M\omega^2 \cdot r$

~~r-dl处的dl $F = \frac{dl}{L}M\omega^2(r-dl) \Rightarrow F = \int_0^r \frac{M}{L}\omega^2 r$~~

69.1-44.

对 $0-r$ $\quad F = m\omega^2 r$ ~~$F_{0r} = \int_0^r m\omega^2 r\,dr =$~~

每dl，$m = \frac{dl}{L}M$, $F = \frac{dl}{L}\omega^2 M r$ $\qquad \sum F = \frac{\omega^2}{L}M(dl + \cdots + ndl)\cdot\frac{r}{n} = \frac{1}{2}\frac{\omega^2 M}{L}\cdot r^2$

整个，$T = \sum F(L) + m\omega^2 \cdot L = (\frac{1}{2}M + m)\omega^2 \cdot L$

$\therefore \quad T(r) = T - \sum F(r) = (\frac{1}{2}M + m)\omega^2 \cdot L - \frac{1}{2}\frac{r^2}{L}\omega^2 M$.

70.1-46

$F = ma \Rightarrow \vec{a} = 2\vec{i} - 12t^2\vec{j} \quad \therefore \vec{v} = \int \vec{a}\,dt = (2t + v_x)\vec{i} - (4t^3 + v_y)\vec{j}$

$= (2t+3)\vec{i} + (4 - 4t^3)\vec{j}$.

$\therefore \vec{v}(1) = 5\vec{i} \qquad F_n = F_y = -24\vec{j}\ N$