

104.2-1

$$A = \int_a^B \vec{F} \cdot d\vec{r} = \int_a^B \vec{F} \cdot dx = -F \cdot R = -12 \text{ J}$$

104.2-2

$$\vec{v} = 5t^2 \vec{i} + 0.5 \vec{j} \Rightarrow \vec{v} = 10t \vec{i}$$

$$A = \frac{1}{2} m \vec{v}(4)^2 - \frac{1}{2} m \vec{v}(2)^2 = 300 \text{ J}$$

104.2-3

$$x_1 = \frac{h}{\tan \alpha_1} = 2\sqrt{3} \text{ m}, \quad x_2 = \frac{h}{\tan \alpha_2} = 2 \text{ m}.$$

$$A = \int_{x_1}^{x_2} F \cdot \cos \alpha \, d\vec{r} \quad \alpha = \tan \alpha = \frac{h}{L-r}$$

$$\Rightarrow L-r = \frac{h}{\tan \alpha} \Rightarrow dr = \frac{h}{\sin^2 \alpha} d\alpha$$

$$\therefore A = h \int_{\alpha_1}^{\alpha_2} F \cdot \frac{\cos \alpha}{\sin^2 \alpha} d\alpha = -\frac{hF}{\sin \alpha} \Big|_{\alpha_1}^{\alpha_2} = 2(2-\sqrt{2}) \cdot 25.6 \text{ J}$$

$$A = \frac{1}{2} M V^2 - \frac{1}{2} M 0^2 \Rightarrow V = \frac{32}{5} \sqrt{2-\sqrt{2}} \text{ m/s}$$

104.2-4

$$\vec{v} = \vec{e}_r \frac{ds}{dt}, \quad \vec{a} = \frac{d^2 s}{dt^2} \vec{e}_r + \frac{1}{\rho} \left(\frac{ds}{dt} \right)^2 \vec{e}_n$$

$$m g_n = N - mg = m \frac{V^2}{R} \Rightarrow V^2 = \frac{m}{R} (N - mg) \frac{R}{m} (N - mg)$$

$$\frac{1}{2} m V^2 - 0 = mgR + W_f \Rightarrow W_f = \frac{1}{2} \frac{R^2}{m} (N - mg)^2 - mgR$$

104.2-5

$$= \frac{1}{2} N^2 R - \frac{3}{2} mgR$$

$$\frac{1}{2} m V_m^2 - 0 = W_f + W_g$$

$$x^2 + h^2 = L^2 \quad \text{两边} \Rightarrow 2x dx = 2L dL \Rightarrow dL = \frac{x}{L} dx$$

$$\text{两边} \times \frac{1}{dt} \Rightarrow \frac{d}{dt} U_L = \frac{x}{L} U_0 = \frac{x}{L} V_0 = V_m$$

$$\cancel{dX_L} = \int_0^t \cancel{V_L} dt = \int_0^t \frac{x}{L} V_0 dt \quad \text{或 } X_L = \sqrt{x_1^2 + h^2} - \sqrt{h^2 + x_0^2}$$

$$\therefore W_f = -mgM \cdot \Delta X_L$$

$$\Rightarrow W_f = \frac{1}{2} m \frac{x_1^2}{L^2} V^2 + mgM (\sqrt{x_1^2 + h^2} - \sqrt{h^2 + x_0^2})$$

$$= \frac{1}{2} m \frac{1}{L^2} (x_1 - x_0)^2 V^2 + mgM (\sqrt{x_1^2 + h^2} - \sqrt{h^2 + x_0^2})$$

$$= \frac{1}{2} m \frac{x_1^2}{h^2 + x_1^2} V^2 + mgM (\sqrt{x_1^2 + h^2} - \sqrt{h^2 + x_0^2})$$