

# 114 學年度第 1 學期普物會考詳解

## <基礎題詳解>

$$1. \quad h = v_0 t - gt^2/2, \quad t_1 = \frac{v_0 - \sqrt{v_0^2 - 2gh}}{g}, \quad t_2 = \frac{v_0 + \sqrt{v_0^2 - 2gh}}{g},$$

Therefore, the answer is (B)  $h = (gt_1 t_2)/2$

$$2. \quad 0 - \frac{m}{2}g \left( \frac{L}{2} \times \frac{1}{2} \right) = \frac{1}{2}mv^2 - mg \left( \frac{L}{2} \right) \rightarrow v = \sqrt{\frac{3}{4}gL} \quad (\text{A})$$

$$3. \quad \frac{4}{3}mg - mg = ma, \rightarrow a = \frac{1}{3}g, \text{ upward. } (\text{A})$$

$$4. \quad \theta(t) = t^3 - 3t^2 + 4t. \text{ radius } r = 2 \text{ and } t = 2. \text{ Centripetal acceleration is } a_c = r\omega^2,$$

$$\text{where } \omega(t) = 3t^2 - 6t + 4, \quad \omega(2) = 3(4) - 6(2) + 4 = 12 - 12 + 4 = 4 \text{ rad/s. } \underline{a_c = r\omega^2 = 32 \text{ m/s}^2}. (\text{E})$$

5. (C). The coefficient of static friction is greater than the coefficient of kinetic friction. This is correct.

6. (C). An object at rest can remain at rest if the net force on it is zero

7. The maximum kinetic energy the object can obtain during the entire motion:

$$W = \Delta K = \int_0^\infty F_0 e^{-kx} dx = \frac{F_0}{k} \quad (\text{E}).$$

8. Ans. C

$$mgh = \frac{1}{2}mv^2$$

$$(1.0)(9.8)(5.0) = \frac{1}{2}(1.0)v^2$$

$$49 = \frac{1}{2}v^2$$

$$v^2 = 98$$

$$v = 9.9 \text{ m/s}$$

## 114 學年度第 1 學期普物會考詳解

9. Ans. C

$$U = \frac{1}{2}kx^2 = \frac{1}{2}(200)(0.10^2)$$

$$U = 100(0.01) = 1.0 \text{ J}$$

10. Ans. C

$$(2)(3) + (1)(0) = (2 + 1)v_f$$

$$6 = 3v_f$$

$$v_f = 2.0 \text{ m/s}$$

11. Ans. B

$$x_{cm} = \frac{m_1x_1 + m_2x_2}{m_1 + m_2}$$

$$x_{cm} = \frac{3(0) + 1(4)}{4} = \frac{4}{4} = 1 \text{ m}$$

12. Ans. D

$$\omega = \omega_0 + \alpha t = 0 + (2)(4) = 8 \text{ rad/s}$$

13. Ans. B

$$K = \frac{1}{2}I\omega^2$$

$$I = \frac{1}{2}MR^2 = \frac{1}{2}(2)(0.5^2) = 1 \times 0.25 = 0.25 \text{ kg}$$

$$K = \frac{1}{2}(0.25)(4^2) = 0.125(16) = 2 \text{ J}$$

# 114 學年度第 1 學期普物會考詳解

14. Ans. B

$$L = I\omega = (0.20)(5) = 1.0 \text{ kg-m}^2/\text{s}$$

15. 在平衡狀態，所有力在各方向成分之合必須等於零。

$$16. E = U + K = \frac{1}{2}Kx_m^2$$

$$2 = \frac{1}{2}K(0.08)^2$$

$$K = 625$$

$$17. v = \frac{\omega}{k}$$

$$18. v = \sqrt{\frac{\tau}{\mu}}$$

$\mu$ : 線質量密度

$\tau$ : 張力

$$19. B = 10\text{dB} \log \frac{I}{I_0} = 10 \log \frac{100}{1} \text{dB} = 10 \cdot 2\text{dB} = 20\text{dB}$$

20. 根據都普勒效應，偵測點靠近聲源時，頻率上升。

<進階題詳解>

1. At the top of the circle, for the string to be just taut, tension  $T_{\text{top}} = 0$ .

Then the only force providing centripetal acceleration is gravity:

$$mg = \frac{mv_{\text{top}}^2}{L}. \quad v_{\text{top}}^2 = gL$$

$$\frac{1}{2}mv_0^2 = \frac{1}{2}mv_{\text{top}}^2 + mg2L, \quad \frac{1}{2}mv_0^2 = \frac{1}{2}mgL + mg2L = \frac{5}{2}mgL \quad v_0 = \sqrt{5gL} \quad \text{(C).}$$

$$2. \quad y_{\text{max}} = \frac{v_0^2 \sin^2 \theta}{2g}, \quad x_{\text{max}} = \frac{2v_0^2 \sin \theta \cos \theta}{g}, \quad y_{\text{max}}/x_{\text{max}} = \frac{1}{4} \tan \theta = \frac{\sqrt{3}}{4}. \quad \text{(B).}$$

# 114 學年度第 1 學期普物會考詳解

3. (E)  $K = ka^3/3 - 3ka^2/2$  ∴  $W = \int_0^a (kx^2 - 3kx)dx = ka^3/3 - 3ka^2/2 = \Delta K$

4. Ans. D

$$mgh = \frac{1}{2}mv^2$$

$$v = \sqrt{2gh} = \sqrt{2(9.8)(1.8)} = 5.94 \text{ m/s}$$

$$p=mv$$

$$p=0.50(5.94)=2.97 \text{ kg}\cdot\text{m/s}$$

5. Ans. A

$$\omega = \frac{v}{R} = \frac{3.0}{0.20} = 15 \text{ rad/s}$$

$$K = K_{\text{trans}} + K_{\text{rot}}$$

$$K = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

$$K_{\text{trans}} = \frac{1}{2}(4.0)(3.0^2) = 2(9) = 18 \text{ J}$$

$$I = \frac{2}{5}MR^2 = \frac{2}{5}(4.0)(0.20^2) = \frac{2}{5}(4)(0.04) = \frac{2}{5}(0.16) = 0.064$$

$$K_{\text{rot}} = \frac{1}{2}I\omega^2 = \frac{1}{2}(0.064)(15^2) = 0.032(225) = 7.2 \text{ J}$$

$$K = 18 + 7.2 = 25.2 \text{ J}$$

6. Ans. E

$$\tau = rF = (0.25)(2.0) = 0.50 \text{ N}\cdot\text{m}$$

$$\alpha = \frac{\tau}{I} = \frac{0.50}{0.40} = 1.25 \text{ rad/s}^2$$

$$\omega = \omega_0 + \alpha t = 0 + (1.25)(3.0) = 3.75 \text{ rad/s}$$

# 114 學年度第 1 學期普物會考詳解

$$7. T \cos 30^\circ = 600$$

$$T \cdot \frac{\sqrt{3}}{2} = 600$$

$$T = 690N$$

$$8. x(t) = x_m \cos(\omega t + \phi)$$

$$a(t) = -\omega^2 x_m \cos(\omega t + \phi)$$

位置 6， $a = -x_m$  振幅最小

$\Rightarrow x = +x_m$  振幅最大

$$9. v = \frac{\omega}{k}$$

$$\text{wave1: } v_1 = \frac{3}{4}$$

$$\text{wave2: } v_2 = \frac{4}{8}$$

$$\text{wave3: } v_3 = \frac{8}{4}$$

從最小到最大  $\therefore v_2 < v_1 < v_3$

10.

$$A: L = \frac{n}{4}\lambda \quad n = 1, 3, 5 \dots \quad \text{基頻 } n = 1 \quad L = \frac{\lambda}{4}$$

$$B: 2L = \frac{n}{4}\lambda \quad n = 1, 3, 5 \dots \quad L = \frac{n\lambda}{8} \quad \text{沒有一個滿足}$$