

5 題

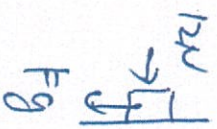
$$\vec{v} = v_f - v_i = 200\hat{j} - 200\hat{i}$$

$$a = \frac{|\frac{d\vec{v}}{dt}|}{dt} = \frac{|200\hat{j} - 200\hat{i}|}{20} = \frac{200\sqrt{2}}{20} = 14$$

2. 圓性化傾向阻止物體在運動中改變

$$3. T - mg = ma$$

$$T = m(g + a) = 1000(9.8 + 3) = 1280$$

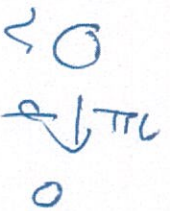


$$F_g = 0.5 \times 9.8 = 4.9 < 12 \text{ 不會重力}$$

5. 等速率圓周運動就是大小為常數方向指向固定點之力

$$6. E_k = \frac{1}{2}mv^2$$

$$m_{\text{地}} : m_{\text{月}} = 1:1 \quad \therefore E_{k\text{地}} : E_{k\text{月}} = 1:1$$



$$F \cdot d = \frac{1}{2}mv^2 \quad F = \frac{mv^2}{2d}$$

進階題

1-



$$T - mg \sin \theta = ma$$

$$40 - m \cdot 9.8 \sin 30 = m \cdot 2$$

$$40 = k \cdot p \cdot m \quad m = 5.8$$

2-

$$T = ma = m \omega^2 r = 2.2 \left(\frac{150 \cdot 2\pi}{60} \right)^2 \cdot 0.6 = 29.57 \approx 30$$

3-

$$F = ma \quad 50 = 2 \cdot a \quad a = 25$$

$$v_f = v_0 + at = 0 + 25 \cdot 2 = 50$$

$$E_k = \frac{1}{2} m v^2 = \frac{1}{2} \cdot 2 \cdot 50^2 = 2500$$

普物會考詳解
第一部分：基礎題型

8. Impulse = $\Delta P = P_f - P_i$
 $= 0.2 \times 20 - 0.2 \times (-30) = 10 \text{ N} \cdot \text{s}$

Ans: A.

9. $x_{\text{com}} = \frac{30 \times 3 + 40 \times (-2) + 20x}{90} = 0$

$$\therefore x = -\frac{10}{20} = -0.5$$

$$y_{\text{com}} = \frac{30 \times 4 + 40 \times (-2) + 20y}{90} = 0$$

$$\therefore y = \frac{-40}{20} = -2$$

Ans: E.

10. $mgh = mg(h - 0.04) + \frac{1}{2}mv^2 + \frac{1}{2}k(0.04)^2$

$$\Rightarrow 0 = -0.04 \times 2 \times g + \frac{1}{2} \times 2 \times v^2 + \frac{1}{2} \times 200 \times (0.04)^2$$

$$\Rightarrow 0 = -0.784 + v^2 + 0.16$$

$$\Rightarrow v = \sqrt{0.624} = 0.79 \text{ ms}^{-1} = 79 \text{ cms}^{-1}$$

Ans: D.

11. $\frac{1}{2}mv^2 = f_k d + \frac{1}{2}kd^2 = \mu_k mgd + \frac{1}{2}kd^2$

$$\mu_k = \frac{0.5 \times 2 \times (2.6)^2 - 0.5 \times 250 \times (0.2)^2}{2 \times 9.8 \times 0.2} = 0.45$$

Ans: B.

12. Mass gain kinetic energy when falling down. Let both mass at height h initially.
After falling ah:

$$M_A gh - M_A g(h - ah) = M_A gah$$

$$M_B gh - M_B g(h - ah) = M_B gah = 2M_A gah$$

$\therefore$ mass B lost twice potential energy of mass A.

$$\therefore K_B = 2K_A$$

Ans: E.

$$13. \quad a_v = \frac{v^2}{r} = \frac{(r\omega)^2}{r} = r\omega^2$$

$$a_t = r\alpha$$

If $a_v = a_t$, then $r\omega^2 = r\alpha$

$$\omega = \alpha t \Rightarrow t = \frac{\sqrt{2.1}}{2.1} = 0.69 \text{ s}$$

Ans: C.

$$14. \quad L = mvr = 1000 \times 50 \times 100 = 5.0 \times 10^6 \frac{\text{kgm}^2}{\text{s}}$$

Ans: A.

第二部分：進階題型

$$4. \quad m_2 g - T_2 = m_2 a \Rightarrow T_2 = m_2(g - a)$$

$$T_1 = m_1(g + a)$$

$$T_2 - T_1 = m_2(g - a) - m_1(g + a) = 2(g - a) - (g + a) = g - 3a$$

$$\tau = l\alpha = l \frac{a}{R} = (T_2 - T_1)R = (g - 3a)R$$

$$\Rightarrow a = \frac{(g - 3a)R \times R}{l} = \frac{1}{5}(g - 3a)$$

$$\Rightarrow a = \frac{1}{8}g$$

Ans: C.

$$5. \quad 2.4 \text{ rev} = 4.8\pi, t = 2 \text{ s}$$

$$\theta = \omega_i t + \frac{1}{2}\alpha t^2 \Rightarrow 4.8\pi = 2\omega_i + \frac{1}{2} \times 2 \times t^2$$

$$\Rightarrow \omega_i = \frac{4.8\pi - 4}{2} = 2.4\pi - 2$$

$$\omega_f = \omega_i + \alpha t = 2.4\pi - 2 + 2 \times 2 \approx 9.54$$

Ans: A.

6. Let v' : speed of 5.0 g - particle; v : speed of 2.0 g - particle.

After collision:

$$\text{Vertical: } 5v' \sin 30^\circ = 2v \sin 30^\circ \Rightarrow 5v' = 2v \quad \text{--- ①}$$

$$\text{Horizontal: } 5v' \cos 30^\circ + 2v \cos 30^\circ = 300 \Rightarrow 5v' + 2v = \frac{300 \times 2}{\sqrt{3}} \quad \text{--- ②}$$

Substitute ① into ②:

$$4v = \frac{600}{\sqrt{3}}$$

$$v = \frac{150}{\sqrt{3}} = 86.6 \text{ ms}^{-1}$$

Ans: B.

< 第一部份：基礎題型 >

15.

An object attached to one end of a spring makes 40 vibrations in 10s. Its period is:

- (A) 4 Hz
- (B) 10 s
- (C) 0.25 Hz
- (D) 4 s
- (E) 0.25 s

$$T = \frac{10}{40} = 0.25 \text{ s}$$

16.

The displacement of a string is given by $y(x, t) = y_m \sin(2kx + \omega t)$, the wavelength of the wave is:

- (A) $4\pi k/\omega$
- (B) k/ω
- (C) $2\omega k$
- (D) π/k
- (E) $2k/\pi$

$$\lambda = \frac{2\lambda}{2k} = \frac{\lambda}{k}$$

17.

A fire whistle emits a tone of 150 Hz. Take the speed of sound in air to be 300 m/s. The wavelength of this sound is about:

- (A) 0.5 m
- (B) 1.5 m
- (C) 2.0 m
- (D) 3.0 m
- (E) 300 m

$$\lambda = \frac{v}{f} = \frac{300}{150} = 2 \text{ m}$$

18.

The sound intensity 4.0 m from point source is 0.80 W/m^2 . The power output of the source is:

- (A) 40 W
- (B) 126 W
- (C) 160 W
- (D) 320 W
- (E) 506 W

$$P = I A = 0.8 \times (4\pi \times 4^2) = 160 \text{ W}$$

19.

How many calories are required to change ten gram of 0°C ice to 100°C steam?

The latent heat of fusion is 80 cal/g and the latent heat of vaporization is 540 cal/g .

The specific heat of water is 1.00 cal/g .

- (A) 7200 cal
(B) 6200 cal
(C) 720 cal
(D) 620 cal
(E) 540 cal

$$\begin{aligned} H &= H_{\text{ice}} + H_{\text{ice} \rightarrow \text{water}} + H_{\text{water}} \\ &= 10 \times 80 + 10 \times 1 \times 100 + 10 \times 540 \\ &= 7200 \text{ cal} \end{aligned}$$

>20.

An object is undergoing simple harmonic motion. Throughout a complete cycle it:

- (A) has constant speed
(B) has varying amplitude
(C) has varying period
(D) has varying acceleration
(E) has varying mass

圓周運動

 $\Rightarrow$ 加速度不同

<第二部份：進階題型>

7.

The rotational inertia of a uniform thin rod about its end is $ML^2/5$, where M is the mass and L is the length. Such a rod is hung vertically from one end and set into small amplitude oscillation. If $L = 1.5\text{ m}$ this rod will have the same period as a simple pendulum of length:

- (A) 30 cm
(B) 40 cm
(C) 60 cm
(D) 90 cm
(E) 150 cm

$$\left\{ \begin{array}{l} \text{for physical pendulum : } T = 2\pi \sqrt{\frac{I}{mgh}} \\ \text{for simple pendulum : } T = 2\pi \sqrt{\frac{L_0}{g}} \end{array} \right.$$

$$\Rightarrow \text{hence : } 2\pi \sqrt{\frac{I}{mgh}} = 2\pi \sqrt{\frac{L_0}{g}}$$

$$\Rightarrow \frac{1}{m h} = L_0$$

$$\Rightarrow L_0 = \frac{m L^2 / 5}{m (L/2)} = \frac{2}{5} L = 0.6 \text{ m} = 60 \text{ cm}$$

Standing waves are produced by the interference of two traveling sinusoidal waves, each of frequency 100 Hz . The distance from the 2nd node to the 7th node is 80 cm . The wavelength of each of the two original waves is:

- (A) 40 cm
(B) 32 cm
(C) 24 cm
(D) 16 cm
(E) 8 cm

distance between 2nd and 7th node : $\Delta x = 80\text{ cm}$

We know that distance between 2nd and 7th node is $\frac{5}{2} \lambda$

$$\text{So, } \frac{5}{2} \lambda = 80\text{ cm}$$

$$\Rightarrow \lambda = 32\text{ cm}$$

8.

9. A source emits sound with a frequency of 1200 Hz. It is moving at 40 m/s toward a stationary reflecting wall. If the speed of sound is 340 m/s an observer at rest directly behind the source hears a beat frequency of:

- (A) 28 Hz
- (B) 118 Hz
- (C) 141 Hz
- (D) 240 Hz
- (E) 286 Hz

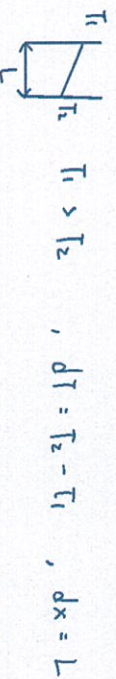
$$f' = \frac{v + v_s}{v - v_o} f = \frac{340 + 0}{340 - 40} \times 1200 = 1360 \text{ Hz}$$

$$f'' = \frac{v - v_s}{v + v_o} f = \frac{340 - 0}{340 + 40} \times 1200 = 1013.68 \text{ Hz}$$

$$\Rightarrow f' - f'' = 1360 \text{ Hz} - 1013.68 \text{ Hz} = 286 \text{ Hz}$$

10. A slab of material has area A , thickness L , and thermal conductivity k . One of its surfaces (P) is maintained at temperature T_1 and the other surface (Q) is maintained at a lower temperature T_2 . The rate of heat flow from P to Q is:

- (A) $kA(T_1 - T_2)L^2$
- (B) $kL(T_1 - T_2)/A$
- (C) $kA(T_1 - T_2)/L$
- (D) $k(T_1 - T_2)/(LA)$
- (E) $LA(T_1 - T_2)/k$



$$r = -kA \frac{dT}{dx}$$

$$= -kA \frac{(T_2 - T_1)}{L}$$

$$= \frac{kA(T_1 - T_2)}{L}$$