

國立高雄大學 113 學年度 第 1 學期理學院

普通物理學基礎能力 會考試題

考試日期：113.12.24(星期二)

考試時間：16：40-18：40

系所：_____ 姓名：_____ 學號：_____

規定事項：

1. 請攜帶學生證（或有照片之證件）準時應考，以便身分核對。
2. 應試時請依當日公告之座位表入座。
3. 遲到逾 20 分鐘者，不得入場；已入場應試者，60 分鐘內不得出場。
4. 答案卡應以 2B 鉛筆作答，攜帶軟性品質較佳之橡皮擦備用。
5. 禁止使用電子產品（如：手機）
6. 電子計算器：僅限簡易型電子計算機（限僅有數字鍵 0~9 及 $+$ $-$ $\times$ $\div$ $\sqrt{}$ $\%$ M 等功能）”

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<第一部份-基礎題型 1-20 共 20 題，每題 2.5 分，共 50 分>

1. How much work would be done if 10 N of force was applied on an object at an angle of 30° above the horizon to move an object 5 meters horizontally.
(A) 7.713 J
(B) 24.989 J
(C) 43.308 J
(D) 49.402 J
(E) 50 J
2. John is dragging a box with a mass of 2 kg. The box starts to move when a force of 50 Newtons is applied. The force is parallel to the ground. Please calculate the static friction coefficient between the box and the ground?
(A) 2.55
(B) 5
(C) 10
(D) 12.5
(E) 25
3. A jet weighing 10,000 kg flies in a circular trajectory with a radius of 5.00×10^4 m. It takes 2.5×10^3 seconds to rotate in one circle. What is the centripetal force? (Ignore the effects of gravity)
(A) 12.567 N
(B) 25.133 N
(C) 75.266 N
(D) 100.56 N
(E) 125.133 N
4. Determine the drag coefficient of a 100 kg skydiver with a projected area of 0.5 m^2 and a terminal velocity of 50 m/s. (Air density is about 1.2 kg/m^3)
(A) 0.133
(B) 0.327
(C) 0.65
(D) 1.307
(E) 65.3

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5. Assume a 10 kg block is maintained at a height of 30 m. Now, the block falls from rest. Find the speed of the block before it hits the ground. (Ignore air resistance.)
- (A) 9.8 m/s
(B) 17.15 m/s
(C) 24.25 m/s
(D) 58.8 m/s
(E) 588 m/s
6. A spring is stretched up to 5 cm, the spring constant of the spring is 1.2 N/m. Find the value of Potential energy stored in the spring?
- (A) 0.002 J
(B) 0.02 J
(C) 0.15 J
(D) 0.6 J
(E) 6 J
7. A student holds a 5 kg stack of books 1.0 m above the ground for 20 s. How much power was used to hold the books during this time?
- (A) 0 W (B) 5 W (C) 20 W (D) 49W (E) 980 W
8. A particle moves along the x axis under the influence of a stationary object. The net force on the particle, which is conservative, is given by $F = (8\text{N/m}^3)x^3$. If the potential energy is taken to be zero for $x = 0$ then the potential energy is given by:
- (A) $(2\text{J/m}^4)x^4$
(B) $(-2\text{J/m}^4)x^4$
(C) $(24\text{J/m}^2)x^2$
(D) $(-24\text{J/m}^2)x^2$
(E) $5\text{J} - (2\text{J/m}^4)x^4$
9. An ideal spring is used to fire a 15.0 g block horizontally. The spring has a spring constant of 20 N/m and is initially compressed by 7.0 cm. The kinetic energy of the pellet as it leaves the spring is:
- (A) zero
(B) 2.5×10^{-2} J
(C) 4.9×10^{-2} J
(D) 9.8×10^{-2} J
(E) 1.4 J

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10. At the same instant that a 0.50 kg ball is dropped from 25 m above Earth, a second ball, with a mass of 0.25 kg, is thrown straight upward from Earth's surface with an initial speed of 15 m/s. They move along nearby lines and pass without colliding. At the end of 2.0 s the acceleration of the center of mass of the two-ball system is:
- (A) $0.25g$
(B) $0.50g$
(C) $0.75g$
(D) g
(E) $g/0.75$
11. A golf ball of mass m is hit by a golf club so that the ball leaves the tee with speed v . The club is in contact with the ball for time T . The average force on the club on the ball during the time T is:
- (A) $2mvT$
(B) mv/T
(C) $(1/2)mv^2T$
(D) $mv^2/(2T)$
(E) $mT^2/(2v)$
12. A flywheel rotating at 12 rev/s is brought to rest in 6 s. The magnitude of the average angular acceleration in rad/s^2 of the wheel during this process is:
- (A) $1/\pi$
(B) 2
(C) 4
(D) 4π
(E) 72
13. A wheel starts from rest and has an angular acceleration that is given by $\alpha(t) = (6\text{rad/s}^4)t^2$. The angle through which it turns in time t is given by:
- (A) $[(1/8)t^4]$ rad
(B) $[(1/4)t^4]$ rad
(C) $[(1/2)t^4]$ rad
(D) (t^4) rad
(E) 12 rad

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14. When a thin uniform stick of mass M and length L is pivoted about its midpoint, its rotational inertia is $ML^2/12$.

When pivoted about a parallel axis through one end, its rotational inertia is:

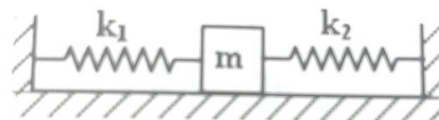
- (A) $ML^2/12$
- (B) $ML^2/6$
- (C) $ML^2/3$
- (D) $7ML^2/12$
- (E) $13ML^2/12$

15. Two identical traveling waves, moving in the same direction, are out of phase by $\pi/3$ rad. What is the amplitude of the resultant wave in terms of the common amplitude y_m of the two combining waves?

- (A) $2y_m$
- (B) $(1/\sqrt{2})y_m$
- (C) $\sqrt{2}y_m$
- (D) $\sqrt{3}y_m$
- (E) $(\sqrt{3}/2)y_m$

16. A block with mass m is connected to two springs of force constant k_1 and k_2 , as shown in figure below. What is the frequency of the block in simple harmonic motion?

- (A) $f = \frac{1}{2\pi} \sqrt{\frac{m(k_1+k_2)}{k_1k_2}}$
- (B) $f = 2\pi \sqrt{\frac{k_1k_2}{m(k_1+k_2)}}$
- (C) $f = 2\pi \sqrt{\frac{m}{k_1+k_2}}$
- (D) $f = 2\pi \sqrt{\frac{m}{k_1k_2}}$
- (E) $f = \frac{1}{2\pi} \sqrt{\frac{k_1+k_2}{m}}$



17. Which is the possible solution for the equation of wave motion $\frac{\partial^2 y}{\partial x^2} = \frac{1}{v^2} \frac{\partial^2 y}{\partial t^2}$?

- (A) $e^x \sin x$
- (B) $e^x \sin(kx - \omega t)$
- (C) $e^x \sin \omega t$
- (D) $\sin \omega t \cos x$
- (E) $e^x \sin xv$

18. The intensity of sound wave A is 100 times that of sound wave B. Relative to wave B the sound level of wave A is?

- (A) -2dB
- (B) +20dB
- (C) +2dB
- (D) +10dB
- (E) -20dB

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19. A string under tension τ_i oscillates in the third harmonic at frequency f_3 , and the waves on the string have wavelength λ_3 . If the tension is increased to $\tau_f = 4\tau_i$ and the string is made to oscillate in the fifth harmonic. What is the frequency f_5 of oscillation in terms of f_3 .

- (A) $\frac{10}{3}f_3$ (B) $\frac{7}{3}f_3$ (C) $\frac{\sqrt{3}}{2}f_3$ (D) $\frac{\sqrt{7}}{2}f_3$ (E) $2f_3$

20. The Doppler shift formula for the frequency detected is $f = f' \frac{v \pm v_D}{v \mp v_s}$

where f' is the frequency emitted, v is the speed of sound, v_D is the speed of the detector, and v_s is the speed of the source. Suppose the source is traveling at 5 m/s away from the detector, the detector is traveling at 7 m/s toward the source, and there is a 3 m/s wind blowing from the source toward the detector. The values that should be substituted into the Doppler shift equation are:

- (A) $v_D = 7$ m/s and $v_s = 5$ m/s
(B) $v_D = 4$ m/s and $v_s = 2$ m/s
(C) $v_D = 4$ m/s and $v_s = 8$ m/s
(D) $v_D = 10$ m/s and $v_s = 8$ m/s
(E) $v_D = 10$ m/s and $v_s = 2$ m/s

<第二部份：進階題型 1-10 共 10 題，每題 5 分，共 50 分>

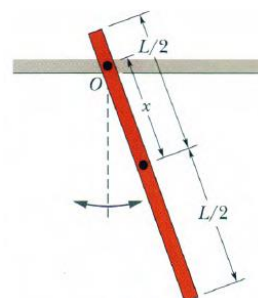
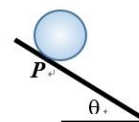
1. A ball on the end of a string is revolved at a uniform rate in a vertical circle of radius 70.0 cm. If its speed is 4.0 m/s and its mass is 0.30 kg, calculate the tension in the string when the ball is at the top of its path.

- (A) 6.557 N, upward
(B) 3.917 N, upward
(C) 3.917 N, downward
(D) 9.797 N, upward
(E) 9.797 N, downward

2. A ball gets pushed off a 5 m high table with a horizontal speed of 10 m/s. How far does the ball travel horizontally before hitting the ground? Let the acceleration of gravity is equal to 10 m/s². (計算球落地的時間即可)

- (A) 0.25 s
(B) 0.5 s
(C) 0.75 s
(D) 1 s
(E) 1.25 s

3. A tractor travels at a constant speed on a flat surface with a known friction coefficient $\mu = 0.24$, pulling a 120 kg object. The tractor takes 150 seconds to travel 500 m. Calculate the power of this tractor.
- (A) 96 W
(B) 192 W
(C) 940.8 W
(D) 3920 W
(E) 141100 W
4. A 0.20 kg particle moves along the x axis under the influence of a stationary object. The potential energy is given by $U(x) = (8.0\text{J/m}^2)x^2 + (2.0\text{J/m}^4)x^4$, where x is in coordinate of the particle. If the particle has a speed of 5.0 m/s when it is at $x = 1.0$ m, its speed when it is at the origin is:
- (A) 0 (B) 2.5 m/s (C) 5.7 m/s (D) 7.9 m/s (E) 11 m/s
5. Two bodies, A and B, have equal kinetic energies. The mass of A is nine times that of B. The ratio of the momentum of A to that of B is:
- (A) 1:9 (B) 1:3 (C) 1:1 (D) 3:1 (E) 9:1
6. A cylinder is 0.10 m in radius and 0.20 m in length. Its rotational inertia, about the cylinder axis on which it is mounted, is $0.020 \text{ kg} \cdot \text{m}^2$. A string is wound around the cylinder and pulled with a force of 1.0 N. The angular acceleration of the cylinder is:
- (A) 2.5 rad/s^2
(B) 5.0 rad/s^2
(C) 10 rad/s^2
(D) 15 rad/s^2
(E) 20 rad/s^2
7. A solid sphere (radius R , mass m) at point P rolls without slipping down an incline as shown in the figure below. The linear acceleration of its center of mass is
- (A) $\frac{1}{3}g\sin\theta$ (B) $\frac{3}{5}g\sin\theta$ (C) $\frac{5}{7}g\sin\theta$ (D) $\frac{2}{3}g\sin\theta$ (E) $g\sin\theta$
8. In the figure below, a stick of length L oscillates as a physical pendulum. What value of distance x between the stick's center of mass and its pivot point O gives the least period?
- (A) $x = \frac{L}{\sqrt{3}}$ (B) $x = \frac{L}{2\sqrt{3}}$ (C) $x = \frac{L}{2\sqrt{2}}$ (D) $x = \frac{L}{3}$ (E) $x = \frac{L}{6}$



9. In pipes A and B, the ratios of a particular harmonic frequency to the next lower harmonic frequency are 1.2 and 1.4, respectively. How many open ends are in pipes A and B?

- (A) Two open ends for both
- (B) One open end for pipe A and two open ends for pipe B
- (C) One open ends for both
- (D) Two open ends for pipe A and one open end for pipe B
- (E) None of the above

10. For $x(t) = x_m \cos(\omega_d t + \phi)$, suppose the amplitude x_m is given by $x_m = \frac{F_m}{[m^2(\omega_d^2 - \omega^2)^2 + b^2\omega_d^2]^{1/2}}$

where F_m is the (constant) amplitude of the external oscillating force exerted on the spring by the rigid support, as shown in figure below. At resonance, what is the velocity amplitude v_m of the oscillating object?

- (A) bF_m
- (B) $F_m/b\omega$
- (C) F_m/b
- (D) $\omega F_m/b$
- (E) F_m/ω