

國立高雄大學 114 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：114.12.23(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. A particle is projected vertically upward. It reaches a height of h meters after t_1 seconds and then returns to the same height h meters after t_2 seconds. What is the value of h ?
(A) $h = gt_1t_2$
(B) $h = (gt_1t_2)/2$
(C) $h = 2gt_1t_2$
(D) $h = \sqrt{gt_1t_2}$
(E) $h = 2\sqrt{gt_1t_2}$
2. A uniform rope of length L lies on a horizontal, smooth table. Part of the rope, of length d ($d = L/2$), hangs over the table, and the rope is released from rest. What is the velocity of the rope at the instant all of the rope leaves the table?
(A) $\sqrt{\frac{3}{4}gL}$ (B) $\frac{1}{2}gL$ (C) $\frac{2}{3}gL$ (D) gL (E) $\sqrt{\frac{5}{4}gL}$
3. A person of weight mg attempts to climb up and down a rope. If the maximum tension the rope can withstand is $T = 4mg/3$, find the maximum acceleration the person can have without breaking the rope.
(A) $g/3$, upward.
(B) $4g/3$, upward
(C) $g/3$, downward
(D) $4g/3$, downward
(E) None of the above
4. An object moves in uniform circular motion with a radius of 2 m. Its angular position as a function of time is given by $\theta(t) = t^3 - 3t^2 + 4t$. When $t=2$ seconds, what is the magnitude of its centripetal acceleration
(A) 4
(B) 8
(C) 16
(D) 24
(E) 32
5. Which of the following statements is correct?
(A) Friction force is a conservative force.
(B) Kinetic friction force is always smaller than the static friction force.
(C) The coefficient of static friction is greater than the coefficient of kinetic friction.
(D) The kinetic friction force is proportional to the applied force.
(E) The static friction force is inversely proportional to the applied force.

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6. Which of the following statements about Newton's three laws of motion is correct?
- (A) An object will have acceleration as long as it experiences a force.
 - (B) The action force is always greater than the reaction force.
 - (C) An object at rest can remain at rest if the net force on it is zero.
 - (D) The acceleration produced by a force on an object is independent of the object's mass.
 - (E) When no net force acts on an object, one in motion continues moving.
7. An object is acted on by a force $F = F_0 e^{-kx}$ and moves along the x-axis. Its velocity is $v = 0$ at $x = 0$. What is the maximum kinetic energy the object can obtain during the entire motion?
- (A) ke^{-kx}
 - (B) $F_0 x$
 - (C) $F_0 k$
 - (D) e^{-kx}/k
 - (E) F_0/k
8. A 1.0 kg ball is dropped from a height of 5.0 m. What is its speed just before hitting the ground? (Ignore air resistance)
- (A) 5.0 m/s
 - (B) 7.0 m/s
 - (C) 9.9 m/s
 - (D) 12.0 m/s
 - (E) 14.0 m/s
9. A spring ($k = 200$ N/m) is compressed by 0.10 m. What is the stored elastic potential energy?
- (A) 0.25 J
 - (B) 0.50 J
 - (C) 1.0 J
 - (D) 2.0 J
 - (E) 5.0 J
10. Two balls collide in one dimension. A 2 kg ball moving at +3 m/s collides and sticks to a 1 kg ball initially at rest. What is their final velocity?
- (A) 0.5 m/s
 - (B) 1.0 m/s
 - (C) 2.0 m/s
 - (D) 3.0 m/s
 - (E) 6.0 m/s

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11. The center of mass of two masses (3 kg at $x = 0$ m and 1 kg at $x = 4$ m) is located at:
- (A) 0.5 m
 - (B) 1.0 m
 - (C) 2.0 m
 - (D) 3.0 m
 - (E) 4.0 m
12. A wheel rotates with a constant angular acceleration of 2.0 rad/s^2 . If its initial angular velocity is 0, what is its angular velocity after 4.0 s?
- (A) 2 rad/s
 - (B) 4 rad/s
 - (C) 6 rad/s
 - (D) 8 rad/s
 - (E) 12 rad/s
13. A solid disk ($I = \frac{1}{2}MR^2$) with mass 2 kg and radius 0.5 m rotates at 4 rad/s. What is its rotational kinetic energy
- (A) 1 J
 - (B) 2 J
 - (C) 4 J
 - (D) 8 J
 - (E) 16 J
14. A rotating object has moment of inertia $0.20 \text{ kg}\cdot\text{m}^2$ and angular velocity 5 rad/s. What is its angular momentum?
- (A) $0.2 \text{ kg}\cdot\text{m}^2/\text{s}$
 - (B) $1.0 \text{ kg}\cdot\text{m}^2/\text{s}$
 - (C) $2.0 \text{ kg}\cdot\text{m}^2/\text{s}$
 - (D) $5.0 \text{ kg}\cdot\text{m}^2/\text{s}$
 - (E) $10.0 \text{ kg}\cdot\text{m}^2/\text{s}$
15. For a body to be equilibrium under the combined action of several forces:
- (A) all the forces must be applied at the same point
 - (B) all of the forces are composed of pairs of equal and opposite forces
 - (C) the sum of the components of all the forces in any direction must equal zero
 - (D) any two of these forces must be balanced by a third force
 - (E) the lines of action of all the forces must pass through the center of gravity of the body

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16. An oscillating block-spring system has a mechanical energy of 2.00 J, an amplitude of 8.00 cm, and a maximum speed of 1.20 m/s. What is the spring constant (N/m)?
- (A) 1600
 - (B) 625
 - (C) 800
 - (D) 960
 - (E) 850
17. The displacement of a string is given by $y(x,t) = y_m \sin(kx + \omega t)$. The speed of the wave is:
- (A) $2\pi k/\omega$
 - (B) ω/k
 - (C) ωk
 - (D) $2\pi/k$
 - (E) $k/2\omega$
18. The speed of a sinusoidal wave on a string depends on:
- (A) the frequency of the wave
 - (B) the wavelength of the wave
 - (C) the length of the string
 - (D) the tension in the string
 - (E) the amplitude of the wave
19. 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) -2 db
 - (B) +2 db
 - (C) +10 db
 - (D) +20 db
 - (E) +100 db
20. A stationary source emits a sound wave of frequency f . If it were possible for a man to travel toward the source at the speed of sound, he would observe the emitted sound to have a frequency of:
- (A) zero
 - (B) $f/2$
 - (C) $2f/3$
 - (D) $2f$
 - (E) infinity infinity

<第二部份：進階題型 1-10 共 10 題，每題 5 分，共 50 分>

1. A small ball of mass m is attached to a light, inextensible string of length L and swings in a vertical circle. At the lowest point of the motion, its speed is v_0 . Air resistance is negligible. Which of the following expressions gives the *minimum* value of v_0 required so that the string remains taut throughout the entire circular motion?
(A) $v_0 = \sqrt{gL}$
(B) $v_0 = \sqrt{2gL}$
(C) $v_0 = \sqrt{5gL}$
(D) $v_0 = 2\sqrt{gL}$
(E) $v_0 = 5\sqrt{gL}$
2. An object is projected from the ground at an elevation angle of 60° . What is the ratio of its maximum vertical height to its maximum horizontal range?
(A) $\sqrt{3}/2$ (B) $\sqrt{3}/4$ (C) $1/3$ (D) $\sqrt{2}/4$ (E) $1/4$
3. A particle of mass m moves along a straight line under a position-dependent force : $F(x) = kx^2 - 3kx$, where k is a positive constant. The particle starts from rest at $x=0$. Which of the following correctly gives the kinetic energy K of the particle when it reaches position $x = a$?
(A) $K = ka^3 - 3ka^2/2$
(B) $K = 3ka^3/2 - 3ka^2/2$
(C) $K = 3ka^3/3 - ka^2/2$
(D) $K = 3ka^3/2 - ka^3/3$
(E) $K = ka^3/3 - 3ka^2/2$
4. A 0.50 kg ball is dropped from a height of 1.8 m. Find its approximate momentum just before it hits the ground? (Ignore air resistance)
(A) $1.5 \text{ kg}\cdot\text{m/s}$
(B) $2.0 \text{ kg}\cdot\text{m/s}$
(C) $2.5 \text{ kg}\cdot\text{m/s}$
(D) $3.0 \text{ kg}\cdot\text{m/s}$
(E) $3.5 \text{ kg}\cdot\text{m/s}$
5. A solid sphere (moment of inertia $I = (2/5)MR^2$) with mass 4.0 kg and radius 0.20 m rolls without slipping at a linear speed of 3.0 m/s. What is its total kinetic energy?
(A) 25.2 J (B) 35.0 J (C) 45.2 J (D) 55.0 J (E) 65.2 J

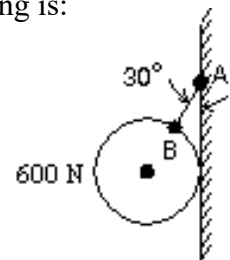
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6. A disk has moment of inertia $I=0.40 \text{ kg}\cdot\text{m}^2$. A 2.0 N force is applied tangentially at radius 0.25 m for 3.0 s . Starting from rest, what is the final angular speed?

- (A) 0.5 rad/s
- (B) 1.5 rad/s
- (C) 2.75 rad/s
- (D) 3.0 rad/s
- (E) 3.75 rad/s

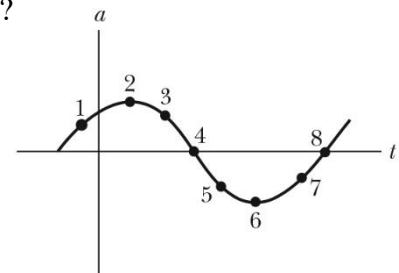
7. The 600-N ball shown is suspended on a string AB and rests against the frictionless vertical wall. The string makes an angle of 30° with the wall. The magnitude of the tension for of string is:

- (A) 690 N
- (B) 1200 N
- (C) 2100 N
- (D) 2400 N
- (E) none of these



8. The figure shows a graph of acceleration a versus time t for a box of in SHM along an x axis. Which of the points on the curve correspond to the instant that the box is at $x = +x_m$?

- (A) 2
- (B) 3
- (C) 4
- (D) 6
- (E) 8



9. Here are the equations for the three waves traveling on separate strings. Rank them according to the maxium transverse speed, least to greatest.

wave 1: $y(x,t) = (2.0 \text{ mm}) \sin [(4.0 \text{ m}^{-1})x - (3.0 \text{ s}^{-1})t]$

wave 2: $y(x,t) = (1.0 \text{ mm}) \sin [(8.0 \text{ m}^{-1})x - (4.0 \text{ s}^{-1})t]$

wave 3: $y(x,t) = (1.0 \text{ mm}) \sin [(4.0 \text{ m}^{-1})x - (8.0 \text{ s}^{-1})t]$

- (A) 1, 2, 3
- (B) 1, 3, 2
- (C) 2, 1, 3
- (D) 2, 3, 1
- (E) 3, 1, 2

10. Two pipes are each open at one end and closed at the other. Pipe A has length L and pipe B has length $2L$. Which harmonic of pipe B matches in frequency the fundamental of pipe A?

- (A) The fundamental
- (B) The second
- (C) The third
- (D) The fourth
- (E) There are none