

國立高雄大學 107 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：108.1.14(星期一)

考試時間：17：00-19：00

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）”

<第一部份-基礎題型 1-15 共 15 題，每題 2 分，共 30 分>

1. A 200 g block connected to a light spring for which the force constant is 5.00 N/m is free to oscillate on a frictionless, horizontal surface. The block is displaced 5.00 cm from the equilibrium and released from rest. Which is true?
(A) the period:3s
(B) maximum speed :0.250m/s
(C) acceleration of the block: 0.8m/s²
(D) angular frequency: 2rad/s
(E) None
2. A sinusoidal wave traveling in the positive x-direction has an amplitude of 15cm, a wavelength of 40cm, and a frequency of 8Hz. The vertical position of an element of the medium at t=0 and x=0 has a displacement of 15cm. Find the period T and speed V of the wave
(A) T:0.2s V:320cm/s
(B) T:0.125s V:250cm/s
(C) T:0.125s V:320cm/s
(D) T:320s V:0.125cm/s
(E) None
3. A point source emits sound waves with an average power output of 80.0W , find the intensity 3.00m from the source?
(A) 0.7
(B) 0.8
(C) 1.0
(D) 1.2
(E) 1.5
4. A spray can containing a propellant gas at twice atmospheric pressure (202 kPa) and having a volume of 125 cm³ is at 22°C . It is then tossed into an open fire. When the temperature of the gas in the can reaches 195°C , what is the pressure inside the can?
(A) 200 kPa (B) 220 kPa
(C) 300 kPa (D) 320 kPa
(E) 420 kPa

國立高雄大學 107 學年度第 1 學期
理學院普通物理學基礎能力會考試題

5. Two waves traveling in opposite direction produce a standing wave. the individual wave functions are $y_1=(4.0\text{cm})\sin(3.0x-2.0t)$ $y_2=(4.0\text{cm})\sin(3.0x+2.0t)$. What is the amplitude of the simple harmonic motion of the medium located at $x=2.3\text{cm}$? $\sin(6.9\text{rad})=0.58$
- (A) 4.6
(B) 2.3
(C) 6.9
(D) 0.58
(E) None
6. The velocity \vec{v} of a particle moving in the xy plane is given by $\vec{v}=(6.0t-2.0t^2)\hat{i}+5.0\hat{j}$, with \vec{v} in meters per second and $t(>0)$ in seconds. When is the acceleration zero?
- (A) 0.5 s
(B) 1.5 s
(C) 3.0 s
(D) 4.5 s
(E) 6.0 s
7. An elevator cab that weighs 27.8 kN moves upward. What is the tension in the cable if the cab's speed is decreasing at a rate of 1.96 m/s^2 ?
- (A) $2.22\times 10^4\text{ N}$
(B) $2.75\times 10^4\text{ N}$
(C) $3.34\times 10^4\text{ N}$
(D) $5.21\times 10^4\text{ N}$
(E) $5.57\times 10^4\text{ N}$
8. A person pushes horizontally with a force of 260 N on a 55 kg crate to move it across a level floor. The coefficient of kinetic friction between the crate and the floor is 0.30. What is the magnitude of the acceleration?
- (A) 0.3 m/s^2
(B) 1.2 m/s^2
(C) 1.8 m/s^2
(D) 5.2 m/s^2
(E) 7.7 m/s^2

國立高雄大學 107 學年度第 1 學期
理學院普通物理學基礎能力會考試題

9. A ice block floating in a river is pushed through a displacement $\vec{d} = (25 \text{ m})\hat{i} - (17 \text{ m})\hat{j}$ along a straight embankment by rushing water, which exerts a force $\vec{F} = (210 \text{ N})\hat{i} - (150 \text{ N})\hat{j}$ on the block. How much work does the force do on the block during the displacement?
- (A) $2.7 \times 10^3 \text{ J}$
(B) $3.4 \times 10^3 \text{ J}$
(C) $5.1 \times 10^3 \text{ J}$
(D) $6.6 \times 10^3 \text{ J}$
(E) $7.8 \times 10^3 \text{ J}$
10. A child whose weight is 267 N slides down a 6.5 m playground slide that makes an angle of 30° with the horizontal. The coefficient of kinetic friction between slide and child is 0.10. How much energy is transferred to thermal energy?
- (A) $1.12 \times 10^2 \text{ J}$
(B) $1.26 \times 10^2 \text{ J}$
(C) $1.34 \times 10^2 \text{ J}$
(D) $1.50 \times 10^2 \text{ J}$
(E) $1.83 \times 10^2 \text{ J}$
11. The center of mass of Earth's atmosphere is:
- (A) a little less than halfway between the Earth's surface and the outer boundary of the atmosphere
(B) near the surface of the Earth
(C) near the outer boundary of the atmosphere
(D) near the center of the Earth
(E) none of the above
12. The angular speed of the second hand of a watch is:
- (A) $(\pi/1800) \text{ rad/s}$
(B) $(\pi/60) \text{ rad/s}$
(C) $(\pi/30) \text{ rad/s}$
(D) $(2\pi) \text{ rad/s}$
(E) $(60) \text{ rad/s}$
13. A hoop rolls with constant velocity and without sliding along level ground. Its rotational kinetic energy is:
- (A) half its translational kinetic energy
(B) the same as its translational kinetic energy

國立高雄大學 107 學年度第 1 學期
理學院普通物理學基礎能力會考試題

- (C) twice its translational kinetic energy
- (D) four times its translational kinetic energy
- (E) one-third its translational kinetic energy

14. The gravitational constant G has the derived units

- (A) $\text{N}\cdot\text{m}$
- (B) $\text{N}\cdot\text{m}/\text{kg}$
- (C) $\text{N}\cdot\text{kg}/\text{m}$
- (D) $\text{N}\cdot\text{m}^2/\text{kg}^2$
- (E) $\text{N}\cdot\text{kg}^2/\text{m}^2$

15. Let F_1 be the magnitude of the gravitational force exerted on the Sun by Earth and F_2 be the magnitude of the force exerted on Earth by the Sun. Then:

- (A) F_1 is much greater than F_2
- (B) F_1 is slightly greater than F_2
- (C) F_1 is equal to F_2
- (D) F_1 is slightly less than F_2
- (E) F_1 is much less than F_2

<第二部份-進階題型 16-29 共 14 題，每題 5 分，共 70 分>

16. According to question 5, what is the possible position of the node and antinodes if one end of the string is at $x=0$

- (A) $\pi/4$
- (B) $\pi/5$
- (C) $\pi/7$
- (D) $\pi/2$
- (E) $\pi/3$

17. A segment of steel railroad track has a length of 30.0m when the temperature is 0.0°C . what is its length when the temperature is 40.0°C (expansion coefficient: $11 \times 10^{-6}/^\circ\text{C}$)

- (A) 0.013m
- (B) 3.001m
- (C) 0.130m
- (D) 30.013m
- (E) None

國立高雄大學 107 學年度第 1 學期
理學院普通物理學基礎能力會考試題

18. Suppose 1.00 g of water vaporizes isobarically at atmospheric pressure. Its volume in the liquid state is $V_{\text{liquid}} = 1.00 \text{ cm}^3$, and its volume in the vapor state is $V_{\text{vapor}} = 1671 \text{ cm}^3$. Find the work done in the expansion
- (A) -169
(B) 169
(C) 338
(D) -338
(E) None
19. Air in a diesel engine cylinder is quickly compressed from an initial temperature of 20°C , an initial pressure of 1 atm, and an initial volume of 800 cm^3 to a final volume of 60.0 cm^3 . Assuming the air to be an idea gas with $\gamma = 1$ and the compression is adiabatic, find the final temperature .
- (A) 0.075 atm
(B) 0.125 atm
(C) 27.6 atm
(D) 37.6 atm
(E) 47.6 atm
20. According to question 19, what is the value of final pressure?
- (A) 826°C
(B) 553°C
(C) 353°C
(D) 426°C
(E) None
21. Suppose that a shot putter can put a shot at the world-class speed $v_0 = 15.00 \text{ m/s}$ and at a height of 2.160 m. What horizontal distance would the shot travel if the launch angle θ_0 is 45.00° .
- (A) 13.06 m
(B) 24.95 m
(C) 36.24 m
(D) 45.71 m
(E) 58.12 m

國立高雄大學 107 學年度第 1 學期
理學院普通物理學基礎能力會考試題

22. A car that weighs 1.30×10^4 N is initially moving at 35 km/h when the brakes are applied and the car is brought to a stop in 15 m. Assuming the force that stops the car is constant, find the magnitude of that force.
- (A) 1.4×10^3 N
(B) 2.3×10^3 N
(C) 3.8×10^3 N
(D) 4.2×10^3 N
(E) 5.6×10^3 N
23. In downhill speed skiing a skier is retarded by both the air drag force on the body and the kinetic frictional force on the skis. Suppose the slope angle is $\theta = 45.0^\circ$, the snow is dry snow with a coefficient of kinetic friction $\mu_k = 0.0380$, the mass of the skier and equipment is $m = 85.0$ kg, the cross-sectional area of the (tucked) skier is $A = 1.30$ m², the drag coefficient is $C = 0.150$, and the air density is 1.20 kg/m³. What is the terminal speed?
- (A) 23.4 m/s
(B) 34.1 m/s
(C) 49.5 m/s
(D) 58.2 m/s
(E) 69.6 m/s
24. The only force acting on a 2.0 kg body as it moves along a positive x axis has an x component $F_x = -6x$ N, with x in meters. The velocity at $x = 3.0$ m is 8.0 m/s. What is the velocity of the body at $x = 4.0$ m?
- (A) 2.8 m/s
(B) 5.3 m/s
(C) 6.6 m/s
(D) 7.3 m/s
(E) 9.8 m/s
25. A 700 g block is released from rest at height h_0 above a vertical spring with spring constant $k = 450$ N/m and negligible mass. The block sticks to the spring and momentarily stops after compressing the spring 19.0 cm. What is the value of h_0 ?
- (A) 0.99 m (B) 1.37 m
(C) 2.36 m (D) 4.82 m
(E) 5.67 m

國立高雄大學 107 學年度第 1 學期
理學院普通物理學基礎能力會考試題

26. At one instant of time a rocket is traveling in outer space at 2500 m/s and is exhausting fuel at a rate of 100 kg/s. If the speed of the fuel as it leaves the rocket is 1500 m/s, relative to the rocket, the thrust is:
- (A) 0
 - (B) 1.0×10^5 N
 - (C) 1.5×10^5 N
 - (D) 2.9×10^5 N
 - (E) 2.5×10^5 N
27. A wheel initially has an angular velocity of 36 rad/s but after 6.0s its angular velocity is 24 rad/s. If its angular acceleration is constant the value is:
- (A) 2.0 rad/s^2
 - (B) -2.0 rad/s^2
 - (C) 3.0 rad/s^2
 - (D) -3.0 rad/s^2
 - (E) 6.0 rad/s^2
28. The coefficient of static friction between a certain cylinder and a horizontal floor is 0.40. If the rotational inertia of the cylinder about its symmetry axis is given by $I = (1/2)MR^2$, then the maximum acceleration the cylinder can have without sliding is:
- (A) $0.1 g$
 - (B) $0.2 g$
 - (C) $0.4 g$
 - (D) $0.8 g$
 - (E) g
29. Assume that Earth is in circular orbit around the Sun with kinetic energy K and potential energy U , taken to be zero for infinite separation. Then, the relationship between K and U :
- (A) $K = U$
 - (B) $K = -U$
 - (C) $K = U/2$
 - (D) $K = -U/2$
 - (E) depends on the radius of the orbit