

國立中山大學 95 學年度轉學生招生考試試題

科目：微積分【化學系二年級、物理系二年級、電機系二年級、機電系二年級、材光系二年級、海工系二年級】

共 頁第 頁

(30%) 1. 求極限 (每小題 5 分, $[x]$ 表示大於 x 之最大整數)

(a) $\lim_{x \rightarrow \infty} (\sqrt{x+\sqrt{x}} - \sqrt{x-\sqrt{x}})$

(b) $\lim_{x \rightarrow 1} [2 + 2x - x^2]$

(c) $\lim_{x \rightarrow \infty} x^4 \left(\cos \frac{1}{x} - 1 + \frac{1}{2x^2} \right)$

(d) $\lim_{x \rightarrow 0} \left(\frac{\sin x}{x} \right)^{1/x^2}$

(e) $\lim_{x \rightarrow \infty} x \left(\left(1 + \frac{1}{x} \right)^x - e \right)$

(f) $\lim_{x \rightarrow \infty} \left(\cos \left(x + \frac{1}{x} \right) - \cos x \right)$

(10%) 2. $\int_0^2 \int_0^1 \sqrt{|y-x^2|} dx dy$

(10%) 3. $\iint_{\Omega} x^2 dA$, 其中 $\Omega = \{ (x, y) \mid x \geq 0, y \geq -1, x^2 + y^2 \leq 2 \}$.

(10%) 4. $\lim_{n \rightarrow \infty} \left\{ \frac{n}{n^2} + \frac{n}{n^2+1^2} + \dots + \frac{n}{n^2+(n-1)^2} \right\}$

(10%) 5. $\int \sin^4 x \cos^2 x dx$

(10%) 6. 求 $y^2 = x^4(2x+1)$ 在圖狀部分之面積.

(10%) 7. 求由曲面 $\sqrt{x^2+y^2} + z = 1$ 與兩個平面 $x = 1$, 及 $x = 0$ 所圍部分之體積.

(10%) 8. 求級數 $\sum_{n=1}^{\infty} \frac{n!}{n^n} x^n$ 之收斂區間, 其中 $n! = 1 \cdot 2 \cdot 3 \cdots n$.

國立中山大學 95 學年度轉學生招生考試試題

科目：普通物理【化學系二年級、物理系二年級、電機系二年級、機電系二年級、材光系二年級、海工系二年級】

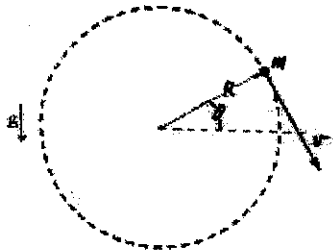
共 4 頁 第 1 頁

一. 選擇題、共有十題、每題 5 分

1. The vector r indicates the instantaneous displacement of a projectile from the origin. At the instant when the projectile is at r , its velocity and acceleration vectors are v and a . Which statement is correct?

- a. v is always perpendicular to r .
- b. a is always perpendicular to r .
- c. a is always perpendicular to v .
- d. a is always perpendicular to v_x .
- e. a is always perpendicular to v_y .

2. An object attached to the end of a string swings in a vertical circle ($R = 1.2$ m), as shown. At an instant when $\theta = 30^\circ$, the speed of the object is 5.1 m/s and the tension in the string has a magnitude of 20 N. What is the mass of the object?



- a. 2.0 kg
- b. 1.5 kg
- c. 1.8 kg
- d. 1.2 kg
- e. 0.80 kg

3. A rocket with an initial mass of 1000 kg adjusts its thrust by varying the rate at which mass is ejected. The ejection speed relative to the rocket is 40 km/s. If the acceleration of the rocket is to have a magnitude of 20 m/s^2 at an instant when its mass is 80% of the original mass, at what rate is mass being ejected at that instant? Ignore any external forces on the rocket.

- a. 0.40 kg/s
- b. 0.50 kg/s
- c. 0.60 kg/s
- d. 0.70 kg/s
- e. 0.80 kg/s

【背面還有試題】

國立中山大學 95 學年度轉學生招生考試試題

科目：普通物理【化學系二年級、物理系二年級、電機系二年級、機電系二年級、材光系二年級、海工系二年級】

共 4 頁 第 2 頁

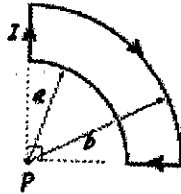
4. Water pressurized to 3.5×10^5 Pa is flowing at 5.0 m/s in a horizontal pipe which contracts to 1/3 its former area. What are the pressure and velocity of the water after the contraction?
- 2.5×10^5 Pa, 15 m/s
 - 3.0×10^5 Pa, 10 m/s
 - 3.0×10^5 Pa, 15 m/s
 - 4.5×10^5 Pa, 1.5 m/s
 - 5.5×10^5 Pa, 1.5 m/s
5. For the transverse wave described by $y = 0.15 \sin\left[\frac{\pi}{16}(2x - 64t)\right]$ (SI units) determine the maximum transverse speed of the particles of the medium.
- 0.192 m/s
 - 0.6π m/s
 - 9.6 m/s
 - 4 m/s
 - 2 m/s
6. If n moles of an ideal gas are compressed isothermally from an initial volume V_1 to a final volume V_2 , the change in entropy is
- $nR \ln(V_2/V_1)$
 - $nRT \ln(V_2/V_1)$
 - $nk_B \ln(V_2/V_1)$
 - $n C_v \int dT/T$
 - $n C_v/T$
7. An electron ($m = 9.1 \times 10^{-31}$ kg, $q = -1.6 \times 10^{-19}$ C) starts from rest at point A and has a speed of 5.0×10^6 m/s at point B. Only electric forces act on it during this motion. Determine the electric potential difference $V_A - V_B$.
- 71 V
 - +71 V
 - 26 V
 - +26 V
 - 140 V

國立中山大學 95 學年度轉學生招生考試試題

科目：普通物理【化學系二年級、物理系二年級、電機系二年級、機電系二年級、材光系二年級、海工系二年級】

共 4 頁 第 3 頁

8. What is the kinetic energy of an electron that passes undeviated through perpendicular electric and magnetic fields if $E = 4.0 \text{ kV/m}$ and $B = 8.0 \text{ mT}$?
- a. 0.65 eV
 - b. 0.71 eV
 - c. 0.84 eV
 - d. 0.54 eV
 - e. 1.4 eV
9. What is the magnitude of the magnetic field at point P if $a = R$ and $b = 2R$?



- a. $\frac{\mu_0 I}{6R}$
 - b. $\frac{3\mu_0 I}{16R}$
 - c. $\frac{\mu_0 I}{12R}$
 - d. $\frac{\mu_0 I}{16R}$
 - e. $\frac{\mu_0 I}{32R}$
10. At what frequency should a 200-turn, flat coil of cross sectional area of 300 cm^2 be rotated in a uniform 30-mT magnetic field to have a maximum value of the induced emf equal to 8.0 V?
- a. 7.5 Hz
 - b. 7.1 Hz
 - c. 8.0 Hz
 - d. 8.4 Hz
 - e. 16 Hz

【背面還有試題】

國立中山大學 95 學年度轉學生招生考試試題

科目：普通物理【化學系二年級、物理系二年級、電機系二年級、機電系二年級、材光系二年級、海工系二年級】

共 4 頁 第 4 頁

二. 計算題、共有五題、每一題 10 分

1. A string is wound around a uniform disk of radius R and mass M . The disk is released from rest with the string vertical and its top end tied to a fixed bar (Fig. 1). Determine (a) the tension in the string, (b) the magnitude of acceleration of the center of mass, (c) the speed of the center of mass after the disk has descended through a distance of h .

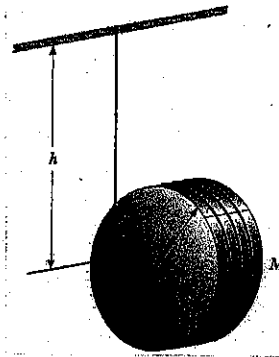


Fig. 1

2. The traveling wave propagates according the expression

$$y(x,t) = (4.0\text{cm})\sin(2.0x - 3.0t)$$

where x is in centimeters and t is in seconds. Determine (a) the amplitude, (b) the wavelength, (c) the frequency, (d) the period, and (e) the direction of travel of the wave.

3. A Carnot heat engine uses a steam boiler at 100°C as the high-temperature reservoir. The low-temperature reservoir is the outside environment at 20.0°C . Energy is exhausted to the low-temperature reservoir at the rate of 15.4 W . Determine the useful power output of the heat engine.
4. A solid sphere of radius R has a uniform charge density ρ and total Charge Q . Derive an expression for its total electric potential energy.

5. A rectangular loop of width a and b is located near a long wire carrying a current I (Fig. 2). The distance between the wire and the closest side of the loop is c . The wire is parallel to the long side of the loop. Find the total magnetic flux through the loop due to the current in the wire.

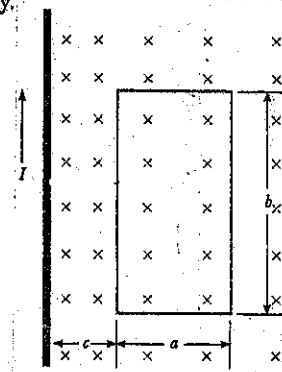


Fig. 2