

1. (10 points) A 3.00-kg object is moving in a plane, with its x and y coordinates given by $x = 5t^2 - 1$ and $y = 3t^3 + 2$, where x and y are in meters and t is in seconds. Find the magnitude of the net force acting on this object at $t = 2.00$ s.

2. (10 points) A long uniform rod of length L and mass M is pivoted about a horizontal, frictionless pin through one end. The rod is released from rest in a vertical position, as shown in Fig. 1. At the instant the rod is horizontal, find (a) its angular speed, (b) the magnitude of its angular acceleration, (c) the x and y components of the acceleration of its center of mass, and (d) the components of the reaction force at the pivot.

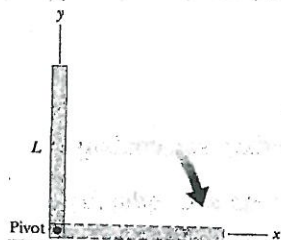


Fig. 1

3. (10 points) A disk of radius R (Fig. 3) has a nonuniform surface charge density $\sigma = Cr$, where C is a constant and r is measured from the center of the disk. Find (by direct integration) the potential at P .

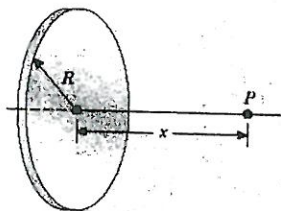


Fig. 2

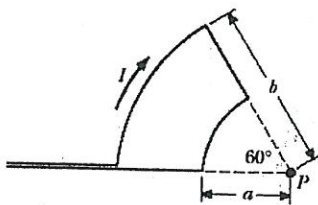


Fig. 3

4. (10 points) Consider the current-carrying loop shown in Fig. 4, formed of radial lines and segments of circles whose centers are at point P . Find the magnitude and direction of B at P .

問答題 (20 points)

- (a) If the speed of a particle is doubled, what happens to its kinetic energy?
(b) What can be said about the speed of a particle if the net work done on it is zero?
- Discuss the change in entropy of a gas that expands (a) at constant temperature and (b) adiabatically.

3. In Fig. 4, the bar magnet is moved toward the loop. Is $V_a - V_b$ positive, negative, or zero? Explain.

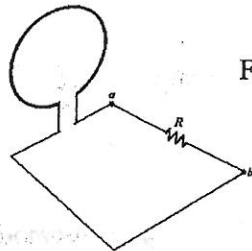
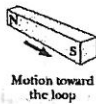


Fig. 4

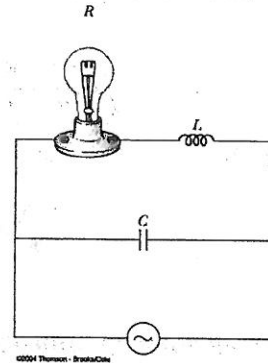


Fig. 5

4. Consider the AC circuit in Fig. 5. The frequency of the AC source is adjusted while its voltage amplitude is held constant. The lightbulb will glow the brightest at (a) high frequencies (b) low frequencies (c) The brightness will be same at all frequencies. Explain.

單選題 (40 points)

1. A light bulb is rated at 30 W when operated at 120 V. How much charge enters (and leaves) the light bulb in 1.0 min?
 - a. 17 C
 - b. 15 C
 - c. 14 C
 - d. 13 C
 - e. 60 C
2. An electron moving in the positive x direction experiences a magnetic force in the positive z direction. If $B_x = 0$, what is the direction of the magnetic field?
 - a. negative y direction
 - b. positive y direction
 - c. negative z direction
 - d. positive z direction
 - e. negative x direction

3. A 100-kW radio station emits EM waves in all directions from an antenna on top of a mountain. What is the intensity of the signal at a distance of 10 km?

- a. $8 \times 10^{-5} \text{ W/m}^2$
- b. $8 \times 10^{-6} \text{ W/m}^2$
- c. $3 \times 10^{-3} \text{ W/m}^2$
- d. 0.8 W/m^2
- e. $2.5 \times 10^{-5} \text{ W/m}^2$

4. The electric fields arriving at a point P from three coherent sources are described by $E_1 = E_0 \sin \omega t$, $E_2 = E_0 \sin (\omega t + \pi/4)$ and $E_3 = E_0 \sin (\omega t + \pi/2)$. Assume the resultant field is represented by $E_p = E_R \sin (\omega t + \alpha)$. The amplitude of the resultant wave at P is

- a. E_0 .
- b. $1.5E_0$.
- c. $1.7E_0$.
- d. $2.7E_0$.
- e. $2.9E_0$.

5. Two harmonic waves are described by

$$y_1 = (4 \text{ m}) \sin\left(\frac{8}{\text{m}}x - \frac{300}{\text{s}}t\right)$$

$$y_2 = (4 \text{ m}) \sin\left(\frac{8}{\text{m}}x - \frac{300}{\text{s}}t - 2\right)$$

What is the frequency of the resultant wave?

- a. 300.
- b. 48
- c. 8
- d. 0.8
- e. 150

6. Two identical containers, A and B, hold equal amounts of the same ideal gas at the same P_0 , V_0 and T_0 . The pressure of A then decreases by a half while its volume doubles; the pressure of B doubles while its volume decreases by a half. Which statement correctly describes the temperatures of the gases after the changes?

- a. $T_A = 0.5T_B = T_0$.
- b. $T_B = 0.5T_A = T_0$.
- c. $T_B = T_A = T_0$.
- d. $T_A = 2T_B = T_0$.
- e. $T_B = 2T_A = T_0$.

國立中正大學九十四學年度學士班二年級轉學生招生考試試題
學系別：數學、物理、機械工程、化學工程學系 科目：普通物理

第 2 節

第 4 頁，共 4 頁

7. A spring ($k = 600 \text{ N/m}$) is placed in a vertical position with its lower end supported by a horizontal surface. A 2.0-kg block that is initially 0.40 m above the upper end of the spring is dropped from rest onto the spring. What is the kinetic energy of the block at the instant it has fallen 0.50 m (compressing the spring 0.10 m)?

- a. 5.3 J
- b. 6.8 J
- c. 6.3 J
- d. 5.8 J
- e. 6.5 J

8. A company that produces pulsed gas heaters claims their efficiency is approximately 90% . If an engine operates between 250°C and 25°C , what is its maximum thermodynamic efficiency?

- a. 83%
- b. 65%
- c. 43%
- d. 90%
- e. 56%