

淡江大學 96 學年度碩士班招生考試試題

系別：物理學系

科目：電 磁 學

准帶項目請打「V」

簡單型計算機

本試題共 / 頁

1. A sphere of radius R is uniformly charged to a density ρ . The sphere contains an uncharged spherical cavity of radius R_1 . The centers of the two spheres are separated by a distance a , where $a + R_1 < R$. Find the electric field \vec{E} inside the cavity.

2. Suppose the electric potential is given by

$$V(\vec{r}) = A \frac{e^{-\lambda r}}{r}$$

for all r (A and λ are constants). Find the electric field \vec{E} , the charge density ρ , and the total charge Q .

3. Consider an infinitely long straight wire carrying a current I . It is surrounded by a hollow cylindrical conductor of inner radius a and outer radius b , arranged coaxially with the wire, and carries uniformly an equal but opposite current. Find the magnetic field \vec{B} as a function of the distance r from the center.

4. Consider the magnetic field on the axis of two current loops a distance s apart as shown in Fig. 1.

(a) Find the \vec{B} field on the axis as a function of z , and show that $\partial \vec{B} / \partial z$ is zero at the point midway between them ($z = 0$).

(b) Determine s such that $\partial^2 \vec{B} / \partial z^2 = 0$ at the midpoint, and find the resulting magnetic field \vec{B} at the midpoint.

5. A metal bar of mass m , length l , and resistance R slides down a pair of frictionless rails of negligible resistance inclined at an angle θ to the horizontal as shown in Fig. 2. A uniform magnetic field is directed vertically upward.

(a) Find the current induced in the bar.

(b) Find the terminal velocity of the bar.

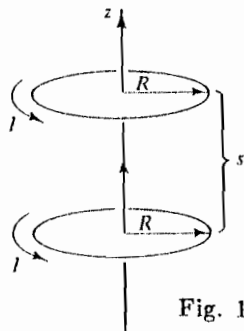


Fig. 1.

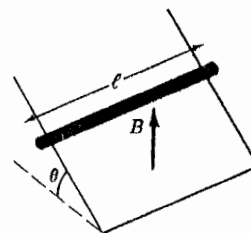


Fig. 2.