

淡江大學八十九學年度碩士班招生考試試題

系別：物理學系

科目：古典物理

本試題共

頁

1. A sphere of radius R carries a charge density $\rho(r) = kr$, k is a constant. Find the electric energy of the configuration.

2. Consider a long solenoid of radius R and n closely packed turns of wire per meter. Let current $I(t)$ flow in the wire. Find the induced electric field inside and outside the long solenoid.

3. A projectile is fired with a velocity V_0 such that it passes through two points both a distance h above the horizontal. Show that if the gun is adjusted for maximum range, the separation of the points is

$$d = \frac{V_0}{g} \sqrt{V_0^2 - 4gh}$$

4. A thin rod of length L and mass m is suspended freely at its end. It is pulled aside and swing about a horizontal axis, passing through its lowest position with an angular speed ω . How high does its center of mass rise above its lowest position? (The rotational inertia of the thin rod, about axis through one end perpendicular to length, is given by $I = \frac{1}{3}mL^2$)

5. The equation of state of the ideal gas is given by

$$PV = nRT$$

The "Volume coefficient of expansion" of the substance is defined as

$$\alpha = \frac{1}{V} \left(\frac{\partial V}{\partial T} \right)_P$$

and the "isothermal compressibility" of the substance is defined as

$$k = \frac{1}{V} \left(\frac{\partial V}{\partial P} \right)_T$$

Calculate the two coefficients α and k .