

淡江大學九十四學年度轉學生招生考試試題

系列： 物理學系三年級

科目： 電 磁 學

准帶項目請打「V」
簡單型計算機

節次： 7月 13日第 5 節

本試題共 壹 頁

1. Two spheres, each of radius R and carrying uniform charge densities $+\rho$ and $-\rho$, respectively, are placed so that they partially overlap as shown in Fig.1. Call the vector from the positive center to the negative center \mathbf{d} . Show that the field in the region of overlap is a constant and find its value.

2. Consider the case of a slab of linear dielectric material, partially inserted between the plates of a parallel plate capacitor (Fig.2). Assume the total charge on the plates Q is held constant, as the dielectric moves. Find the force acting on the dielectric by the plates.

3. At the interface between one linear dielectric and another, the electric field lines bend (Fig.3). Show that $\tan \theta_2 / \tan \theta_1 = \epsilon_2 / \epsilon_1$, assuming there is no free charge at the boundary.

4. A large parallel-plate capacitor with uniform surface charge σ on the upper plate and $-\sigma$ on the lower is moving with a constant speed v , as shown in Fig.1.
 - (a) Find the magnetic field between the plates and also above and below them.
 - (b) Find the magnetic force per unit area on the upper plate, including its direction.
 - (c) At what speed v would the magnetic force balance the electrical force?

5. Write down the four Maxwell's Equations in free space.



Fig.1

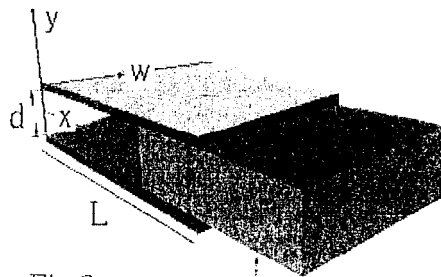


Fig.2

dielectric

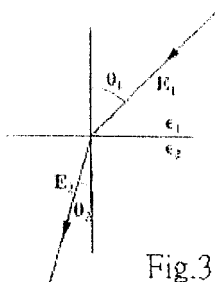


Fig.3



Fig.4