淡江大學 102 學年度碩士班招生考試試題

系別：物理學系　　　　　　　科目：普通物理(含近代物理)

考試日期：3 月 10 日(星期日) 第 3 節　　　　　本試題共　四　大題，　1　頁

（一）（20 points）

A bullet of mass m is fired into a large block of mass M, which is suspended like a pendulum. As a result of collision, the pendulum and bullet together swing up to a maximum height h. Determine the initial horizontal speed v of the bullet in terms of h.

（二）(30 points)

A solid sphere of mass M and radius r_0 starts from rest at a vertical height H and rolls down along an incline (making an angle θ with the horizontal) without slipping. The moment of inertia of a solid sphere is $I_{CM} = \frac{2}{5} M r_0^2$.

(1). Find the speed of the sphere when it reaches the bottom of the incline. (15 points)

(2). Find the friction force between the sphere and the incline. (15 points)

（三）（35 points）

(1). Write down the Maxwell's equations in the absence of dielectric or magnetic materials. (10 points)

(2). An air-gap capacitor has circular plates of area A. It is charged by a battery of voltage V through a resistor of resistance R. At the instant the battery is connected, the electric filed between the plates is charging most rapidly. Calculate the electric field between the plates at the instant. (10 points)

(3). From (b), determine the magnetic field induced between the plates. Assume the electric field is uniform between the plates at any instant and is zero at all points beyond the edges of the plates. (15 points)

（四）(15 points)

(1). Describe the photoelectric effect. (10 points)

(2). Calculate the energy of a photon of blue light, $\lambda = 450$ nm in air. (5 points)