# 國立交通大學八十八學年度碩士班入學考試試題

科目：261 普通物理（電子物理學系 ）　　　　　　　　　　　　　　第 1 頁,共 2 頁
＊作答前,請先核對試題、答案卷（試卷）與准考證上之所組別與考試科目是否相符!!

1. (10%) The magnitude F of the damping force exerted by the air on a baseball as it falls is nearly proportional to the speed squared: $F = cv^2$, where the proportionality constant c=0.0013 N $s^2/m^2$. Determine the terminal speed of the baseball in air.

2. (20%) An open door of mass $M$ is at rest when struck by a ball of clay (黏土) of mass $m$ as shown in the figure. The clay sticks to the door after the collision. (a) Find the resulting angular speed of the door. (b) Find the change in kinetic energy of the system (door plus clay). (c) Find the impulse acted by hinge to the system during the collision.



initial　　　　　　　　　　　　　　after
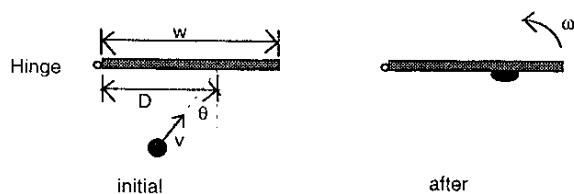
3. (15%) For a Carnot engine with one mole of ideal monatomic gas, the cycle is shown in the figure below. Find (a) the volume of the system at state 3, (b) he heat released at lower temperature, and (c)the efficiency of this engine
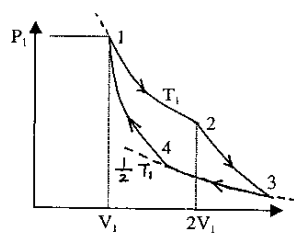


4. (15%) 本題為填空題。請將答案寫在答案卷上並標上格號，不必寫過程。
   (a)有一波函數為 $f(x, t)=30 \sin(40x-60t)$，回答下列問題。答案中可有 $\pi$，不必計算。
   其振幅(amplitude)為 (1) ，角頻率(angular frequency)為 (2) ，頻率(frequency)為 (3) 、波數(k, wave number)為 (4) ，波長(wave length, λ) 為 (5) 、波速(velocity, v)為 (6) 。
   (b)兩聲波頻率分別為 1000 Hz 及 1002 Hz。若此兩聲波產生 Beating 現象，其 Beating 頻率為 (7) Hz。
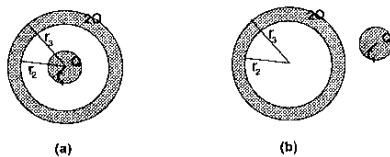
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科目：261 普通物理（電子物理學系　）　　　　　　　　　　　第 2 頁, 共 2 頁
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5.（15%）

　（a）有一金屬實心小球，帶電荷為 $Q$，半徑為 $r_1$。其外有一內徑為 $r_2$，外徑為 $r_3$ 之同心金屬空心球。此

　　空心球帶電 2Q。利用高斯定律及金屬性質，求實心球及空心球上電荷分佈情形。假設外界之其他電

　　場均可忽略。

　（b）若小球在空心球外，解答上述問題。



(a)　　　　　　　(b)

6.（15%）

　（a）What is Ohm's law? Write down its microscopic form.

　（b）Derive the relations between resistivity and the microscopic parameters of a conductor.

　（c）Explain why the resistivity of a metal increases with temperature?

7.（10%）Explain why a metal plate can be used to shield the ac magnetic field.



ac magnetic field
created here

magnetic field here
can be greatly
reduced by the
metal plate

metal plate