A.選擇題(每題 4 分)

1. A particle of mass m moves in a circular orbit of radius r as the result of the action of a central force of magnitude F. What is the magnitude of the torque that the force F exerts on this particle?
   (a) (F)(r)
   (b) $(F)(m)(r^2)$
   (c) $(F)(0.5)(m)(r^2)$
   (d) (F)/[(m)(r)]
   (e) zero

2. Which is the best example of a reservoir in thermodynamics?
   (a) A small mass of Aluminum
   (b) A sleeping bag
   (c) A glass of iced tea
   (d) The pacific ocean
   (e) The light bulb

3. Three polarizing plates are stacked. The first and third are crossed; the one between has its polarizing direction at 45° to the polarizing directions of the other two. What fraction of the intensity of an originally unpolarized beam is transmitted by the stack?
   (a) 1/2
   (b) 1/4
   (c) 1/8
   (d) 1/16
   (e) 0

4. If we have simple harmonic motion with x=0 at $\omega t=n(2\pi)$ radians, where n is an integer, what would be the phase angle, $\phi$, for $x(t)=[A \cos(\omega t+\phi)]$
   (a) zero
   (b) $\pi/4$ radians
   (c) $\pi/2$ radians
   (d) $\pi$ radians
   (e) none of these

# 國立交通大學八十九學年度碩士班入學考試試題

科目名稱：普通物理(251)　　　　　　　　考試日期：89 年 4 月 23 日 第 1 節
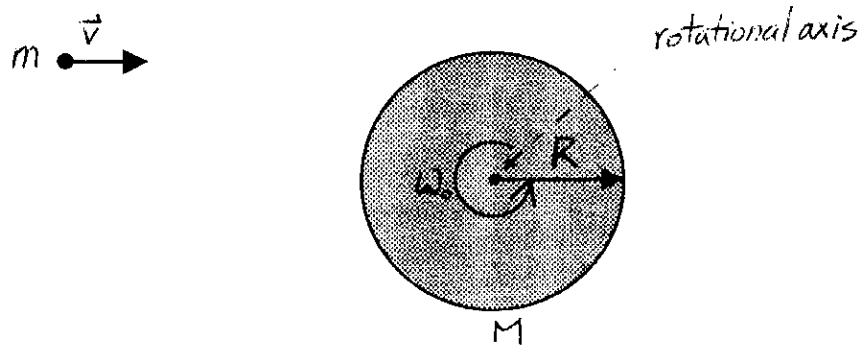系所班別：電子物理學系　　　　　　　　　　　　第 2 頁,共 3 頁
＊作答前,請先核對試題、答案卷（試卷）與准考證上之所組別與考試科目是否相符！！

5. Cv for a mole of gas is 3.5R. What is the number of degrees of freedom for this gas.

(a) 3

(b) 3.5

(c) 5

(d) 7

(e) None of these

B. 計算題( 共計 80 分)

1. A mass M is in the shape of a thin uniform disk of radius R. Let the z-axis represent the symmetry axis of the disk. The center of the disk is at a coordinate $z=0$. (a) What is the gravitational field of the disk at a coordinate z along the symmetry axis of the disk? (10pts) (b) What is the expression in part (a) when $z \gg R$? (5pts) (c) Let $\sigma$ be the surface mass density, what is the expression in part (a) in terms of $\sigma$ and G when $z \to 0$? (5pts)

2. A putty wad of mass m moves at a constant velocity $\vec{v}$ along a straight line which is tangent to a solid circular disk of mass M and radius R. The putty wad hit and stick to the rim(邊緣) of the disk while the disk is spinning with an angular speed $\omega_0$ about its central axle. (a) Calculate the rotational inertia of the disk. (5pts) (b) Find the impulse provided by the axle to the system consisting the putty and the disk. (4pts) (c) Find the final angular speed of the system right after the putty wad is on the disk. (7pts) (d) What is the incident velocity v that is sufficient for the putty wad to bring the disk to a halt. (4pts)

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3. A mole ideal gas initially at temperature $T_i$ with pressure $P_i$, and volume $V_i$ has its pressure reduced to a final value $P_f$ via the following processes: (1) isochoric, (2) isothermal, and (3) adiabatic. (a) Sketch each process schematically on a P-V diagram. (3pts) (b) What is work done in each process? (6pts) (c) What is the ratio of the absolute magnitude of the heat transfer to the gas during the isothermal process to that during the isochoric process? (6pts) (d) In which process is the absolute magnitude in the change of the internal energy the greatest? Explaining your reason. (5pts)

4. As shown below , a microwave transmitter at height a above the water level of a wide lake transmits microwaves of wavelength $\lambda$ toward a receiver on the opposite shore, a distance z above the water level. The microwaves reflecting from the water interfere with the microwaves arriving directly from the transmitter. Assuming that the lake width d is much greater than a and z, and $\lambda \geq a$, what value of z is the signal at the receiver maximum? (10pts)
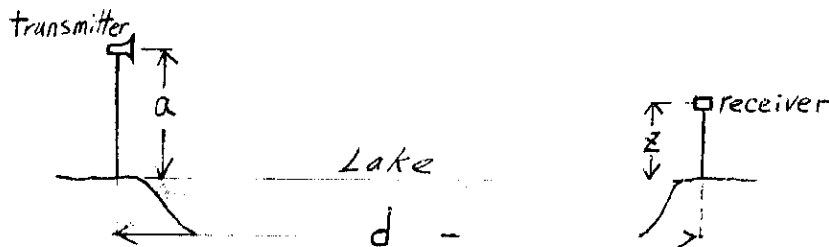


5. In the circuit shown below, the upper branch is an ideal 5 amp. fuse. It has the zero resistance as long as the current through it remain less than 5 amp.. If the current reaches 5 amp., it blows and thereafter has infinite resistance. Switch S is closed at time t=0. (a) When does the fuse blow? (5pts) (b) Sketch a graph of the current I through the inductor as a function of time. Please mark the time at which the fuse blows. (5pts)