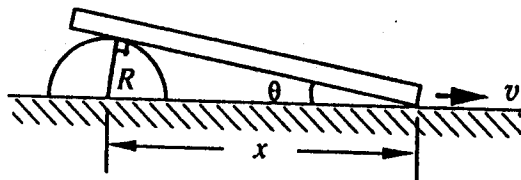
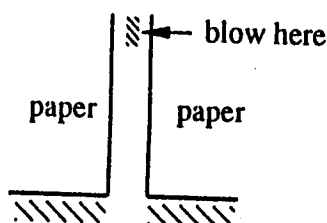


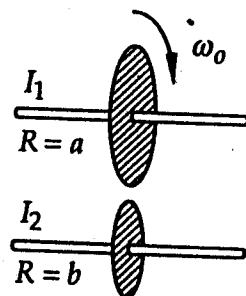
1. (16%) A rod leans against a stationary cylindrical body as shown in the figure, and its right end slides to the right on the floor with a constant velocity  $v$ . Please find  
 (a) the angular speed  $\omega$ , and  
 (b) the angular acceleration  $\alpha$ , in terms of  $v$ ,  $x$ , and  $R$ .



2. (16%) You are given two sheets of thin paper and fix them as shown in the figure. Now if you blow a steady stream of air into the gap between the papers on the free end. Describe what do you expect to see and the reason behind your judgment.



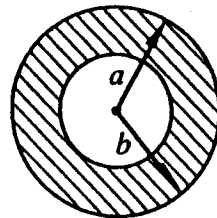
3. (16%) Two uniform disks, as shown in the figure, rotate separately on parallel axes. The upper disk (radius  $a$  and moment of inertial  $I_1$ ) has angular speed  $\omega_0$  and the lower disk (radius  $b$  and moment of inertial  $I_2$ ) is at rest. Now the two disks are moved together so that their rims touch. After a short time, the two disks will rotate without slipping. Please find the final angular speed for the upper disk.



4. (18%) Please give a concise statement on the contain and essence the following terms:  
 (a) the zeroth law of thermodynamics,  
 (b) the first law of thermodynamics,  
 (c) the Kelvin-Planck statement of the second law of thermodynamics,  
 (d) the Clausius statement of the second law of thermodynamics,  
 (e) the law of increasing entropy.

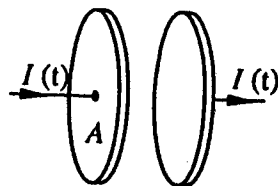
(背面仍有題目,請繼續作答)

5. (18%) A thick spherical metal shell has an outer radius  $a$  and inner radius  $b$ . The shell is hanged from the ceiling by an insulating thread, and a total amount of charge  $Q$  is put on the shell. If you wait for a while, the net charge will redistribute itself and reach its equilibrium position. Please find:



- the magnitude of the electric field for every region of space (i.e. for  $r < b$ ,  $b < r < a$ , and  $r > a$ ),
- the electric potential for every region of space, and
- where does the net charge go and why?

6. (16%) If the electric current  $I$ , flows through a capacitor is changing with time. Assume the plate is very large and the edge effect can be neglect. Please find



- the relation between the electric field,  $E$ , in the plate and the current, and
- the relation between the magnetic field,  $B$ , in the plate and the current.