1. See fig. 1.

15% (a.) Find the electric field on the axis and a distance z away from a circular disk of radius r_a and of uniform charge density σ ?

(b.) For $z \ll r_a$, discuss the result about (a) ?

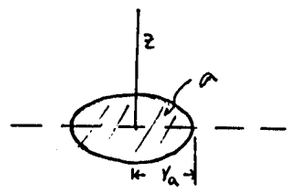

fig. 1

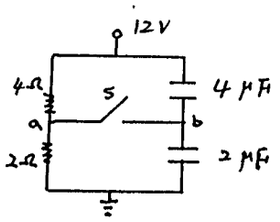

fig. 2

2. (a.) What is the potential of point a with respect to point b in fig. 2. when switch
15% S is open ?

(b.) What is the final potential of point b when switch S is closed ?

(c.) How much charge flows through switch S when it is closed ?

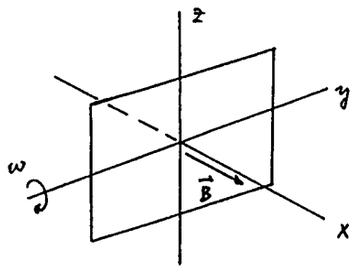

fig. 3

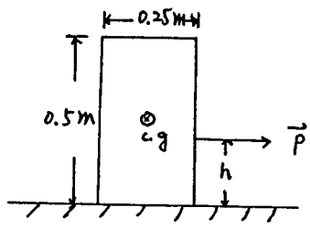

fig. 4

3. The rectangular loop in fig. 3. of area A and resistance R, rotates at uniform
20% angular velocity ω about the y-axis. The loop lies in a uniform $\vec{B}$-field in the direction of the x-axis. Sketch the following graphs:

(a) the flux Φ through the loop as a function of time (let $t=0$ in the position shown in fig. 3)

(b.) the rate of change of flux $d\Phi/dt$.

(c.) the induced emf in the loop.

(d.) the torque $\vec{\Gamma}$ needed to keep the loop rotating at constant angular velocity.

(e.) the induced emf if the angular velocity is doubled.

4. A rectangular block 0.25 m wide and 0.5 m high is dragged to the right along
20% a level surface at constant speed by a horizontal force $\vec{P}$, see fig. 4. The coeffi-

cient of sliding friction is 0.4; the block weighs 25 N; and its center of gravity is at its center.

(a.) Find the magnitude of the force $\vec{P}$?

(b.) Find the position of the line of action of the normal force $\vec{n}$ exerted on the block by the surface; if the height $h = 0.125\ m$.

(c.) Find the value of h at which the block just starts to tip?

5. Water flows steadily from a reservoir, as in fig.5. The elevation of point 1 is 15% 10m; of points 2 and 3, 1m. The cross section at point 2 is $0.04\ m^2$; at point 3, $0.02\ m^2$. The area of the reservoir is very large compared with the cross sections of the pipe. Assume Bernoulli's equation applies, compute.

(a.) the gauge pressure at point 2?

(b.) the discharge rate in cubic meters per second?

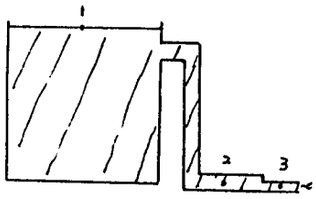

fig. 5

6. Two moles of an ideal gas undergo a reversible isothermal expansion from 15% $0.02\ m^3$ to $0.04\ m^3$ at a temperature of 27°C. what is the change in entropy of the gas?