1. Consider a solid cylinder of mass M and radius R rolling down an
10% inclined plane without slipping. See fig. 1. Find the speed of its center of mass when the cylinder reaches the bottom?

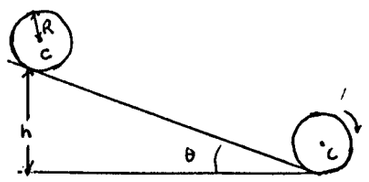

fig. 1.

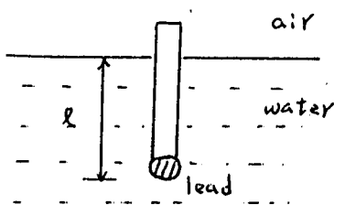

fig. 2.

2. A cylindrical wooden rod is loaded with lead at one end so that
14% it floats upright in water. See fig. 2. The length of the submerged portion is $\ell = 2.5$ m. The rod is set into vertical oscillation. (a.) Show that the oscillation is simple harmonic? (b.) Find the period of the oscillation? Neglect the fact that the water has a damping effect on the motion.

3. A radio station operating at a freguency of 1500 KHz has two
14% identical vertical dipole antennas spaced 400 m. apart. Where are the intensity maximum and minimum in the resulting radiation pattern?

4. In fig. 3. $R = 15\,\Omega$, $C = 4.7\,\mu F$, and $L = 25$ mH. The generator
16% provides a sinusoidal voltage of amplitude $\mathcal{E} = 75$ V (r.m.s) and freguency $\nu = 550$ Hz. (a.) Calculate the r.m.s current amplitude? (b.) Find the r.m.s voltages V_{ab}, V_{bc}, V_{cd}, V_{bd}, V_{ad}? (c.) What average power is dissipated by each of the three circuit elements?

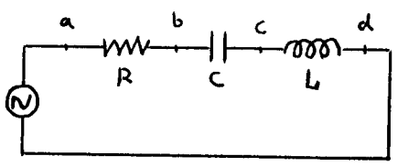

fig. 3.

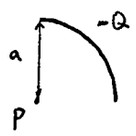

fig. 4.

ans: 118

5. Negative electric charge is distributed uniformly around a guarter
14%

of a circle of radius a, with total charge $-Q$, what are the electric field and electrical potential at point P. See fig. 4.

6. 16% An ideal diatomic gas ($\gamma = 1.40$) is caused to pass through the cycle shown on the p-V diagram in fig. 5., where $V_2 = 3V_1$. Determine, in terms of P_1, V_1, T_1, and R = (a.) P_2, P_3, and T_3? (b.) W, Q, ΔU, and ΔS, per mole, for all three processes?

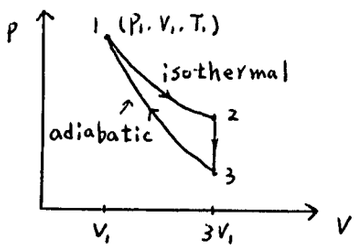

fig. 5.

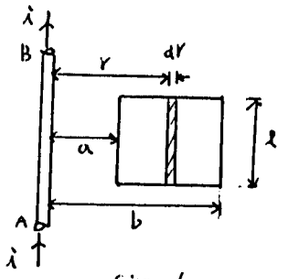

fig. 6.

7. 16% The current in the wire AB of fig. 6. is upward and increasing steadily at a rate di/dt.

(a.) At an instant when the current is i, what are the magnitude and direction of the field $\vec{B}$ at a distance r from the wire?

(b.) What is the flux $d\Phi$ through the narrow shaded strip?

(c.) What is the total flux through the loop?

(d.) What is the induced emf in the loop?