1. Assume the earth is a perfect sphere with radius R. What is the altitude of a geostationary (geosynchronous) satellite（地球同步衛星）in a circular orbit? Assume the mass of the earth is M and the gravitational constant is G. You can also assume the angular speed of the satellite is a constant, ω. (10%)

2. For the purpose of computing the rotational inertia of a body, can the mass of the body be considered as concentrated at its center of mass, and why is that? (10%)

3. A traveling sinusoidal wave is described by Eq. (1) in SI unit.
$$y(x,t) = 0.05 \sin(\pi x - 2\pi t) \qquad (1)$$
   (a) What are the wave number and the frequency of this wave?
   (b) What are the (transverse) velocity and acceleration of the element at x=2 m and t=0.5 s? (20%)

4. Assume that the indices of refraction of air and a plate glass are 1.0 and 1.732, respectively. (a) What is the Brewster angle on an air-glass interface? (b) What angle of refraction corresponds to this incident angle? (c) If the wavelength of incident ray in air is 500 nm, what is the wavelength in glass (the speed of light in air is 3×10^8 m)? (20%)

5. A line charge extends from $x=-L$ to $x=+L$ and has density $q(x) = q_0$ Cm^{-1}.

   Find the electric potential and E-field at the point p (> +L) on the axis. (10%)
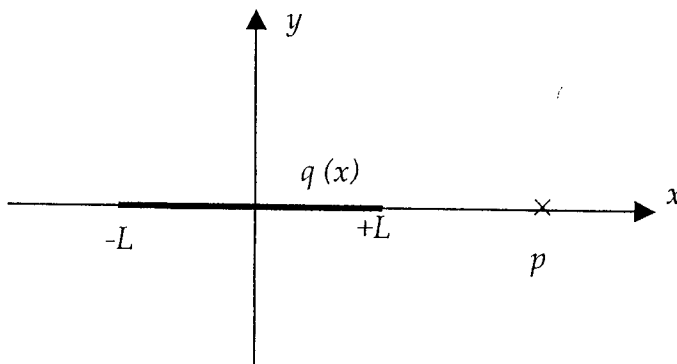
6. Which of the following E-fields could be produced by a static charge distribution (10%)

    (1) $\vec{E} = -cy\hat{x} - cx\hat{y} + 0\hat{z}$

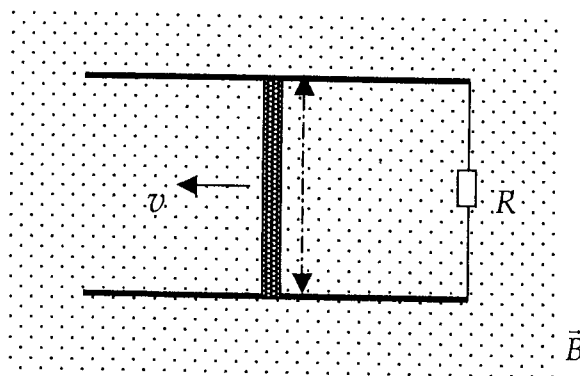   (2) $\vec{E} = -2cx\hat{x} - 2cy\hat{y} + c\hat{z}$

    (3) $\vec{E} = 3cxz\hat{x} + cxy\hat{y} + cxz\hat{z}$

    where c is a constant.

7. A bar of length L and of mass m slides along two fixed metal conductors connected by a resistor of resistance R, where there is a uniform magnetic field $\vec{B}$ coming out of the paper as shown in the figure. If at time $t=0$ an impulse causes the bar to move with an initial velocity v_0.

(1) Calculate the voltage induced between the two conductors and find the current direction flowing through the resistance R. (10%)

(2) Find the velocity $v(t)$ of the moving bar. (neglect any resistance in the bar and conductors and assume a frictionless contact between the bar and conductors). (10%)