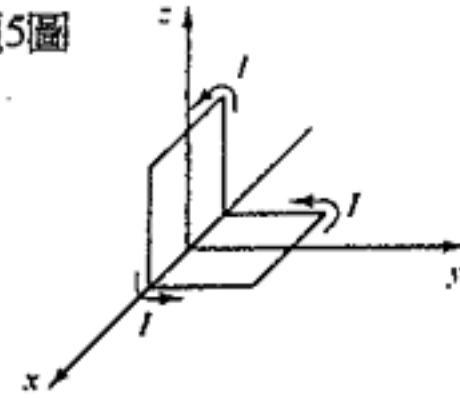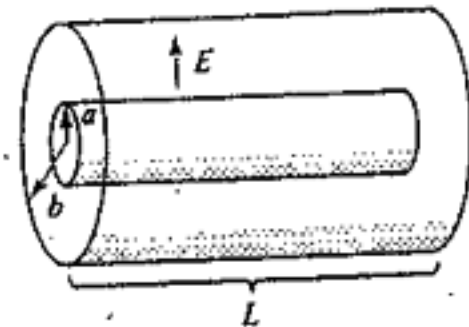1. Find the electric field a distance z above the midpoint of a straight line segment of length $2L$ which carries a uniform line charge λ. (10%)

2. Find the potential inside and outside a spherical shell of radius R, which carries a uniform surface charge σ_s. Set the reference point at infinity. (10%)

3. A metal sphere of radius a carries a charge Q. It is surrounded, out to radius b, by a linear dielectric material of permittivity ε. Find the potential at the center (relative to infinity). (10%)

4. Find the magnetic field of an infinite uniform surface current $\vec{K} = K\hat{i}$ covering the xy plane. (10%)

5. Find the magnetic dipole moment of the "bookend - shaped" loop. All sides have length s, and it carries a current I. (10%)

題5圖

6. An infinite solenoid (N turns per unit length, current I) is filled with linear material of susceptibility χ_m. Find the magnetic field inside the solenoid. (10%)

題7圖

7. Two long cylinders (radii a and b) are separated by a material of conductivity σ. If they are maintained at a potential difference V, what current flows from one to the other, in a length L. (10%)

8. A long coaxial cable carries current I (the current flows down the surface of the inner cylinder, radius a, and back along the other cylinder, radius b). Find the magnetic energy stored in a section of length l. (10%)

題8圖

9. Write down the (real) electric and magnetic fields for a monochromatic plane wave of amplitude E_0, angular frequency ω, and phase angle zero that is traveling, in free space, in the negative y - direction and polarized in the x - direction. (10%)

10. Consider an electromagnetic wave of angular frequency ω in a conducting medium containing n_e free electrons per unit volume. What is the condition (on ω) that the electromagnetic wave propagates in this medium without attenuation. (10%)