Assignment 9
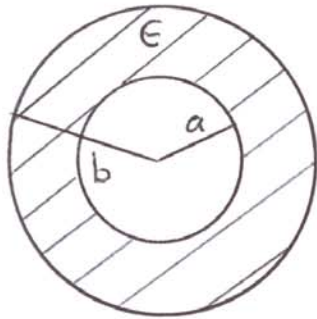
1a) Write down Maxwell's equations for vacuum.

b) Explain in words what each equation means.

2. Show the following equations result from Maxwell's equations written in 1a.

$$\vec{E} = -\nabla\Phi - \frac{1}{c}\frac{\partial\vec{A}}{\partial t}$$

$$\vec{B} = \nabla \times \vec{A}$$

Note that the six quantities E_x, E_y, E_z, B_x, B_y, and B_z are derivable from four potentials Φ, A_x, A_y and A_z.

3. Consider a conducting sphere with charge Q surrounded by dielectric material ϵ.

a) Find the energy density stored everywhere.

b) What is the total potential energy?

4. The magnetostatic energy is given by

$$W = \frac{1}{8\pi}\int_{allspace} \vec{H} \cdot \vec{B}d^3x$$

Show that this is equivalent to the following.

$$W = \frac{1}{2c}\int_{allspace} \vec{A} \cdot \vec{J}d^3x$$