Set #2 - for Thurs Oct. 16

Read

HR&K, Vol. 2	Ch. 26, Ch. 27 (pay attention to the examples)
Purcell	Ch. 1, Sects. 1.1 – 1.14, Ch. 2 Sects. 2.1 – 2.6
Feynman, Vol. 2	Ch. 2, Ch. 3 (vector calculus)

Solve

From HR&K

Ch. 26 Problems 11

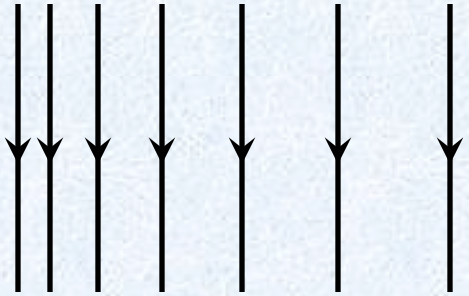
Ch. 27 Problems 1, 2, 6, 8, 9, 13

From Purcell

Ch. 1 Problems 1.39 (use total force and not energy approach)

Problems 1.76

Problem 1. Explain why the electrostatic field lines could not look like it is shown on the picture.



Problem 2. A point charge q is placed at one corner of the cube of side a. What is the flux through each of the cube faces?

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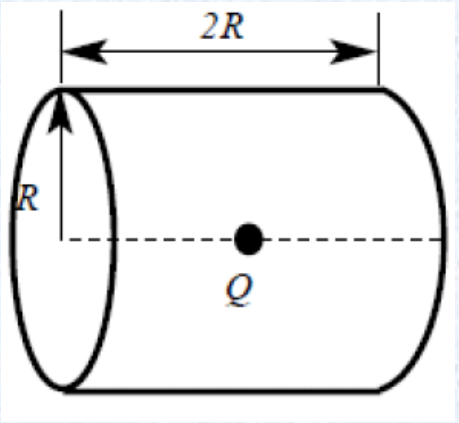
Problem 3. A point charge Q is on the axis of a cylinder at its center, as shown below. The diameter of the cylinder is equal to its length. What is the total electric flux through the curved sides of the cylinder?



Problem 4-1. Suppose a dipole $\vec{p}$ is placed in a nonuniform electric field $\vec{E} = E \cdot \hat{i}$ that points along the x axis. If $\vec{E}$ depends only on x and the electric field varies very slowly from the negative to the positive charge in the dipole ($2l$ is the distance between charges in the dipole), show that the net force on the dipole is

$$\vec{F} = \left(\vec{p} \cdot \frac{d\vec{E}}{dx} \right) \hat{i}.$$

Problem 4-2. Explain that the field described in the problem cannot be created in the empty space.

Problem 4-3 (Extra credit) Show that in the general case,

$$\vec{F} = \left(\vec{p} \cdot \vec{\nabla} \right) \vec{E}.$$

Good Luck, Dr. B