Phys 222 SI Session #5

**Topics:** Dipoles

Intro Discussion: Is a hot dog a sandwich?

1. An electric dipole is placed in the non-uniform electric field represented by the electric field lines as shown at right. If the dipole is released at rest, which of the following is true about the motion of the dipole in the presence of the electric field?
   A. It will rotate counterclockwise and move to the left.
   B. It will rotate counterclockwise and move to the right.
   C. It will rotate clockwise and move to the left.
   D. It will rotate clockwise and move to the right.
   E. The electric field has no effect on the dipole as the dipole is electrically neutral.

2. An initially stationary electric dipole of dipole moment \( p = (5.00 \times 10^{-10} \text{ C} \cdot \text{m}) \mathbf{i} \) is placed in an electric field \( \mathbf{E} = (2.00 \times 10^6 \text{ N/C}) \mathbf{i} + (2.00 \times 10^6 \text{ N/C}) \mathbf{j} \). What is the magnitude of the maximum torque that the electric field exerts on the dipole?

3. A dipole which consists of a +3.0 C charge separated from a −3.0 C charge by 5.0 cm is in a uniform electric field of magnitude 40 N/C. Both the dipole and the electric field are in the plane of the paper, as shown at the right. What is the magnitude of the torque exerted on the dipole, in N-m, and the direction of rotation, clockwise or counterclockwise as viewed from above?

4. An electric dipole consists of charges ±5.00 μC separated by 1.20 mm. It is placed in a vertical electric field of magnitude 525 N/C oriented as shown in the figure. What is the magnitude of the net torque this field exerts on the dipole?

5. A +4.0 C charge is at the origin and a -4.0 C charge is at \( (x, y) = (-2.4 \text{ m}, -3.2 \text{ m}) \) forming an electric dipole, and there is a uniform electric field \( \mathbf{E} = (4.0 \text{ N/C}) \mathbf{i} \). What is the magnitude of the torque on the dipole, in N-m, and what is the direction of rotation?