3.3: Oscillation of a Dipole in an Electric Field

Consider a dipole oscillating in an electric field (Figure III.3). When it is at an angle $\theta$ to the field, the magnitude of the restoring torque on it is $(pE \sin \theta)$, and therefore its equation of motion is

$$I\ddot{\theta} = -pE\sin \theta \label{1}$$

where $I$ is its rotational inertia.

For small angles, Equation $\ref{1}$ can be approximated as

$$I\ddot{\theta} \approx -pE\theta$$

and so the period of small oscillations is

$$P = 2\pi\sqrt{\frac{I}{pE}} \label{3.3.1}$$

Would you expect the period to be long if the rotational inertia were large? Would you expect the vibrations to be rapid if $p$
\text{\(, \text{ and } E\)} were large? Is the above expression dimensionally correct?

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