Homework Assignment #19
(due Mo, Oct. 17, 2022, at the beginning of class)

1. Griffiths 4.3

2. Griffiths 4.4
   Hint: After you have determined $\vec{p}$ of the atom, use Eq. (3.103) to determine the $\vec{E}$-field due to $\vec{p}$ at the location of the charge q.

3. Griffiths 4.5

4. Griffiths 4.9
   For 4.9a: put q in the origin and $\mathbf{r}$ is therefore $\mathbf{r} = x\,\hat{\mathbf{x}} + y\,\hat{\mathbf{y}} + z\,\hat{\mathbf{z}}$. Then express $\mathbf{E}$ and $\mathbf{p}$ in cartesian coordinates and use the formula for the force on a dipole due to an electrostatic field.
   For 4.9b use Eq. (3.104).

5. **Just for Fun (will not be graded and is optional):** Griffiths 4.6
   Hint: Use the method of images: The figures show how to choose the image dipole $\vec{p}_2$. Then tilt the scenario as shown in the most right figure, so that you can use Eq. (3.103).
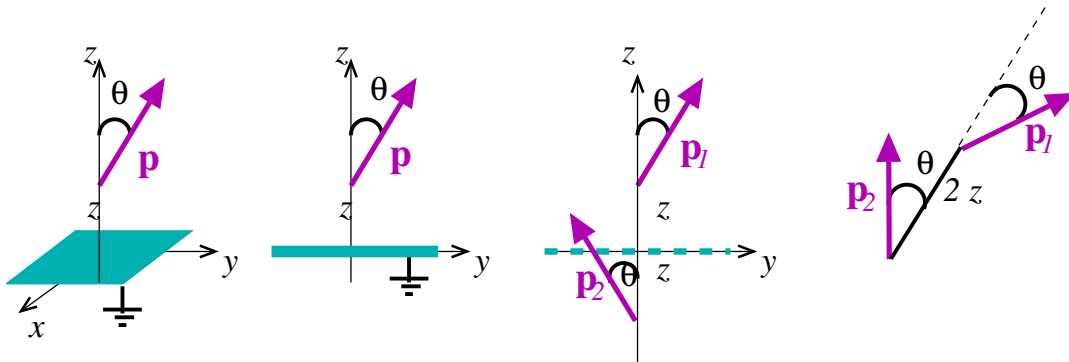

Fig.1: Dipole above infinite grounded Fig.2: Method of Images
conducting plane, distance z above.