# Announcements

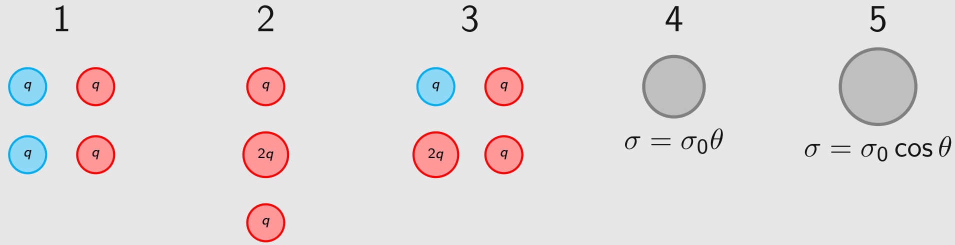
- Homework 6 due on tonight!
    - If it isn't in tonight, I make no guarantees about having it graded by Friday
- Exam 1 on Friday in class!
    - More homework solutions cleaned up but not quite through all of them
    - Still working on putting together learning objectives
- Read Ch 4.2 for Tuesday.

# Questions

- Questions about expectations or format for the exam?

# Q1

In which of the below situations is the dipole term the leading non-zero contribution to the potential?




A. 1 and 3

B. 2 and 4

C. 1 and 4

D. 1 and 5

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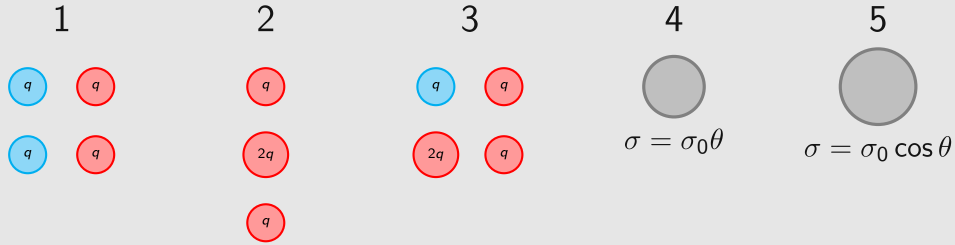


A. 1 and 3
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# Q2

Consider a single point charge at the origin. It will have *only* a monopole contribution to the potential at the location

$$\vec{\boldsymbol{r}} = x\hat{\boldsymbol{x}} + y\hat{\boldsymbol{y}} + z\hat{\boldsymbol{z}}$$

However, if we move the charge to another location, say at $\vec{\boldsymbol{r}}_s = d\hat{\boldsymbol{z}}$, the distribution now has a dipole contribute to the potential at $\vec{\boldsymbol{r}}$!
What on earth is going on?

A. It's just how the math works out. Nothing has changed physically at $\vec{\boldsymbol{r}}$.
B. There is something different about the field at $\vec{\boldsymbol{r}}$ and the potential is showing us that.
C. The multipole expansion only applies for points far from the charge, so this doesn't matter.
D. I'm confused and have no idea how to explain this.

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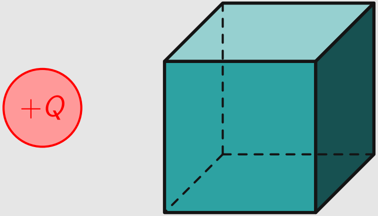
# Q3

A stationary point charge $+Q$ is near a block of insulating (of dielectric) material. The net electrostatic force on the block due to the point charge is:

A. attractive (to the left)
B. repulsive (to the right)
C. 0
D. attractive (upwards)



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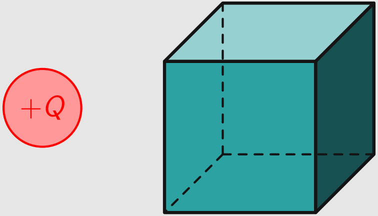


# Q4

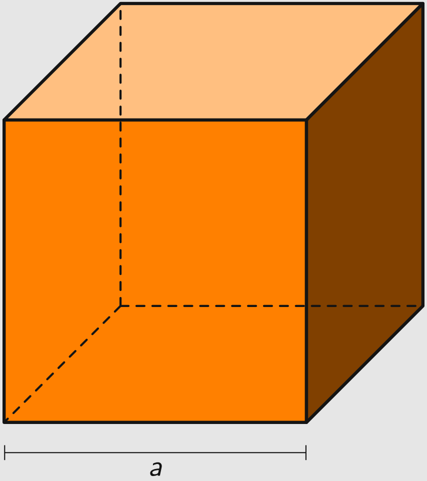
The cube to the right (with side length $a$) has uniform polarization $\vec{\mathbf{P}}_0$ pointing in the $\hat{\boldsymbol{z}}$ direction. What is the total dipole moment of this cube?

A. $0$

B. $a^3\vec{\mathbf{P}}_0$

C. $\vec{\mathbf{P}}_0$

D. $\vec{\mathbf{P}}_0/a^3$



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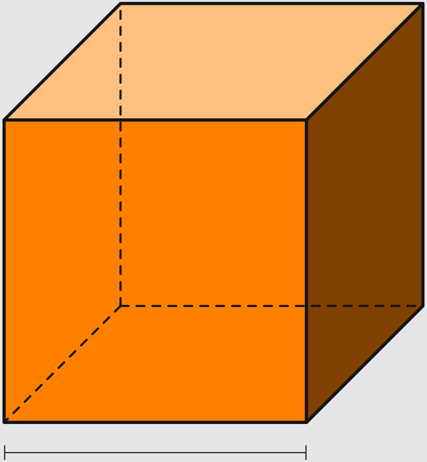

# Q5

Consider a cylinder of radius $a$ and height $b$ that has its base at the origin and is aligned along the $z$ axis. The polarization of this cylinder in "baked in" and can be modeled by

$$\vec{\mathbf{P}} = P_0 \left(\frac{z}{b}\right) \hat{\mathbf{z}}$$

What is the total dipole moment of the cylinder?

A. $P_0 \pi a^2 b \hat{\mathbf{z}}$

B. $\frac{1}{2} P_0 \pi a^2 b \hat{\mathbf{z}}$

C. $2 P_0 \pi a^2 b \hat{\mathbf{z}}$

D. Something else

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