

Which charge distributions below produce a potential that looks like $\frac{C}{r^2}$ when you are far away?

+2q
●

A)

+2q
●
●
+2q

B)

+q +q
● ●
● ●
-q -q

C)

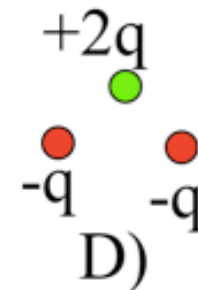
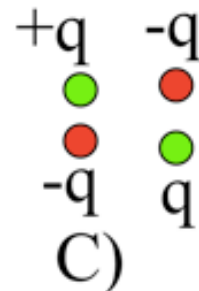
+2q +q
● ●
● ●
-q -2q

D)

E) None of these, or more than one of these!

(For any which you did not select, how DO they behave at large r ?)

Which charge distributions below produce a potential that looks like $\frac{C}{r^2}$ when you are far away?

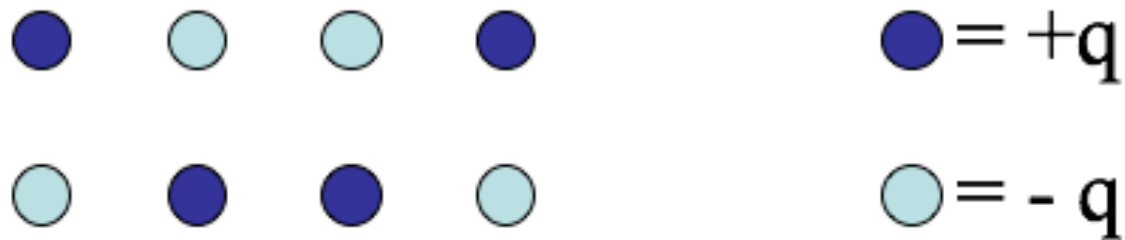


E) None of these, or more than one of these!

(For any which you did not select, how DO they behave at large r ?)

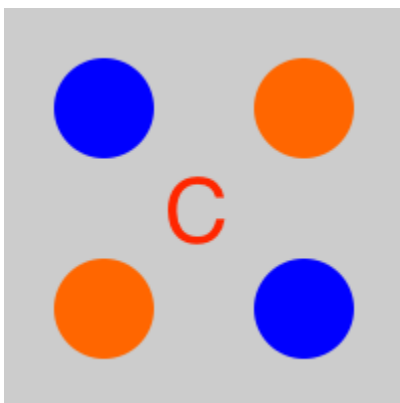
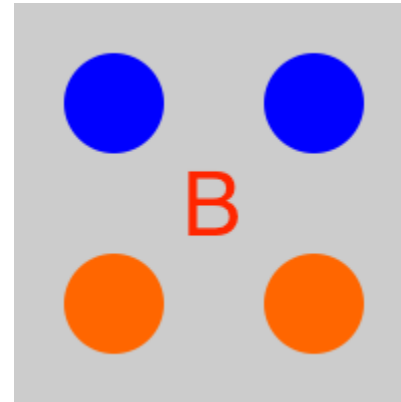
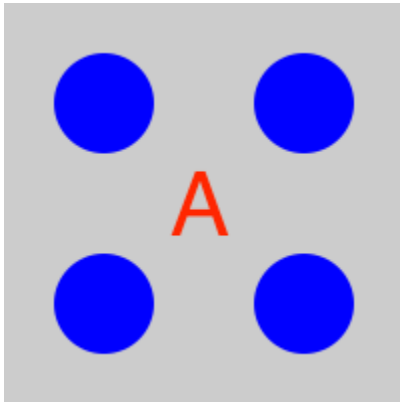
In terms of the multipole expansion

$V(r) = V(\textit{mono}) + V(\textit{dip}) + V(\textit{quad}) + \dots$, the following charge distribution has the form:



- A. $V(r) = V(\textit{mono}) + V(\textit{dip}) +$ higher order terms
- B. $V(r) = V(\textit{dip}) +$ higher order terms
- C. $V(r) = V(\textit{dip})$
- D. $V(r) =$ only higher order terms than dipole
- E. No higher terms, $V(r) = 0$ for this one.

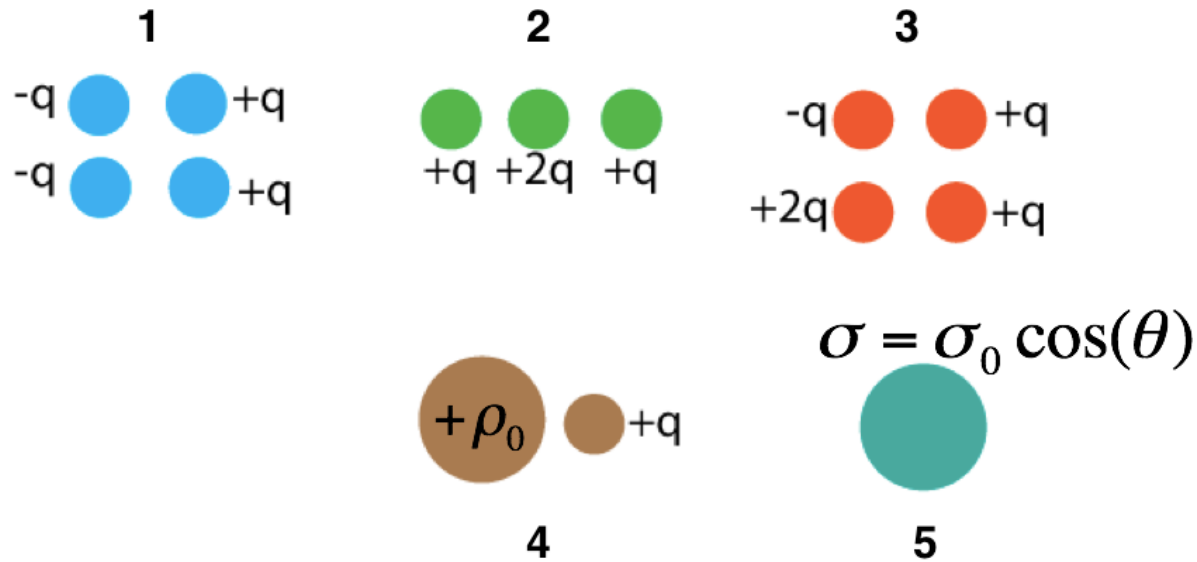
Which of the following distributions could have a dipole contribution to the potential far from the charges?



D. None

E. More than one!

In which situation is the dipole term the leading non-zero contribution to the potential?



- A. 1 and 3
- B. 2 and 4
- C. only 5
- D. 1 and 5
- E. Some other combo

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

$$\mathbf{r} = \langle x, y, z \rangle.$$

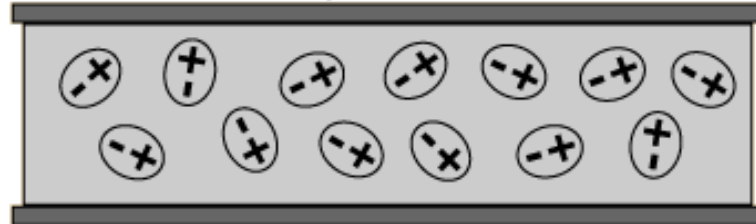
As we have seen, if we move the charge to another location (e.g., $\mathbf{r}' = \langle 0, 0, d \rangle$), the distribution now has a dipole contribution to the potential at \mathbf{r} !

What the hell is going on here?

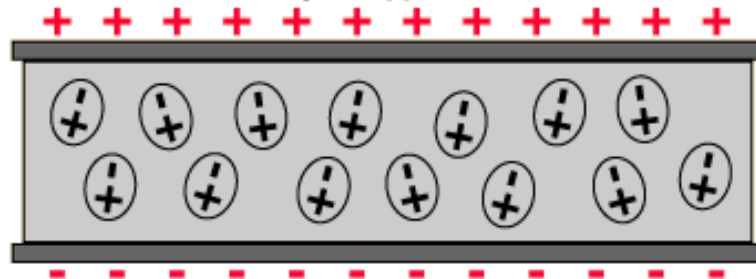
- A. It's just how the math works out. Nothing has changed physically at \mathbf{r} .
- B. There is something different about the field at \mathbf{r} and the potential is showing us that.
- C. I'm not sure how to resolve this problem.

POLARIZATION

Unpolarized

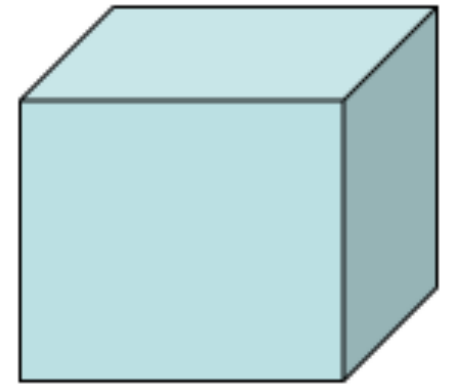


Polarized by an applied electric field.



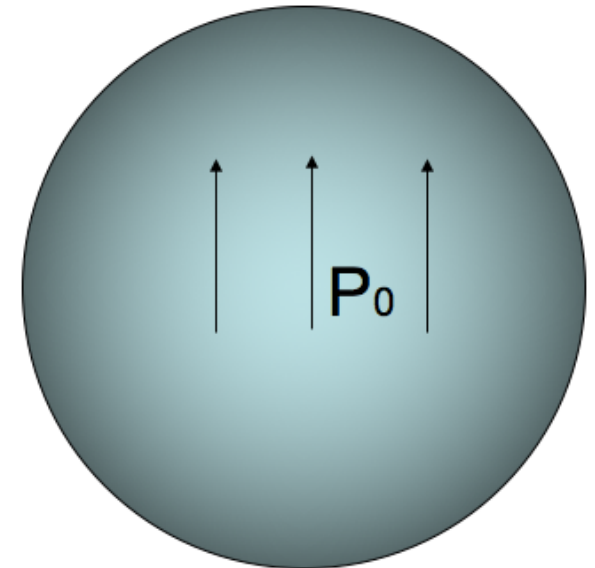
A stationary point charge $+Q$ is near a block of polarization material (a linear dielectric). The net electrostatic force on the block due to the point charge is:

$+Q$
 \oplus



- A. attractive (to the left)
- B. repulsive (to the right)
- C. zero

The sphere below (radius a) has uniform polarization \mathbf{P}_0 , which points in the $+z$ direction. What is the total dipole moment of this sphere?



- A. zero
- B. $\mathbf{P}_0 a^3$
- C. $4\pi a^3 \mathbf{P}_0 / 3$
- D. \mathbf{P}_0
- E. None of these/must be more complicated

The cube below (side a) has uniform polarization \mathbf{P}_0 , which points in the $+z$ direction. What is the total dipole moment of this cube?

- A. zero
- B. $a^3 \mathbf{P}_0$
- C. \mathbf{P}_0
- D. \mathbf{P}_0/a^3
- E. $2\mathbf{P}_0 a^2$

