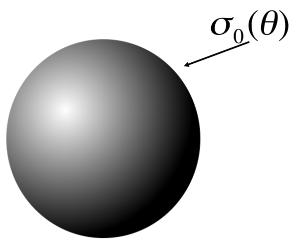
3.21

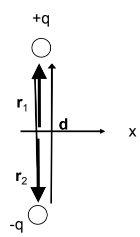
How many boundary conditions (on the potential V) do you use to find V inside the thin plastic spherical shell?



A) 1
B) 2
C) 3
D) 4
E) other/depends on σ_0

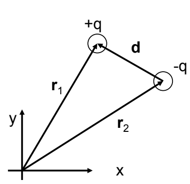
MD6.1

The dipole moment, $\vec{p} = \sum_i q_i \vec{r}_i = ?$



A) $+q\vec{d}$
B) $+2q\vec{d}$
C) $-2q\vec{d}$
D) zero
E) None of these

MD6.1



$\sum_i q_i \vec{r}_i = ?$

A) $+q\vec{d}$
B) $+2q\vec{d}$
C) $-2q\vec{d}$
D) zero
E) None of these

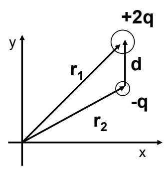
MD6 - 3

For a collection of point charges, the dipole moment is defined as

$$\vec{p} = \sum_i q_i \vec{r}_i$$

Consider the two charges, +2q and –q, shown. Which statement is true?

A) The dipole moment is independent of the origin.
B) The dipole moment depends on the position of the origin.
C) The dipole moment is zero.
D) The dipole moment is undefined.



3.22 c

You have a physical dipole, +q and -q a finite distance d apart.
When can you use the expression:

$$V(\vec{r}) = \frac{1}{4\pi\varepsilon_0}\frac{\vec{p}\cdot\hat{r}}{r^2}$$

A) This is an exact expression everywhere.

B) It's valid for large r

C) It's valid for small r

D) ?

3.22

d

You have a physical dipole, +q and -q, a finite distance d apart.
When can you use the expression

$$V(r) = \frac{1}{4\pi\varepsilon_0}\sum \frac{q_i}{\mathfrak{R}_i}$$

A) This is an exact expression everywhere.

B) It's valid for large r

C) It's valid for small r

D) ?

3.22 b

An ideal dipole (tiny dipole moment p=qd) points in the z direction.

We have derived $\vec{\mathbf{E}}(\vec{r}) = \frac{p}{4\pi\varepsilon_0 r^3}\left(2\cos\theta\,\hat{\mathbf{r}} + \sin\theta\,\vec{\theta}\right)$

Sketch this E field...
(What would change if the dipole separation d was not so tiny?)

3.22 a

A small dipole (dipole moment p=qd) points in the z direction.
We have derived $V(\vec{r}) \approx \frac{1}{4\pi\varepsilon_0}\frac{qd\,z}{r^3}$

Which of the following is correct (and "coordinate free")?

A) $V(\vec{r}) = \frac{1}{4\pi\varepsilon_0}\frac{\vec{p}\cdot\hat{r}}{r^2}$

B) $V(\vec{r}) = \frac{1}{4\pi\varepsilon_0}\frac{\vec{p}\cdot\hat{r}}{r^3}$

C) $V(\vec{r}) = \frac{1}{4\pi\varepsilon_0}\frac{\vec{p}\cdot\vec{r}}{r^2}$

D) $V(\vec{r}) = \frac{1}{4\pi\varepsilon_0}\frac{\vec{p}\times\hat{r}}{r^2}$

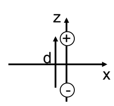
E) None of these

MD6 - 2

For a dipole at the origin pointing in the z-direction, we have derived

$$\vec{\mathbf{E}}_{\mathrm{dip}}(\vec{\mathrm{r}}) = \frac{\mathrm{p}}{4\pi\varepsilon_0 \mathrm{r}^3}\left(2\cos\theta\,\hat{\mathbf{r}} + \sin\theta\,\hat{\theta}\right)$$

For the dipole **p** = q **d** shown, what does the formula predict for the direction of **E**(**r**=0)?



A) Down B) Up C) some other direction

D) The formula doesn't apply.

3.23

Griffiths argues that the force *on* a dipole in an E field is: $\vec{\mathbf{F}} = (\vec{\mathbf{p}} \bullet \vec{\nabla})\vec{\mathbf{E}}$

If the dipole **p** points in the z direction, what direction is the force?

A) Also in the z direction
B) perpendicular to z
C) it could point in any direction

3.24

Griffiths argues that the force *on* a dipole in an E field is: $\vec{\mathbf{F}} = (\vec{\mathbf{p}} \bullet \vec{\nabla})\vec{\mathbf{E}}$

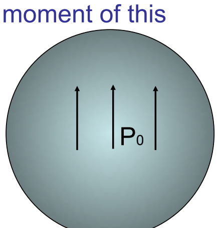
If the dipole **p** points in the z direction, what can you say about **E** if I tell you the force is in the x direction?

A) **E** simply points in the x direction
B) Ez must depend on x
C) Ez must depend on z
D) Ex must depend on x
E) Ex must depend on z

4.1 alt

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) $P_0 a^3$
C) $4\pi a^3 P_0/3$
D) P_0
E) None of these/must be more complicated

4.1

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) $2\,\mathbf{P}_0\,a^2$