What is the value of:

$$\int_{-\infty}^{\infty} x^2 \delta(x-2)dx$$

A. 0

B. 2

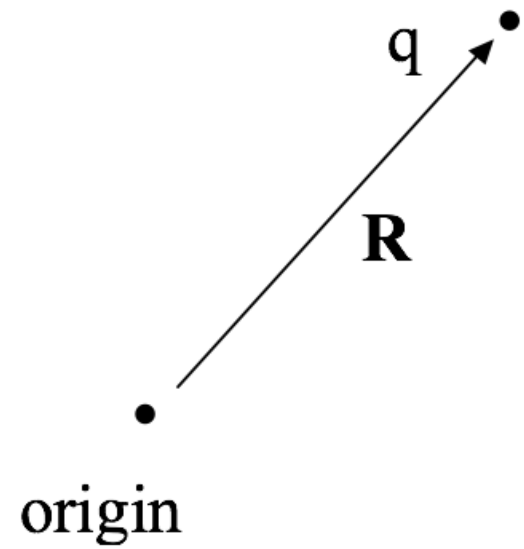
C. 4

D. ∞

E. Something else

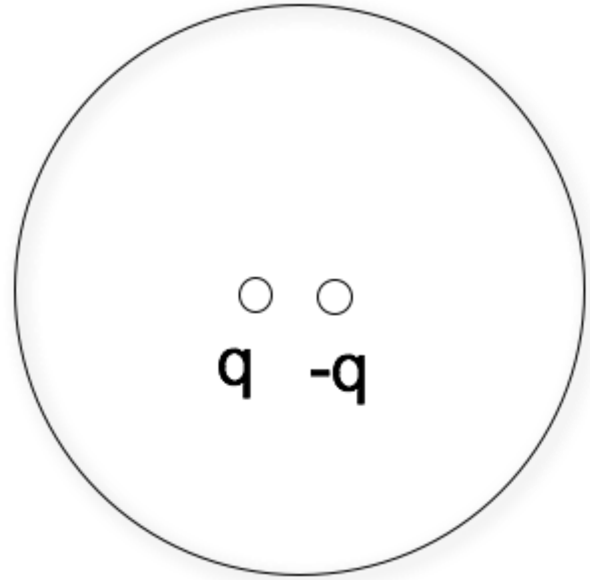
A point charge (q) is located at position $\mathbf{R}$, as shown. What is $\rho(\mathbf{r})$, the charge density in all space?

A. $\rho(\mathbf{r}) = q\delta^3(\mathbf{R})$
B. $\rho(\mathbf{r}) = q\delta^3(\mathbf{r})$
C. $\rho(\mathbf{r}) = q\delta^3(\mathbf{R} - \mathbf{r})$
D. $\rho(\mathbf{r}) = q\delta^3(\mathbf{r} - \mathbf{R})$
E. Something else??



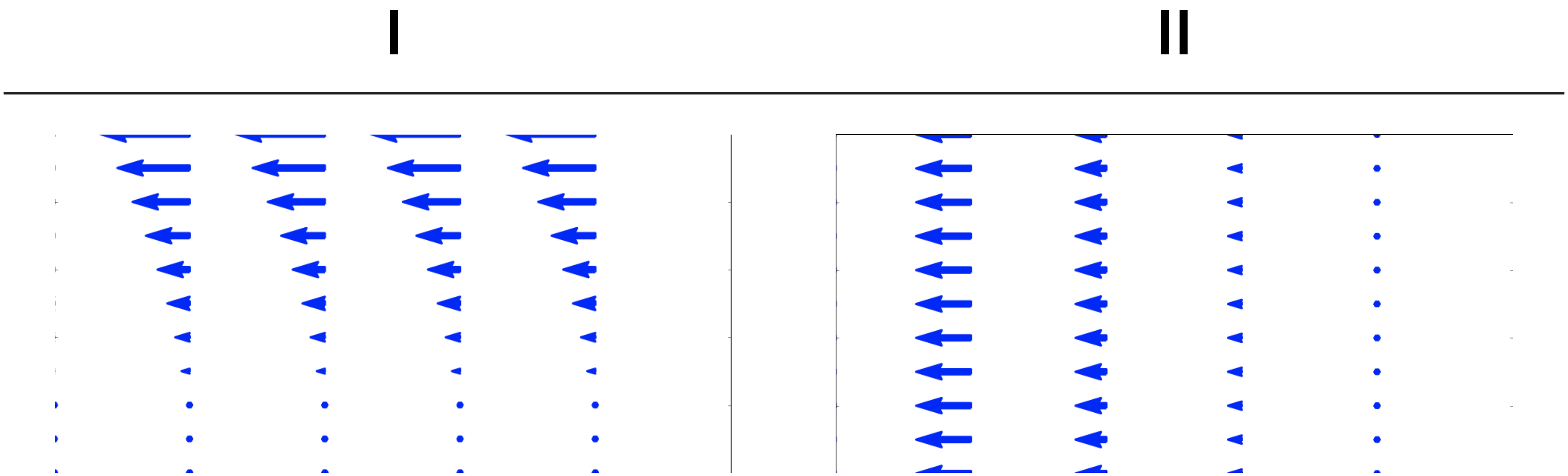
An electric dipole ($+q$ and $-q$, small distance d apart) sits centered in a Gaussian sphere.

What can you say about the flux of $\mathbf{E}$ through the sphere, and $|\mathbf{E}|$ on the sphere?



A. Flux = 0, E = 0 everywhere on sphere surface
B. Flux = 0, E need not be zero *everywhere* on sphere
C. Flux is not zero, E = 0 everywhere on sphere
D. Flux is not zero, E need not be zero...

Which of the following two fields has zero curl?



A. Both do.

B. Only I is zero

C. Only II is zero

D. Neither is zero

E. ???

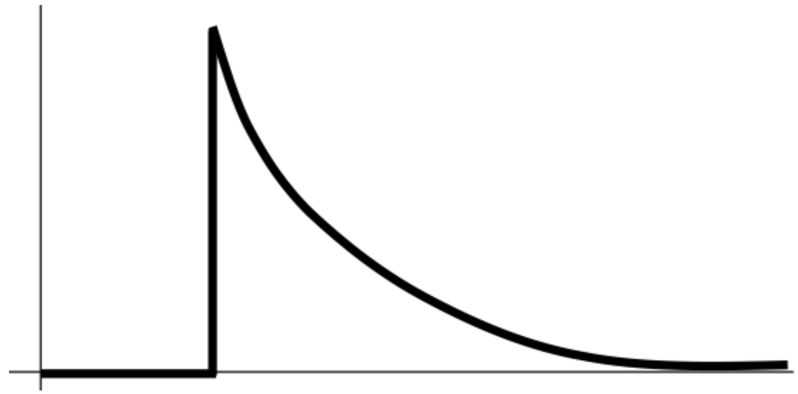
Can superposition be applied to electric potential, V?

$$V_{tot} \stackrel{?}{=} \sum_i V_i = V_1 + V_2 + V_3 + \ldots$$

A. Yes

B. No

C. Sometimes



Could this be a plot of $|\mathbf{E}(r)|$? Or $V(r)$? (for SOME physical situation?)

A. Could be $E(r)$, or $V(r)$

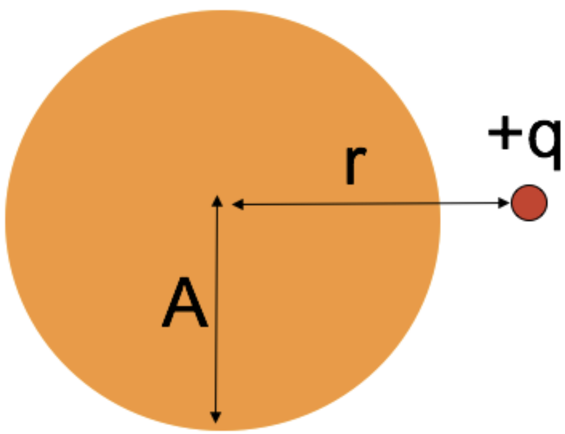
B. Could be $E(r)$, but can't be $V(r)$

C. Can't be $E(r)$, could be $V(r)$

D. Can't be either

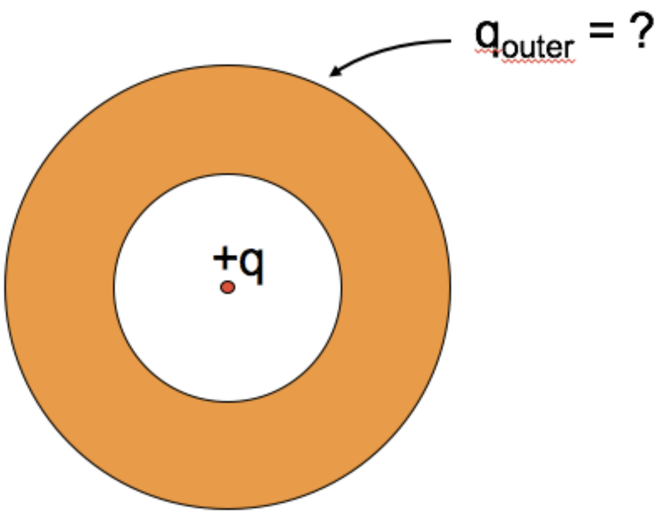
E. ???

A point charge $+q$ sits outside a **solid neutral conducting copper sphere** of radius A. The charge q is a distance $r > A$ from the center, on the right side. What is the E-field at the center of the sphere? (Assume equilibrium situation).



A. $|E| = kq/r^2$, to left
B. $kq/r^2 > |E| > 0$, to left
C. $|E| > 0$, to right
D. $E = 0$
E. None of these

A neutral copper sphere has a spherical hollow in the center. A charge $+q$ is placed in the center of the hollow. What is the total charge on the outside surface of the copper sphere? (Assume Electrostatic equilibrium.)



A. Zero

B. $-q$

C. $+q$

D. $0 < q_{outer} < +q$

E. $-q < q_{outer} < 0$

True or False: The electric field, $\mathbf{E}(\mathbf{r})$, in some region of space is zero, thus the electric potential, $V(\mathbf{r})$, in that same region of space is zero.

A. True

B. False

True or False: The electric potential, $V(\mathbf{r})$, in some region of space is zero, thus the electric field, $\mathbf{E(r)}$, in that same region of space is zero.

A. True

B. False

The general solution for the electric potential in spherical coordinates with azimuthal symmetry (no ϕ dependence) is:

$$V(r,\theta) = \sum_{l=0}^{\infty} \left(A_l r^l + \frac{B_l}{r^{l+1}} \right) P_l(\cos\theta)$$

Consider a metal sphere (constant potential in and on the sphere, remember). Which terms in the sum vanish outside the sphere? (Recall: $V \to 0$ as $r \to \infty$)

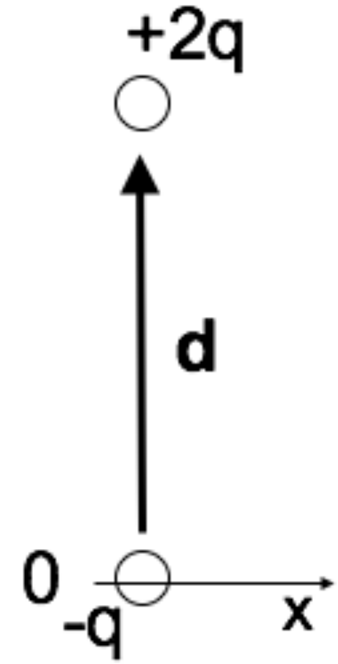
A. All the A_l's
B. All the A_l's except A_0
C. All the B_l's
D. All the B_l's except B_0
E. Something else

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

What is the dipole moment of this system?

(BTW, it is NOT overall neutral!)

A. $q\mathbf{d}$
B. $2q\mathbf{d}$
C. $\frac{3}{2}q\mathbf{d}$
D. $3q\mathbf{d}$
E. Someting else (or not defined)



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

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

A. This is an exact expression everywhere.

B. It's valid for large r

C. It's valid for small r

D. No idea...

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

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

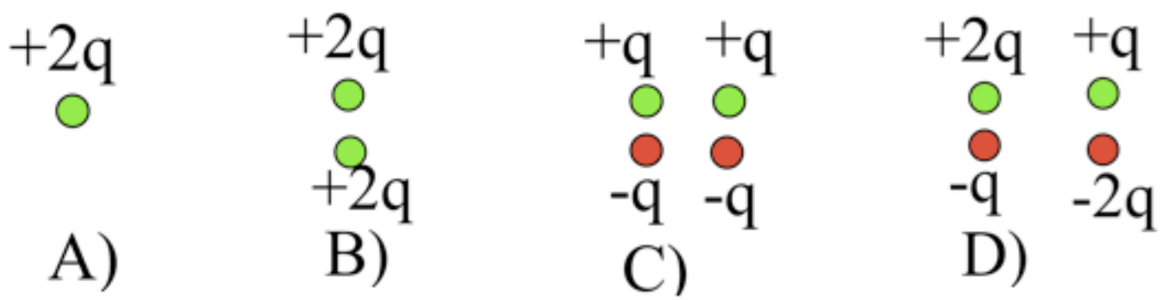
A. This is an exact expression everywhere.

B. It's valid for large r

C. It's valid for small r

D. No idea...

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?)