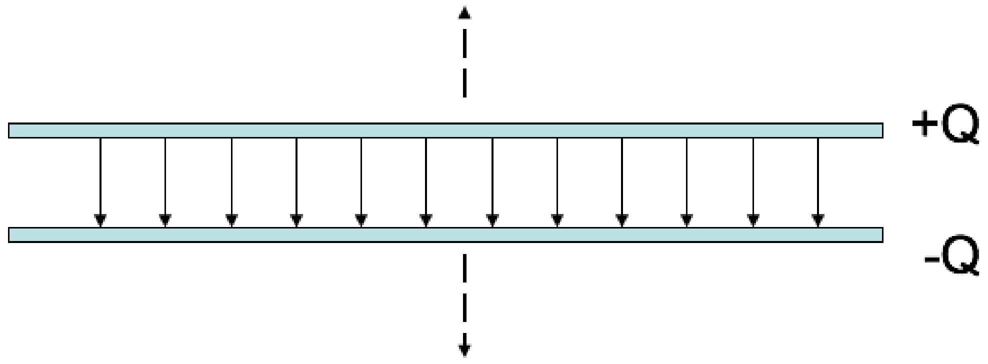
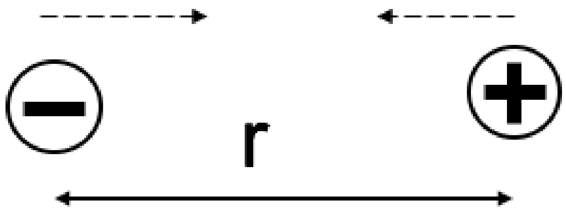


A parallel-plate capacitor has $+Q$ on one plate, $-Q$ on the other. The plates are isolated so the charge Q cannot change. As the plates are pulled apart, the total electrostatic energy stored in the capacitor:

A. increases
B. decreases
C. remains constant.



Two charges, $+q$ and $-q$, are a distance r apart. As the charges are slowly moved together, the total field energy

$$\frac{\varepsilon_0}{2}\int E^2 d\tau$$

A. increases

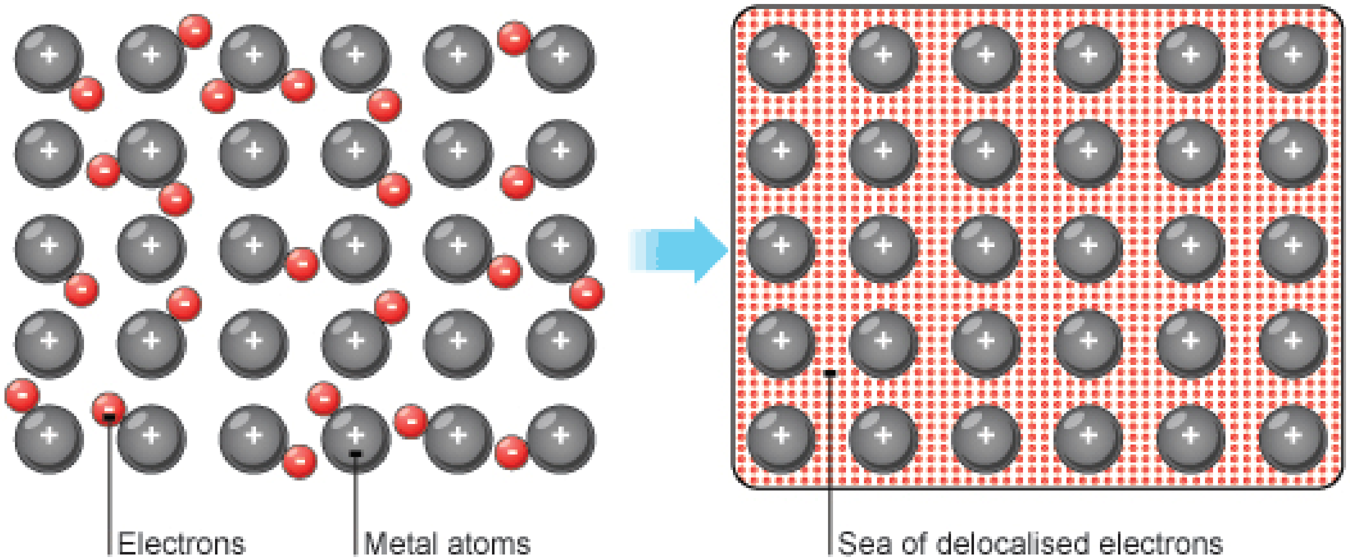
B. decreases

C. remains constant

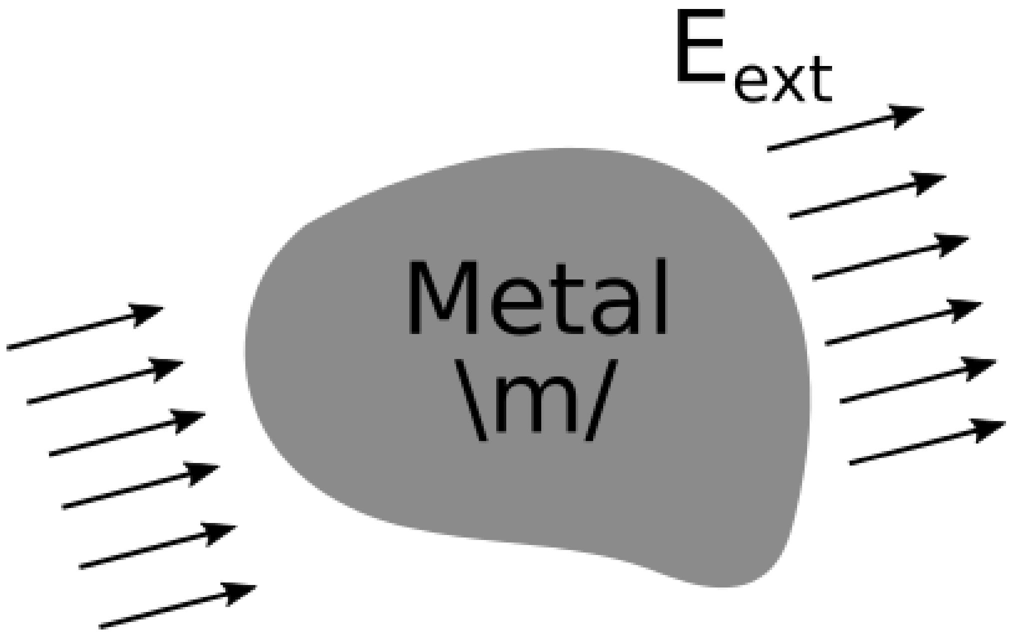
ANNOUNCEMENTS

- Test on Wednesday (7-9pm)
  - All Homework solutions posted on Slack
  - Practice Exam and Solutions on Slack, too
  - You may bring in one side of a piece of paper with your own notes

CONDUCTORS



THE CONDUCTOR PROBLEM

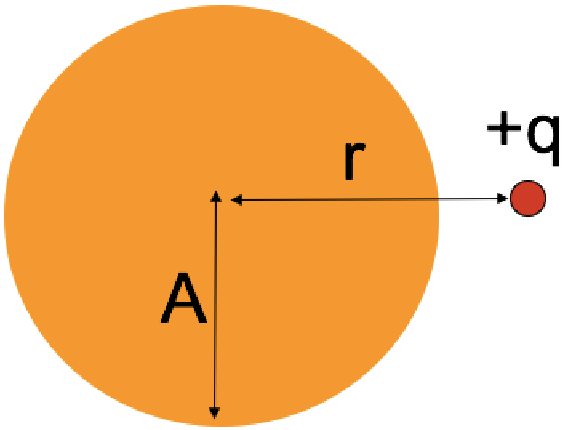


A typical metal has one free election per atom. These electrons are free to move in response to external electric fields. There are $\sim\ 10^{22}$ free electrons in a cubic centimeter of copper.

Roughly what size of electric field could a single 1cm cube of copper "respond" to by polarizing?

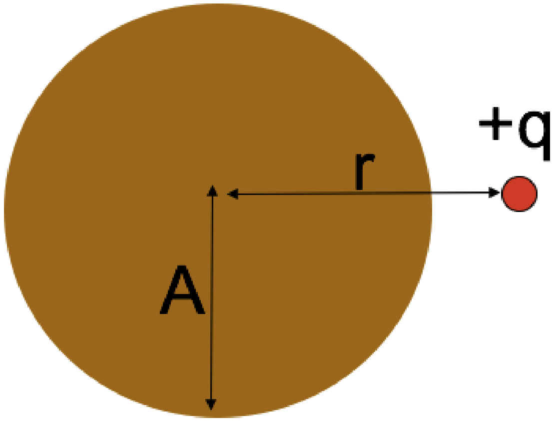
A. 1 N/C
B. 10 N/C
C. 100 N/C
D. 1000 N/C
E. Something more than these

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).



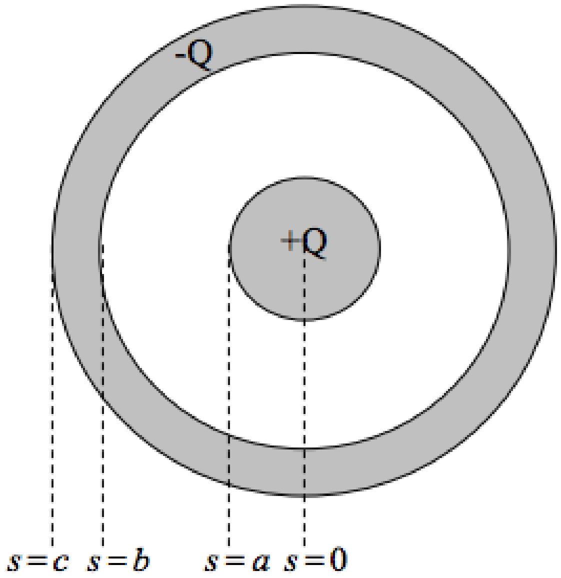
A. $|E| = kq/r^2$, to left
B. $kq/r^2 > |E| > 0$, to left
C. $|E| > 0$, to right
D. $E = 0$
E. None of these

In the previous question, suppose **the copper sphere is charged**, total charge $+Q$. (We are still in static equilibrium.) What is now the magnitude of the E-field at the center of the sphere?



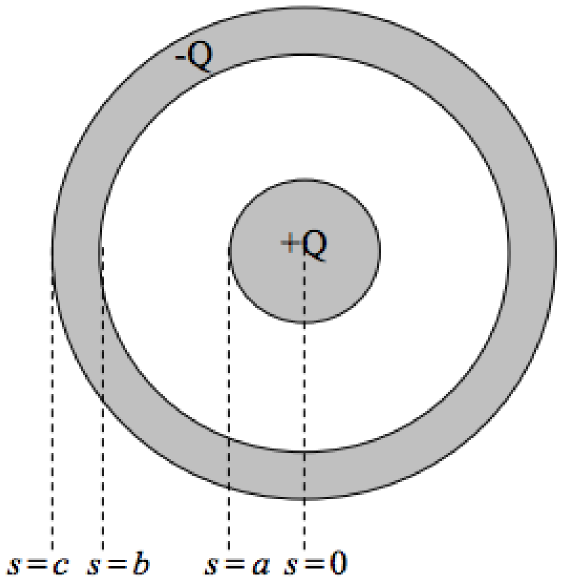
A. $|E| = kq/r^2$
B. $|E| = kQ/A^2$
C. $|E| = k(q - Q)/r^2$
D. $|E| = 0$
E. None of these! / it's hard to compute

Consider a long coaxial with charge $+Q$ placed on the inside metal wire and $-Q$ outside metal sheath as shown.



Sketch the distribution of charge in this situtation using plus signs to represent positive chages and minus signs to represent negative charges.

If you were calculating the potential difference, ΔV, between the center of the inner conductor ($s = 0$) and infinitely far away ($s \to \infty$), what regions of space would have a (non-zero) contribution to your calculation?



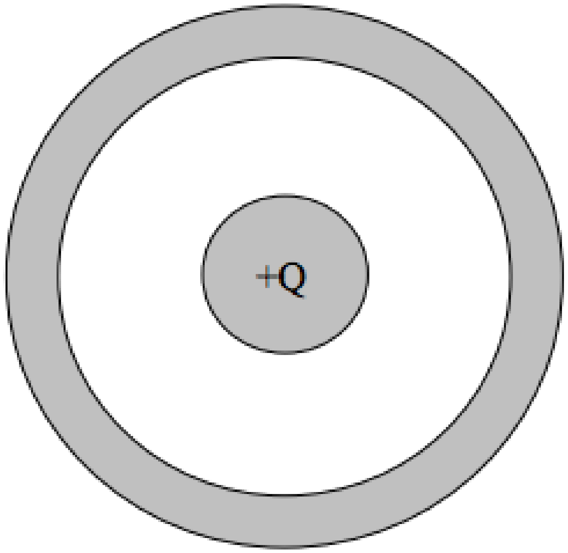
A. $s < a$

B. $a < s < b$

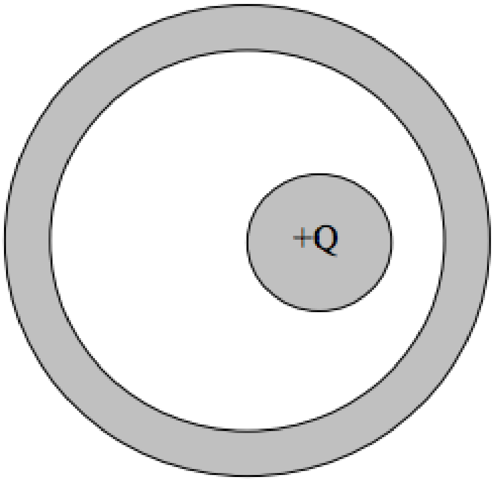
C. $b < s < c$

D. $s > c$

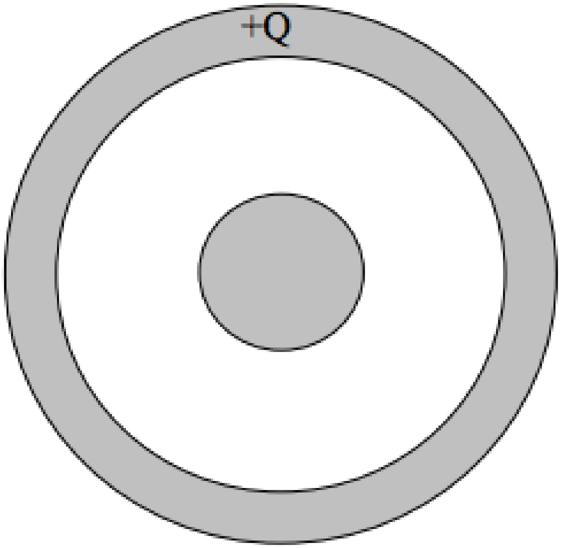
E. More than one of these



Now, draw the charge distribution (little + and – signs) if the inner conductor has a total charge $+Q$ on it, and the outer conductor is electrically neutral.



Consider how the charge distribution would change if the inner conductor is shifted off-center, but still has $+Q$ on it, and the outer conductor remains electrically neutral. Draw the new charge distribution (little + and – signs) and be precise about how you know.



Return the inner conductor to the center.

Instead of the total charge $+Q$ being on the inner conductor, sketch the charge distribution (little + and – signs) if the outer conductor has a total charge $+Q$ on it, and the inner conductor is electrically neutral. Be precise about exactly where the charge will be on these conductors, and how you know.