SUNDAY Oct 6: FIRST HOUR EXAM 8:10-9:30 PM in SEC 111 (Ch. 21-24)
Bring with you
- calculator (any type is fine except one that has network capabilities)
- #2 pencils and eraser
- 8.5 x 11 single sided formula sheet, prepared by you

- 16 multiple choice problems
- Table of fundamental constants will be provided (e, k, $\varepsilon_0$, electron mass, …)
- Practice problems and representative sample exam on the class website
A charge of $+2 \, \mu C$ is on the x-axis at $x = +20 \, cm$. An unknown charge $Q$ is on the x-axis at $x = -40 \, cm$. If the electric field is zero at $x = +40 \, cm$, what is the value of $Q$?
A charge of $+4 \ nC$ is located at the point $(20 \ cm, \ 15 \ cm)$, and another charge of $+4 \ nC$ is located at $(20 \ cm, \ -15 \ cm)$. What is the magnitude of the electric field at the origin?
A charge of 100 nC is uniformly distributed along the y axis from $y = 5.0$ m to $y = 10.0$ m. What is the magnitude of the electric field at the origin?

Answer: $k \frac{2}{(10 \text{ m})} = 2.0 \text{ N/C}$
The three hollow, concentric spherical conductors shown in the figure are charged as follows: the inner conductor carries charge $Q$, the middle conductor carries charge $-2Q$ while the outer conductor carries charge $-Q$. What is the charge on the outer surface of the middle conductor?
Consider the two concentric spherical shells in the figure, one with radius R and one with radius 2R. Both have the same charge Q. At a point just inside the outer shell, what is the magnitude of the electric potential, \( V \)? (Assume \( V = 0 \) at infinity.)

Answer: \( \frac{2kQ}{(2R)^2} = \frac{kQ}{R} \)
A long, insulating solid cylinder of radius $R$ carries a uniform volume charge density $\rho$. What is the magnitude of the electric field for $r > R$, where $r$ is the perpendicular distance from the axis of the cylinder?

Answer: $E = \frac{\pi R^2 \rho}{2 \pi \varepsilon_0} = \frac{R^2 \rho}{2 \varepsilon_0}$
How much work is required to set up the arrangement of charges in the figure?

Answer: $kq^2(\sqrt{2} - 4)/a$
A point charge $q_1 = 3.0 \text{ nC}$ is located on the $x$-axis at $x = 4.0 \text{ m}$, and a second charge $q_2 = -9.0 \text{ nC}$ is on the $y$-axis at $y = 2.0 \text{ m}$. What is the total electric flux $\Phi_E$ due to these two point charges through a spherical surface centered at the origin and with radius $r = 2.2 \text{ m}$?

Note: $\varepsilon_0 \approx 9 \times 10^{-12} \text{ C}^2/\text{N} \cdot \text{m}^2$. 

Answer: $-1.0 \times 10^3 \text{ N m}^2/\text{C}$
An electric field of 50 \textit{N/C} points in the positive X-direction. A proton enters this field with an initial velocity of 23 \textit{m/s} in the positive Y-direction. After $1 \times 10^{-8}$ seconds, what will be the proton’s X-component of velocity?

Answer: 48 \textit{m/s}
What is the electric potential at point P due to the four charges positioned as shown? Assume $V = 0$ at infinity.
Two charges exert repulsive forces of 100.0 \( N \) on each other. If their separation is then decreased so that it becomes 40\% of the initial separation, what will be the new repulsive force between them?

Answer: 625 N
A charge of +2.0 \( \mu C \) is on the x-axis at \( x = +3 \text{ cm} \), while a charge of -3.0 \( \mu C \) is on the y-axis at \( y = +3 \text{ cm} \). What is the magnitude of the force on a third charge of -1.0 \( \mu C \) placed at the origin?

Answer: 36 N