A charged point particle is placed at the center of a spherical Gaussian surface. The electric flux \( \Phi_E \) is changed if:

- A. the sphere is replaced by a cube of the same volume
- B. the sphere is replaced by a cube of one-tenth the volume
- C. the point charge is moved off center (but still inside the original sphere)
- D. the point charge is moved to just outside the sphere
- E. a second point charge is placed just outside the sphere

A point particle with charge \( q \) is placed inside a cube but not at its center. The electric flux through any one side of the cube:

- A. is zero
- B. is \( q/\varepsilon_0 \)
- C. is \( q/4\varepsilon_0 \)
- D. is \( q/6\varepsilon_0 \)
- E. cannot be computed using Gauss' law

A conducting sphere of radius 0.01 m has a charge of \( 1.0 \times 10^{-9} \text{C} \) deposited on it. The magnitude of the electric field in N/C just outside the surface of the sphere is:

- A. 0
- B. 450
- C. 900
- D. 4500
- E. 90,000

\[
E = \frac{Q}{4\pi\varepsilon_0 a^2} = \frac{kQ}{a^2} = \frac{9 \times 10^9 \text{N m}^2/\text{C} \cdot (1 \times 10^{-9} \text{C})}{(0.01 \text{m})^2} = 9 \times 10^4 \text{N/C}
\]

A long line of charge with \( \lambda_f \) charge per unit length runs along the cylindrical axis of a cylindrical shell which carries a charge per unit length of \( \lambda_c \). The charge per unit length on the inner and outer surfaces of the shell, respectively are:

- A. \( \lambda_f \) and \( \lambda_c \)
- B. \( -\lambda_f \) and \( \lambda_c + \lambda_f \)
- C. \( -\lambda_f \) and \( \lambda_c - \lambda_f \)
- D. \( \lambda_f + \lambda_c \) and \( \lambda_c - \lambda_f \)
- E. \( \lambda_f - \lambda_c \) and \( \lambda_c + \lambda_f \)

Charge \( Q \) is distributed uniformly throughout a spherical insulating shell. The net electric flux in N \( \cdot \) m\(^2\)/C through the outer surface of the shell is:

- A. 0
- B. \( Q/\varepsilon_0 \)
- C. \( 2Q/\varepsilon_0 \)
- D. \( Q/4\varepsilon_0 \)
- E. \( Q/2\pi\varepsilon_0 \)
Two large parallel plates carry positive charge of equal magnitude that is distributed uniformly over their inner surfaces. Rank the points 1 through 5 according to the magnitude of the electric field at the points, least to greatest.

\[ E = \frac{\sigma}{\varepsilon_0} \text{ or } \frac{\sigma}{2\varepsilon_0} \]

A. 1, 2, 3, 4, 5  
B. 5, 4, 3, 2, 1  
C. 1, 4, and 5 tie, then 2 and 3 tie  
D. 2 and 3 tie, then 1 and 4 tie, then 5  
E. 2 and 3 tie, then 1, 4, and 5 tie

If 500 J of work are required to carry a charged particle between two points with a potential difference of 20 V, the magnitude of the charge on the particle is:

A. 0.040 C  
B. 12.5 C  
C. 20 C  
D. cannot be computed unless the path is given  
E. none of these

\[ \Delta V = \frac{\Delta U_E}{q} = \frac{W_{\text{YOU}}}{q} \]

\[ W_E = -\Delta U_E = -W_{\text{YOU}} \]

\[ q = \frac{W_{\text{YOU}}}{\Delta V} = \frac{500 J}{20 V} = 25 \frac{J}{V} = 25 C \]