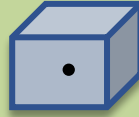


CONCEPT: GAUSS'S LAW

- **GAUSS'S LAW** = the **NET flux** through a closed surface depends ONLY on the charge _____ *within* the surface.

$$\Phi_{\text{NET}} = \text{---}$$

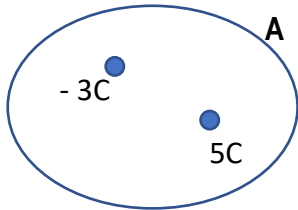
- Remember, $\epsilon_0 = 8.85 \times 10^{-12}$



- There are three common problems where you'll need to use Gauss's Law:

Given $Q(s)$, asked for Φ

EXAMPLE: What is the net flux through surface A?



Given Φ , asked for $Q(s)$

EXAMPLE: The flux through 4 sides of a closed pyramid are given. How much charge is enclosed within the pyramid?

$$\begin{array}{ll} \Phi_1 = 10 \text{ Nm}^2/\text{C} & \Phi_2 = 20 \text{ Nm}^2/\text{C} \\ \Phi_3 = 8 \text{ Nm}^2/\text{C} & \Phi_4 = -15 \text{ Nm}^2/\text{C} \end{array}$$

Given $Q(s)$, asked for $(\vec{E})$

EXAMPLE: Use Gauss's Law to write an expression for $\vec{E}$ due to a point charge Q at any distance r .

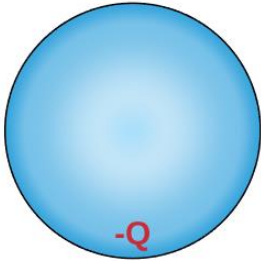


$$k = \text{---}$$

- When solving for $\vec{E}$, choose an imaginary "Gaussian surface" with symmetry where $\vec{E}$ will be _____ everywhere.
 - In most problems, your Gaussian surface will be a box, cylinder, or sphere.

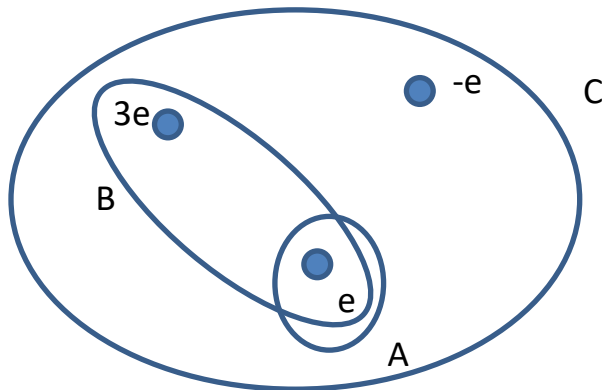
EXAMPLE: ELECTRIC FIELD WITHIN SPHERICAL CONDUCTOR

Using Gauss's law, find the electric field *inside* a spherical conductor with some charge $-Q$.



PRACTICE: FLUX THROUGH MULTIPLE SURFACES

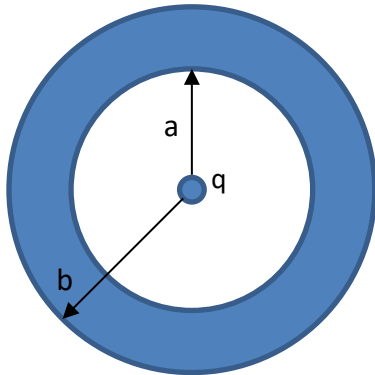
Rank the flux through surfaces A, B and C in the figure below from greatest to smallest.



EXAMPLE: ELECTRIC FIELD DUE TO A HOLLOW SHELL

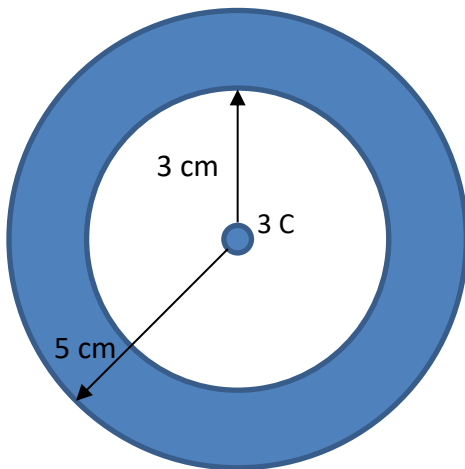
What is the electric field in the following three regions due to the conducting spherical shell:

- a) $r < a$
- b) $a < r < b$
- c) $r > b$



EXAMPLE: SURFACE CHARGE DENSITIES

What is the surface charge density on the inner and outer surface of the hollow shell in the following figure?



PRACTICE: ELECTRIC FIELD DUE TO A SHELL

A spherical, thin conducting shell of radius 8cm has a charge of -6C . If a 4C charge were placed at the center of the shell, what is the electric field 4 cm from the center? At 12 cm?

