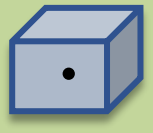
CONCEPT: GAUSS'S LAW

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

$\Phi_{NET} =$ ——

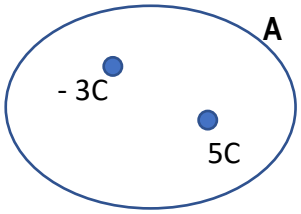


- Remember, $\varepsilon_0 = 8.85\times10^{-12}$

- 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?

$\Phi_1 = 10\ Nm^2/C$ $\Phi_2 = 20\ Nm^2/C$
$\Phi_3 = 8\ Nm^2/C$ $\Phi_4 = -15\ Nm^2/C$

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

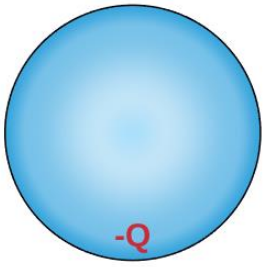
EXAMPLE: Use Gauss's Law to write an expression for $\vec{E}$ due to a point charge ***Q*** at *any* distance ***r***.

$k =$ ——

- 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.

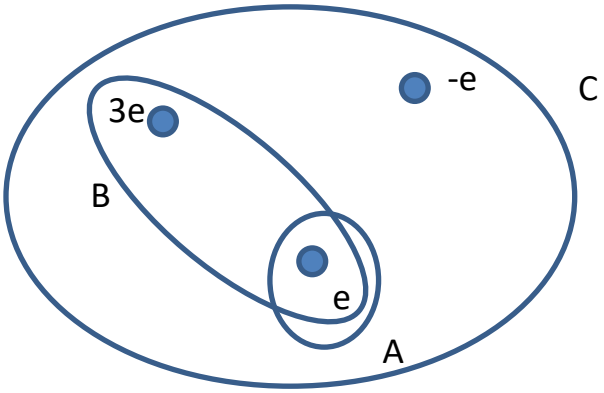
EXAMPLE: ELECTRIC FIELD WITHIN SPHERICAL CONDUCTOR

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



PRACTICE: FLUX THROUGH MULTIPLE SURFACES

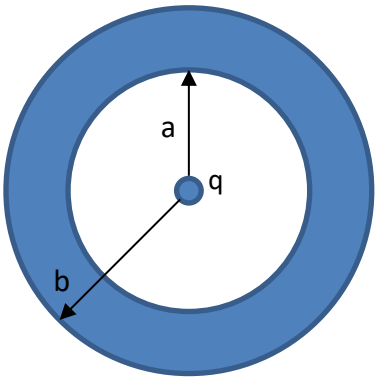
Rank the flux through surfaces A, B and C in the figure below from greatest to smallest.



EXAMPLE: ELECTRIC FIELD DUE TO A HOLLOW SHELL

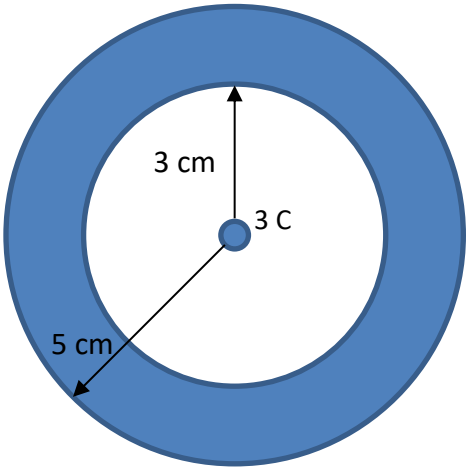
What is the electric field in the following three regions due to the conducting spherical shell:

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?