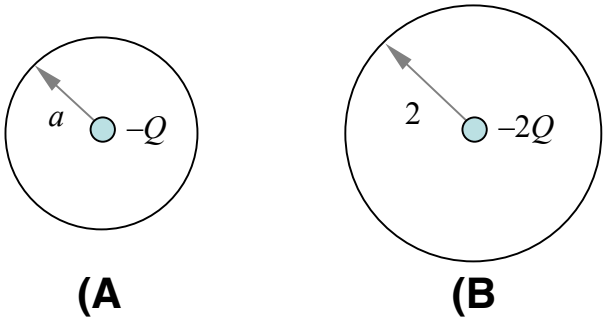
Name: _____ Sec. _____ **P212: Quiz 2A Week 3**

1) In figure **A**, a negative charge $-Q$ is located at the center of a sphere of radius a. In figure **B**, a negative charge $-2Q$ is at the center of a sphere of radius $2a$. Compare Φ_A, the flux through the sphere in Figure A, to Φ_B, the flux through the sphere in Figure B. (Remember the sign convention for flux through a closed surface: positive flux points *outwards*.) **[4]**

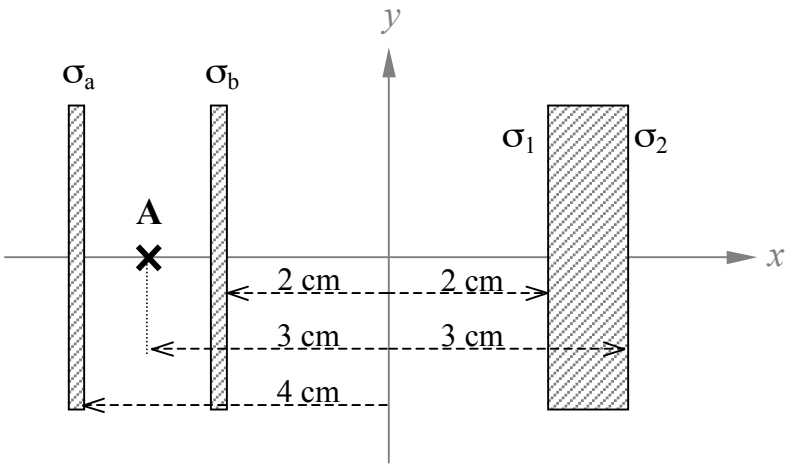


(a) $\Phi_A < \Phi_B$ (b) $\Phi_A = \Phi_B$ (c) $\Phi_A > \Phi_B$

Flux = enclosed charge / ε_0
$\Phi_A = -Q / \varepsilon_0$
$\Phi_B = -2Q / \varepsilon_0$
Therefore the correct answer is (c) $\Phi_A > \Phi_B$.

Award 2 points for the correct answer (a).
Award 2 points for correctly setting up Gauss's law, i.e. $\Phi_A = Q_{enclosed} / \varepsilon_0$

Consider the three infinite metal slabs shown below. The left and middle slabs are very thin and carry surface charge densities of –3 C/m^2 and +5 C/m^2 respectively. The right-hand plate has a thickness of 1 cm and carries no net charge.



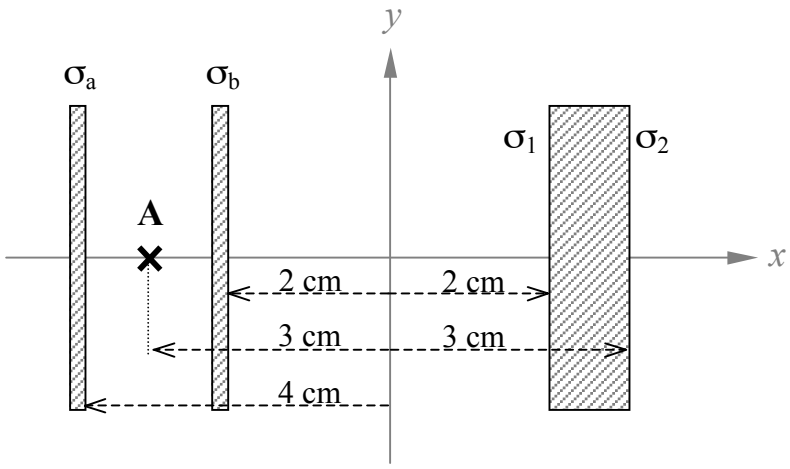
$\sigma_a = -3$ C/m^2
$\sigma_b = +5$ C/m^2
$\sigma_1 + \sigma_2 = 0$

2) What is the electric field **E** at the point **A** due to the thick slab alone? Be sure to indicate both magnitude and direction. **[4]**

E = 0 because the total charge on the thick slab is Q = 0.

Award 4 points for the correct answer E=0.

3) What is the electric field at point **A** due to all three slabs? Be sure to give both magnitude and direction. **[8]**



$\sigma_a = -3\ C/m^2$
$\sigma_b = +5\ C/m^2$
$\sigma_1 + \sigma_2 = 0$

$E = +(\sigma_a - \sigma_b)/(2\varepsilon_0)$
$= (-3-5)/(2\varepsilon_0)$
$= -4.5\times10^{11}$ N/C (in the negative-x direction)

4 points for setting up problem
2 points for correct solution
2 points for correct direction

4) What is the sign of σ_2 (the surface charge induced on the right-hand face of the thick slab)? You must supply a reason to receive credit. **[4]**

$\sigma_2 > 0$ because σ_b is positive and σ_a is negative, with $|\sigma_b| > |\sigma_a|$, which means the net E-field on the slab is in the positive x-direction and pushes positive charges to the right

2 points for correct answer and 2 points for correct explanation