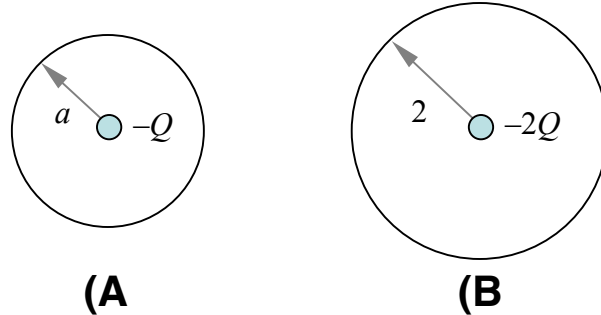
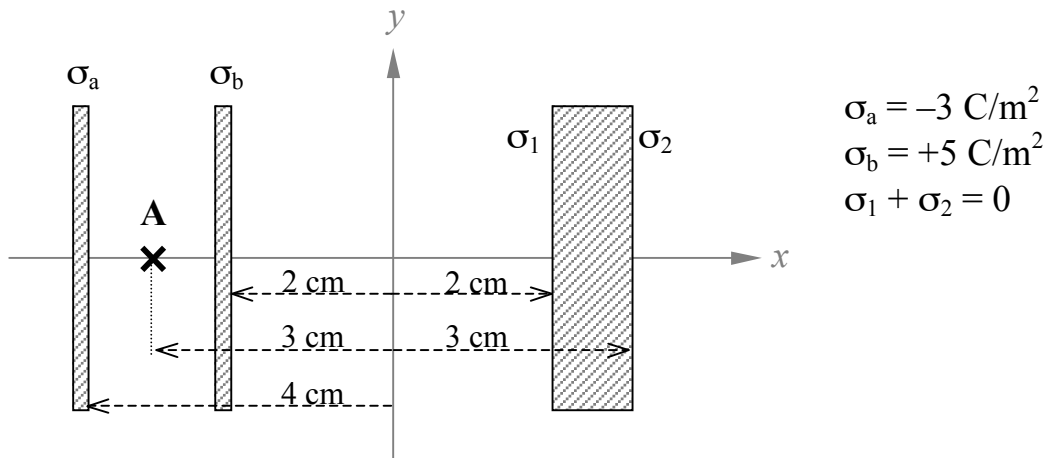


- 1) In figure **A**, a negative charge  $-Q$  is located at the center of a sphere of radius  $a$ . In figure **B**, a negative charge  $-2Q$  is at the center of a sphere of radius  $2a$ . Compare  $\Phi_A$ , the flux through the sphere in Figure A, to  $\Phi_B$ , the flux through the sphere in Figure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



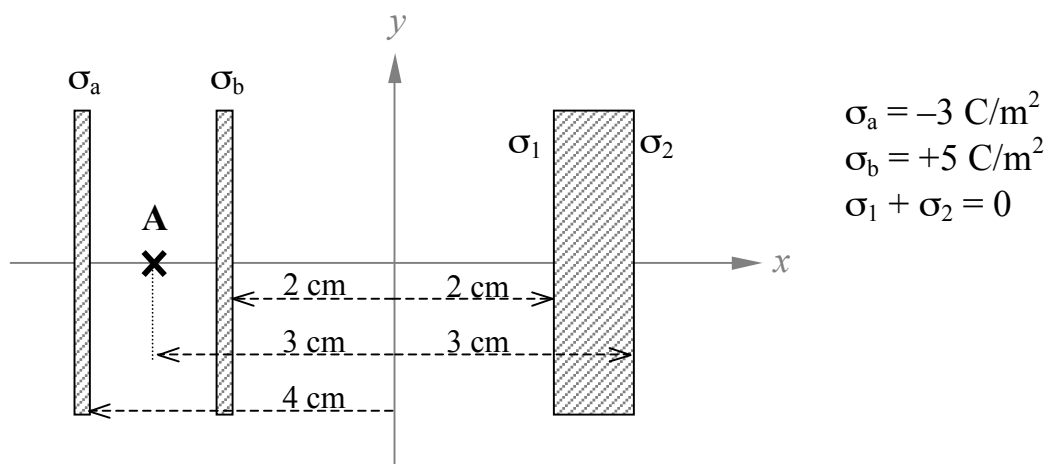
- (a)  $\Phi_A < \Phi_B$       (b)  $\Phi_A = \Phi_B$       (c)  $\Phi_A > \Phi_B$

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



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

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



- 4) What is the sign of  $\sigma_2$  (the surface charge induced on the right-hand face of the thick slab)? You must supply a reason to receive credit. [4]