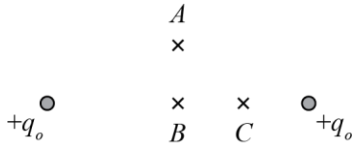
Name _____ **Student ID** _____ **Score**_____
last *first*

IV. [25 points total] Tutorial question.

A. Two positive point charges with charge $+q_o$ are shown at right. Points *A* and *B* are located are equidistant from the two point charges, and point *B* and *C* lie on the axis of the two charges.



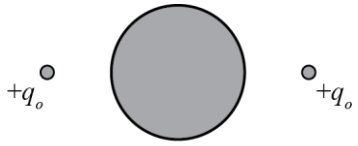
[8 pts] Rank the electric potentials of the three points V_A, V_B, and V_C from highest to lowest. Explain your reasoning.

$V_C > V_B > V_A$.

One could use superposition of $V = \frac{kQ}{r}$ *directly, or consider the direction of the electric field at various locations. The latter explanation is given:*

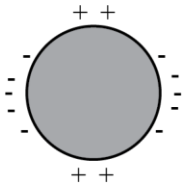
At locations B and C, the electric field points leftwards, as the push from the right charge is always larger than the push from the left charge. Between A and B, the electric field points upwards, as the horizontal components cancel and the upward vertical components add. Electric field points in the direction of decreasing potential.

B. A neutrally charged spherical conductor is placed in between the two point charges, such that the center of the conductor is at the midpoint of the two point charges.



Conducting sphere

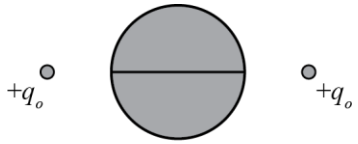
[6 pts] Sketch the charge distribution on the conductor after a long time on the diagram below. Explain your reasoning.


Sketch charges: cross-sectional view

The positive charges will attract negative charges toward it, and push positive charges away. Conductors in equilibrium should have no net charge inside, so all charge should be on the surface.

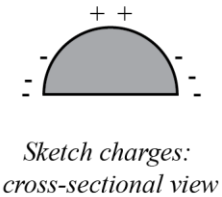
Alternately, negative charges prefer to go toward high potential and positive charges prefer to go to low potential. We can use our answer above with those guidelines to sketch the charges.

C. After a long time, the conductor is cut in half across its horizontal plane, and a very thin insulating plate is inserted between the halves.



Cut conducting sphere

i. [5 pts] On the diagram below, sketch the charge distribution on the top half of the sphere immediately after the sphere is cut. Explain your reasoning.


Sketch charges: cross-sectional view

There should be no change from the top half of the diagram above. The charge distribution above already makes the net electric field inside the conductor zero, so there is no reason to redistribute charges.

ii. [6 pts] Immediately after the sphere is cut, in what direction is the net electric force on the top half of the conductor? If the net electric force is zero, state so explicitly. Explain your reasoning.

Upwards.

Electrostatic pressure describes the pressure charges exert on the surface of a conductor as they want to go outward, but are held back by the material. Since the top portions of the top half have charge the bottom face has no charge, the charges will pull upward on the top half.