

# *Physics 4B*

## **PLC activity #2: Electrostatics**

**Work with one or more partners in the PLC. Do your calculations, initial sketches and other work as a group on a whiteboard so you can discuss them with your partners and show them to the tutor.**

*To get credit for this activity, you must show your answers to a PLC tutor and have them initial the sign-out sheet **before 4:00 pm on Wednesday.***

### **Part 1: Electrostatic Physlets**

#### **1) Physlet Problem 22.3**

In the animation the electrostatic force on each charge is indicated by an arrow (position is given in meters). The magnitude of each charge is 1 C, and the blue charge is negative. What is the net charge shown in the animation?

#### **2) Physlet Problem 22.4**

A positive charge (red) is shown along with a region blocked by a gray curtain (position is given in meters). The electric force on the positive charge is represented with a force vector. The region behind the gray curtain contains two charges of equal magnitude but unknown polarity (unknown sign). You can drag the red charge along the black circle.

Draw a picture showing the sign and location of each charge within the covered area.

3) Physlet Problem 22.8

A positive test charge of  $1 \times 10^{-5} \text{ C}$  with a mass of  $0.9 \text{ kg}$  is shown near a variable charge with a fixed position (at the origin). You may change the charge of the central charge and the initial velocity of the test charge (position is given in meters and time is given in seconds).

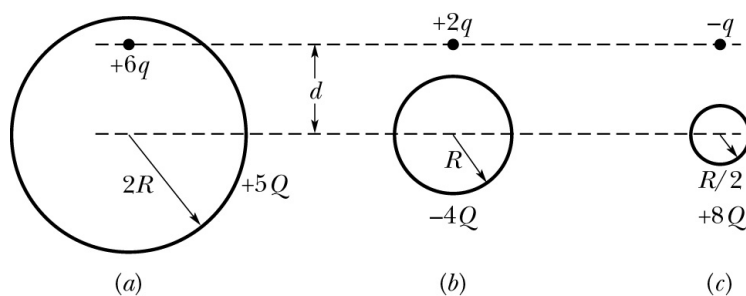
Set the charge of the central charge to  $-20 \times 10^{-5} \text{ C}$ .

a) What initial velocity must you give the test charge so that the test charge can make it from its starting place to the finish line in a circular path?

b) For an arbitrary negative central charge,  $Q$ , what initial velocity must you give the test charge so that the test charge can make it from its starting place to the finish line in a circular path? Your answer should be a formula for  $v$  in terms of  $Q$ . When you have an answer, test it with  $Q = -10 \times 10^{-5} \text{ C}$  and  $Q = -30 \times 10^{-5} \text{ C}$ .

Part 2: Ranking Task Exercise and Conceptual Questions

4) The figure shows three situations involving a charged particle and a uniformly charged spherical shell. The charges are given, and the radii of the shells are indicated. Rank the situations according to the magnitude of the force on the particle due to the presence of the shell, greatest first.



5) Given below are arrangements of three fixed electric charges. In each figure, a point labeled P is also identified. All of the charges are the same size charge,  $q$ , but they can be either positive or negative as indicated. The charges and point P all lie on a straight line. The distances between adjacent items, either between two charges or between a charge and point P, are all the same. There are no other charges in this region. A test charge,  $+Q$ , is placed at point P.

Rank these arrangements from greatest to least on the basis of the strength (magnitude) of the electric force on the test charge,  $+Q$ , at P.



Greatest 1 \_\_\_\_\_ 2 \_\_\_\_\_ 3 \_\_\_\_\_ 4 \_\_\_\_\_ 5 \_\_\_\_\_ 6 \_\_\_\_\_ Least

**Please carefully explain your reasoning.**