

Discussion questions

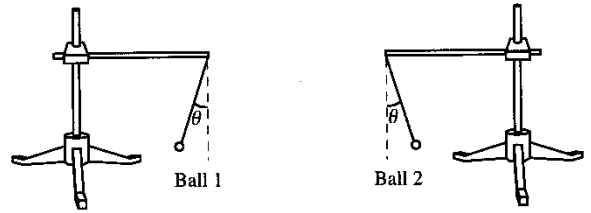
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Electric Charge

1. Two identical metal balls are suspended by insulating strings. Both balls have the same net charge. In this problem, do not assume the balls are point charges.

a. Draw a separate free-body diagram for each ball. Label the forces to indicate:

- The object exerting the force,
- The object on which the force is exerted
- The type of force (gravitational, normal, etc)



b. Predict what will happen if the charge on the second ball is reduced slightly, so it is less than that on the first ball. Draw a sketch to illustrate your answer.

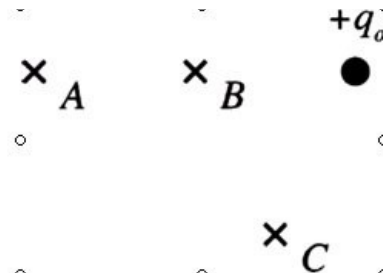
Is the angle that ball 1 makes with the vertical, *greater than*, *less than*, or *equal to* the angle that ball 2 makes with the vertical? Explain your reasoning.

c. Predict what will happen if the net charge on the second ball is reduced to zero. Draw a sketch to illustrate your answer.

2. A positive charge of magnitude q_0 is shown.

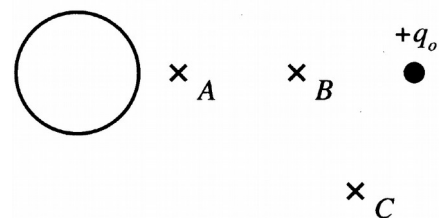
a. Points B and C are distance r_0 away from the charge and point A is at distance $2r_0$.

- i. Indicate the direction of the electric field at points A, B and C on the diagram.
- ii. Compared to the absolute value of the work done by an external agent in moving a small test charge from A to B.
- iii. Would the absolute value of the work done by an external agent in moving the same test charge from B to C be *larger*, *smaller*, or *the same*? Explain (group discussion).
- iv. Would the absolute value of the work done by an external agent in moving the same test charge from A to C be *larger*, *smaller*, or *the same*? Explain (group discussion).



b. A large metal sphere with zero net charge is now placed to the left of point A, as shown.

- i. Sketch the charge distribution on the metal sphere in the diagram at right.
- ii. Has the *magnitude* of the electric field at points B and C *increased*, *decreased*, or *remained the same*? Explain (group discussion).
- iii. Has the *direction* of the electric field at points B and C changed? Explain (group discussion).
- iv. Has the absolute value of the electric potential difference ΔV_{AB} from point A to point B *increased*, *decreased*, or *remained the same*? Explain (group discussion).



Short calculations

3. A point charge of $+3.00 \times 10^{-6} \text{C}$ is 12.0cm distant from a second point charge of $-1.50 \times 10^{-6} \text{C}$. Determine the magnitude and direction of the force on each charge.

4. Calculate the direction and magnitude of the electric field at the point P in the figure due to three point charges.

