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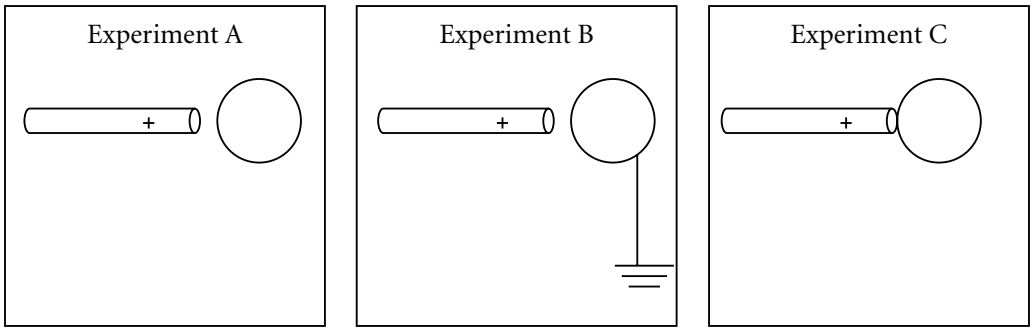
Section 17-1

HOLT PHYSICS

Concept Review

Electric Charge

1. A plastic rod rubbed with wool was used to charge a small metal sphere in three experiments, as illustrated below. The spheres were held by insulating stands. The sphere in Experiment B was grounded. Assume the rod had a positive charge.



a. Were charges transferred in Experiments A, B, or C? If so, between which objects?

b. Sketch the charge distribution for the spheres in each experiment.

c. The rod was removed after a while. In which experiment(s) did the sphere end up with excess electric charge?

d. In which experiment(s) did polarization occur?

e. What happened to the excess charge on the rod after it was removed in experiment A? in B? in C?

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Section 17-2

HOLT PHYSICS

Math Skills

Electric Force

Use $k_C = 8.99 \times 10^9\ \text{N} \cdot \text{m}^2/\text{C}^2$.

1. Two point charges, q_1 and q_2, of 4.00 μC each, are placed –16.0 cm and 16.0 cm away from the origin on the x-axis. A charge q_3 of –1.00 μC is placed 12.0 cm away from the origin on the y-axis.

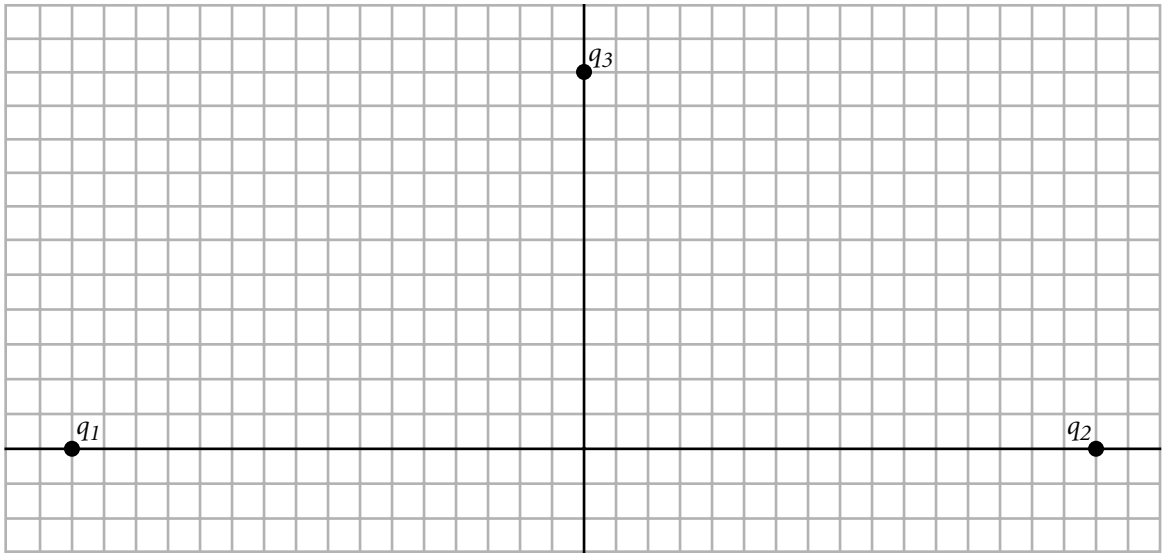
a. Find the distance from q_3 to q_1 and from q_3 to q_2 _____

b. Find the magnitude and the direction of the force F_{13} exerted by q_1 on q_3. _____

c. Find the magnitude and the direction of the force F_{23} exerted by q_2 on q_3. _____

d. Find the magnitude and the direction of the force F_{12} exerted by q_1 on q_2. _____

e. In the space below, sketch the vectors representing forces F_{13} and F_{23}.



f. Find the angle between the q_1–q_3 line and the x-axis. _____

g. Find the x and y components of forces F_{13} and F_{23}. _____

h. Find the resultant force of forces F_{13} and F_{23}. _____

i. If q_3 is released, in which direction will it move? _____

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Section 17-3

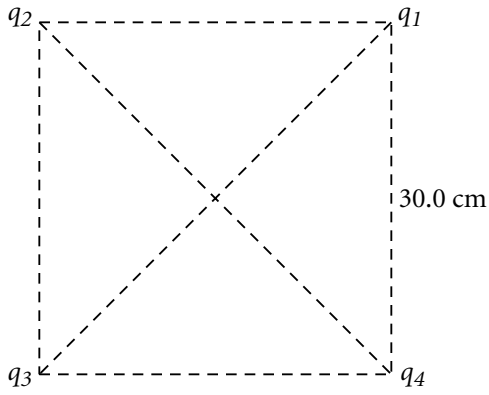
HOLT PHYSICS

Concept Review

The Electric Field

Use $k_C = 8.99 \times 10^9\ \text{N} \cdot \text{m}^2/\text{C}^2$.

1. Four positive charges, q_1, q_2, q_3, and q_4, of 8.00 μC, each are arranged to form a 30.0 cm wide square as shown.



a. Find the distance of each charge from the center of the square.

_____

b. Find the strength and direction of the electric field vectors of q_1, q_2, q_3, and q_4 at the center of the square.

_____

_____

c. Find the strength and direction of the electric field at the center of the square.

_____

2. In a Millikan experiment, a droplet of mass 4.7×10^{-15} kg floats in an electric field of 3.20×10^4 N/C.

a. What is the force of gravity on this droplet?

_____

b. What is the electric force that balances it?

_____

c. What is the excess charge?

_____

d. How many excess electrons are there on this droplet?

_____

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Chapter 17

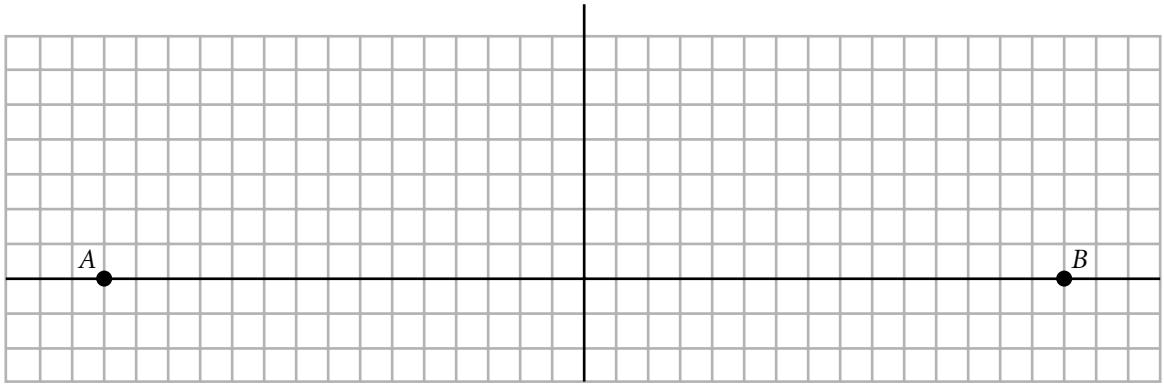
HOLT PHYSICS

Mixed Review

Electric Forces and Fields

Use $k_C = 8.99 \times 10^9\ \text{N} \cdot \text{m}^2/\text{C}^2$.

1. Two spheres, *A* and *B*, are placed 0.60 m apart, as shown. Sphere *A* has +3.00 μC excess charge. Sphere *B* has +5.00 μC excess charge.



a. How many electrons are missing on sphere *A*? on sphere *B*?

b. How do the forces of *B* on *A* and *A* on *B* compare? Does the greater charge exert a greater force?

2. A third spherical charge, *C*, of +2.00 μC, is placed on the line connecting spheres *A* and *B*. Find the resultant force exerted by *A* and *B* on *C* when *C* is placed in the following locations.

a. 0.20 m to the left of *A*

b. 0.20 m to the right of *A* between *A* and *B*

c. exactly in the middle between *A* and *B*

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Chapter 17

HOLT PHYSICS

Mixed Review *continued*

3. Alpha particles are made of two protons and two neutrons.
$m_p = 1.673 \times 10^{-27}$ kg; $m_n = 1.675 \times 10^{-27}$ kg; $q_e = 1.60 \times 10^{-19}$ C

a. Find the electric force acting on an alpha particle in a horizontal electric field of 6.00×10^2 N/C.

b. What is the acceleration of this alpha particle?

c. How does this acceleration compare with gravity? Describe the particle's trajectory. Will it be close to horizontal? to vertical free fall?

4. A 2.00 μC point charge of mass 5.00 g is suspended on a string and placed in a horizontal electric field. The mass is in equilibrium when the string forms a 17.3° angle with the vertical.

a. In the space below, sketch a free-body diagram of the problem. Show the vertical and horizontal components of the tension force in the string.

b. Find the electric force on the charge in this field.

c. Find the strength of the electric field.

5. How many electrons are there in 1.00 C? How many electrons are there in 1.00 μC?