I. Messing with charges

Two identical charges of magnitude *q* rest at the positions A and B as shown. The electric force felt by charge A due to charge B has magnitude *F*. Answer each question assuming that the original situation is restored before the change described in the question (i.e., don't cumulate changes).

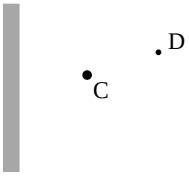
A. How would the electric force felt by the charge at A change if the charge at B were doubled? Explain why you think so.

B. How would the electric field felt by the charge at A change if the charge at B were doubled? Explain why you think so.

C. How would the electric field felt by the charge at A change if the charge at A was doubled? Explain why you think so.

II. More messing with charges

Points C and D are located near a charged rod as shown. After the rod is rubbed, a 10 nc (nanocoulomb) bead at point C feels a an electric force of magnitude 0.20 newtons. For each question below, **explain** your answer.



A. Would the electric *field* felt by the bead increase, decrease, or stay the same if

1. The charge on the bead were increased?

2. The rod was rubbed some more, increasing its charge

3. The bead were moved to point D?

B. Would the electric *force* felt by the bead increase, decrease, or stay the same if

1. The charge on the bead were increased?

2. The rod was rubbed some more, increasing its charge

3. The bead were moved to point D?

C. Again consider the original scenario described before part A. Which of the following quantities, if any, can you calculate from the given information? Explain why or why not in each case.

1. The charge on the rod.

2. The electric field that a 25 nC particle would feel at point C.

3. The force that the 10 nC bead at point C exerts on the rod.

III. Point charge fields vs. forces

In this diagram, one of the two tiny particles carries three times as much charge as the other.

A. Which particle, if either, experiences a bigger electric *force*? Explain how you know.

B. Which particle, if either, feels a bigger electric *field*? Explain.

C. Intuitively, what would guess is the ratio of the electric field felt by Q to the electric field felt by $3Q$?

D. Reconcile your part C conclusion about the fields with your part A conclusion about the forces. In other words, explain intuitively how the particles can feel different fields but the same forces?

IV. Gravitational fields vs. forces

The distinction between fields and forces applies to gravity, too. To see why it's important, imagine two bathroom scales sitting side by side. A bowling ball is placed on scale 1 and a pencil is placed on scale 2.

A. We'll start with a "duh" question. On which scale, if either, does the object feel a greater gravitational force?

B. At which scale is there a greater gravitational field? Explain.

C. If necessary, reconcile your part A and part B answers. As part of your answer, discuss which property of an object determines how strongly it gets pulled by a given gravitational field.

D. If the bowling ball were shot 1000 miles straight up, would there be an increase, decrease, or no change in

1. the gravitational force it experiences? Explain.

2. the gravitational field it feels? Explain.