

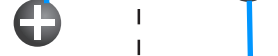
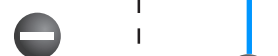
# POLARITY SHIFT

Name:

Date:

## Level 1: Dueling Charges - Professor Mode

In each of the following, draw and label the forces exerted on each of the balls.



When do the balls attract one another?

When they are opposite charges

When do the balls repel one another? Give two examples.

When they have the same charge

-Positive/positive

-Negative/negative

How does the distance between the balls affect the forces exerted on them?

Closer together means greater force

Compare the magnitude and direction of the force exerted on each ball.

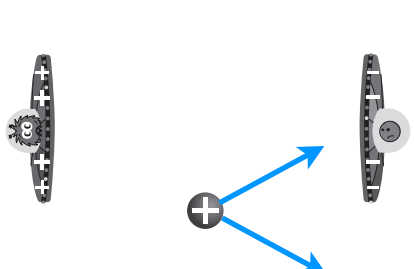
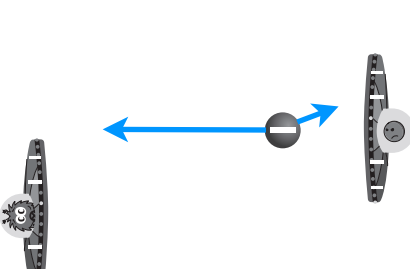
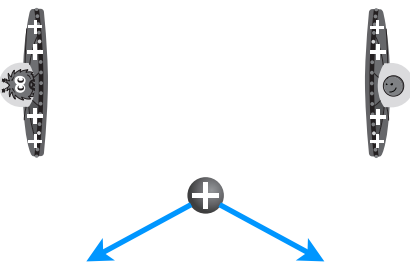
The magnitudes are equal and they are collinear

-Toward each other for opposite charges

-Away from each other for like charges

## Level 2: Polarity Shift - Professor Mode

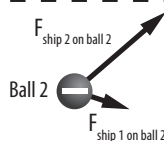
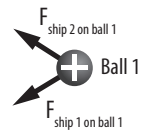
In each of the following, draw and label the forces exerted on the ball by each of the electrically charged ships.



When is the best time to flip your charge so that you can repel the ball toward your opponent? Explain why this is the case.

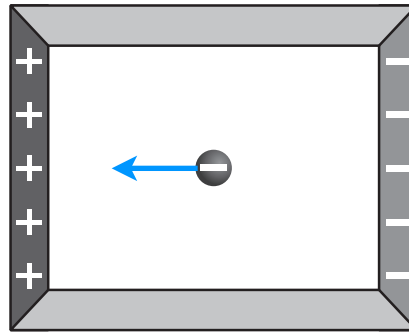
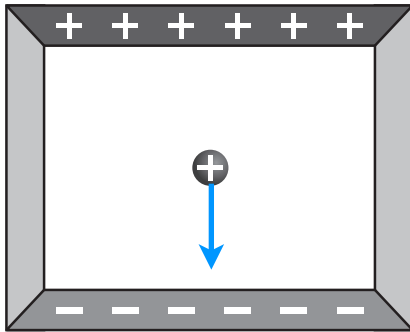
When the ball is closest to you, so it will speed up since the force will be greater.

Show where you could place each ball for it to match the force diagram shown.

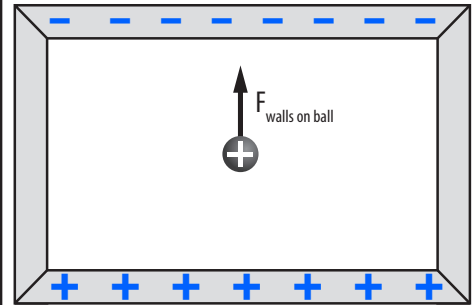


### Level 3: Electric Field Chamber - Professor Mode

In each of the following, draw and label the force exerted on the ball.



Draw the charge of the walls to match the force diagram.



Give two examples in which the force exerted on the ball is zero.

+ ball between two + walls

- ball between two - walls

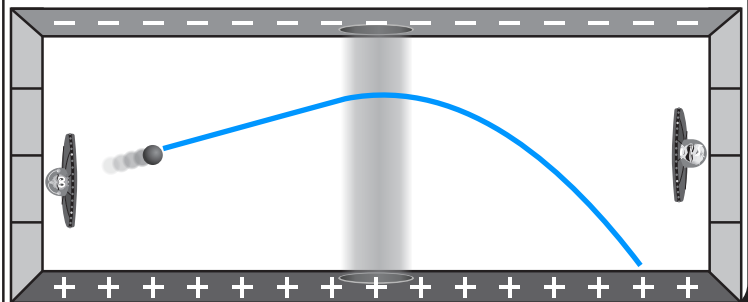
or if there's no charge on the walls

What is the shape of the ball's path when it feels an electric force? What about when it does not feel an electric force?

Curved since it will accelerate down in the upwardly directed field.

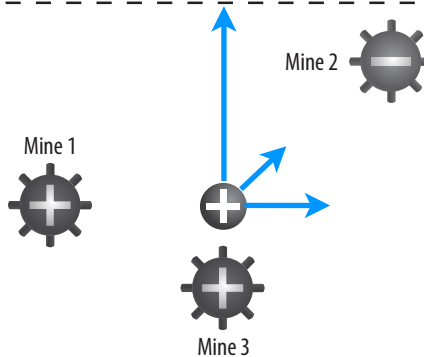
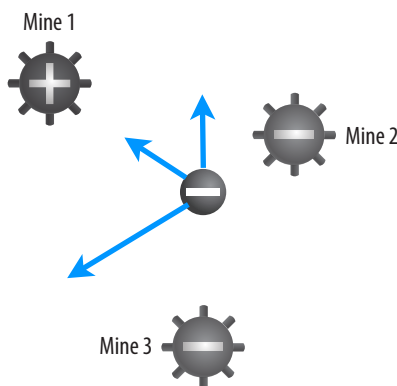
Straight line when the  $F_{net}$  is zero.

The neutral ball shown below is about to pass through the electron beam and become negatively charged. Draw the complete path of the ball below.

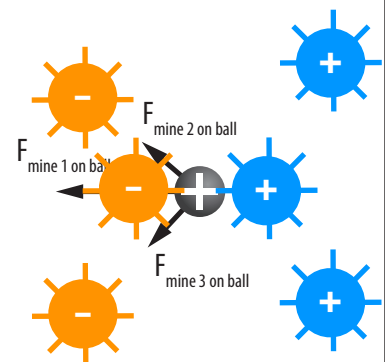


### Level 4: Charge Mines - Professor Mode

In each of the following, draw and label the forces exerted on the ball by the mines.



Draw the missing charge mines!



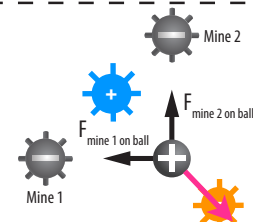
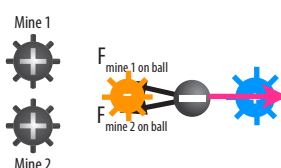
Could have either charge along each line of force

How can you use the charge mines to help defend your wall? Explain your answer.

Put mines with the same charge as the ball in front of the wall.

Like charges repel.

In each of the following, draw in a third charge mine to put the ball in equilibrium. Then complete the force diagram.



Could have either the positive or negative charge shown in a scenario.