Minds•On Physics Activity 41

Recognizing Interactions

Purpose and Expected Outcome

In this activity you will learn to recognize when two objects are interacting and when they are not.

Prior Experience / Knowledge Needed

When two objects influence each other we say that they are *interacting*. The effect of an interaction can vary depending on the circumstances. Sometimes the motions of the objects are changed in some way. (Ultimately this is what we will be most interested in understanding.) At other times the shapes of one or more objects are changed, such as when a spring is compressed. Quite often both the motion and the shape of objects are affected by an interaction, although sometimes we can ignore the effects because they are so small.

Explanation of Activity

There are three parts to consider in this activity. In the first part, you are asked to specify whether or not particular pairs of objects are interacting and how they influence each other. In the second part, you will examine the interaction during specified periods of time. In the third set, you will explore the influence of an interaction on the environment in which the object exists.

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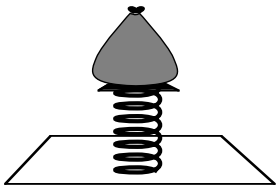
PART A: Recognizing the Interaction between Two Objects

For each of the situations described below in A1 – A3, (a) indicate if the pair of objects specified are interacting, and (b) indicate how each object influences the other. (For example, is the shape, or motion, or both affected?) Then, answer the questions below about the situations.

A1. A water balloon is set on a spring one meter off the ground. Consider the water balloon and the spring.

(a) Are the water balloon and the spring interacting?

(b) How does each influence the other?



A2. A child stands on a wooden plank joining two large boulders on opposite sides of a brook. Consider the child and the plank.

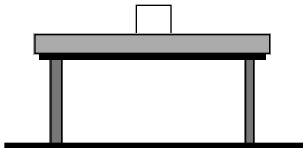
(a) Are the child and the plank interacting with each other?

(b) How does each influence the other?

A3. A block sits at rest on a horizontal table. Consider the block and the table.

(a) Are the block and the table interacting?

(b) How does each influence the other?



A4. In situation A1, if the spring were to suddenly disintegrate, what would happen to the water balloon?

A5. (a) In situation A2, is the child interacting (directly) with the boulders?

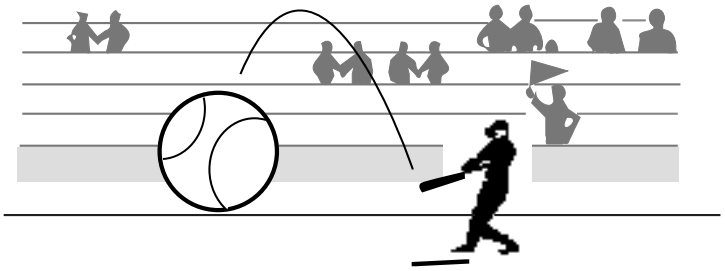
(b) With what object is the child interacting directly?

A6. (a) In what ways are the spring, the plank, and the table the same?

(b) How are they different?

PART B: Exploring an Interaction at Different Times

Consider the following situation: A baseball is thrown by the pitcher and then hit by the batter.



For each of the time periods described in B1 – B3, (a) indicate whether or not the ball and the bat are interacting, (b) indicate how the ball influences the bat, and (c) indicate how the bat influences the ball. Then answer the questions below.

B1. When the ball has left the pitcher's hand, but has not yet arrived at the batter...

(a) Are the ball and the bat interacting?

(b) How does the ball influence the bat?

(c) How does the bat influence the ball?

B2. When the ball is in contact with the bat (for only about 0.002 seconds!!)...

(a) Are the ball and the bat interacting?

(b) How does the ball influence the bat?

(c) How does the bat influence the ball?

B3. When the ball is in the air and heading straight toward the left fielder...

(a) Are the ball and the bat interacting?

(b) How does the ball influence the bat?

(c) How does the bat influence the ball?

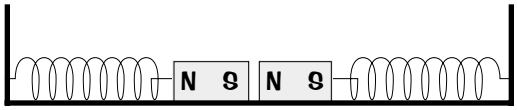
B4. Do the bat and ball need to be in contact to interact with each other? Explain.

B5. Give some examples of pairs of objects that interact <u>without</u> being in contact with each other?

PART C: Exploring an Interaction in Different Situations

Consider two magnets. When opposite poles are facing each other, the two magnets stick to each other as shown to the right:

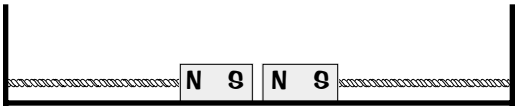
C1. Each magnet is connected to a spring, which in turn is attached firmly to a wall. The magnets are placed with opposite poles facing each other, and released. All surfaces are frictionless.



(a) Are the two magnets interacting? Explain.

(b) Describe how the magnets influence each other.

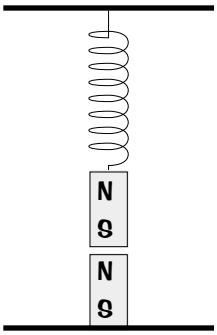
C2. Each magnet is connected to a piece of string, which is attached firmly to a wall. The magnets are placed with opposite poles facing each other, and released. All surfaces are frictionless.



(a) Are the two magnets interacting? Explain.

(b) Describe how the magnets influence each other.

C3. One magnet is connected to a spring, which is attached to the ceiling. The second magnet is placed on the floor with opposite poles facing each other.



(a) Are the two magnets interacting? Explain.

(b) Describe how the two magnets influence each other.

Reflection

R1. When an object interacts with another object is there anything other than its shape and motion that could be affected? Explain.

R2. When two objects interact, must they influence each other in exactly the same way? Explain.

R3. Is it possible for one object to influence another object's interactions with a third object? Explain.

R4. Comment on the similarities and differences between a string and a spring.