Minds•On Physics Activity 1

Looking Ahead

Purpose and Expected Outcome

When you begin to study something new, what you already know and how you think about the subject affects what you notice and what you learn. Sometimes what you know and think is helpful in deciding what to pay attention to and how to interpret new ideas. At other times, what you know and think can interfere with understanding new ideas. Because of this, it is a good idea to become aware of what you think about a subject before you try to make sense of the new ideas presented to you. In order to understand fully the new ideas it may be necessary for you to put aside or alter the way you think about the subject.

The first part of this course will be concerned with describing the motion of objects and understanding why objects move the way they do. Two of the most important ideas you will study are *force* and *acceleration*. The purpose of this activity is to record your initial thinking about forces and acceleration before we start to study the physics definitions of these ideas. Later on, when you have finished studying forces and acceleration, you will return to this activity to see how your ideas have changed.

Prior Experience / Knowledge Needed

No prior knowledge or experience is needed to do this activity.

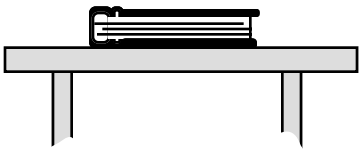
Explanation of Activity

This activity has two parts. In the first part, you will consider a number of different situations and attempt to describe the forces acting on the objects in the situations. In the second part, you will predict what <u>you</u> believe will happen in a number of other situations. Answer the questions according to <u>your</u> intuition, rather than being overly concerned with getting the "correct" answer.

PART A: Analyzing the Motion of Common Objects

Below are some familiar situations. For each one, state what you believe to be the force (or forces) acting on the specified object, and indicate whether or not you think the object is accelerating.

A1. A book rests on a table.

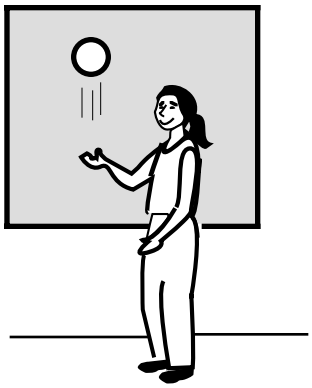


(a) List and describe the forces that you think are acting on the book.

(b) Do you think the book is accelerating? Explain.

(c) Explain why the book does not fall.

A2.



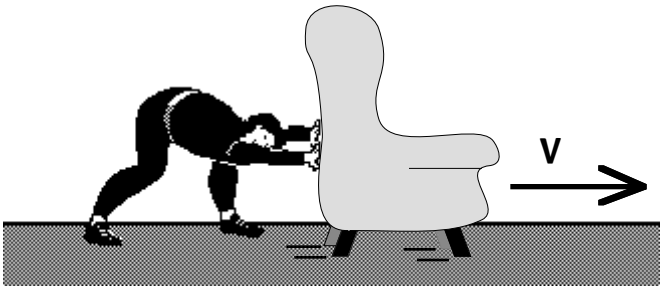
A ball is thrown straight up. Consider the ball while it is in the air (<u>after</u> it is released).

(a) List and describe the forces that you think are acting on the ball.

(b) Do you think the ball is accelerating? If so, during which parts of its motion is it accelerating? Explain.

(c) Explain why the ball moves upward and then moves downward.

A3. A chair is pushed across the floor at constant speed. Consider only when the chair is in motion.

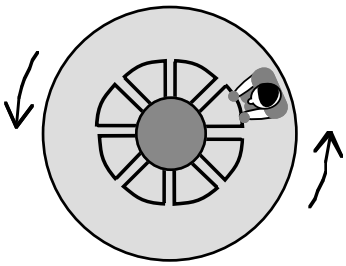


(a) List and describe the forces that you think are acting on the chair.

(b) Do you think the chair is accelerating? Explain.

(c) Explain why the chair is moving at constant speed.

A4.



A child is riding on a merry-go-round that is spinning very quickly at a constant rate.

(a) List and describe the forces that you think are acting on the child.

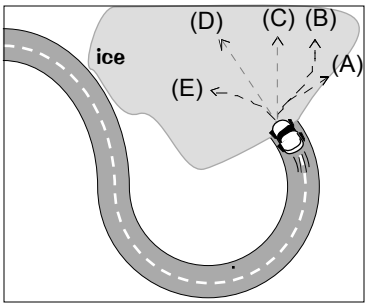
(b) Do you think the child is accelerating? Explain.

(c) Explain why the child is moving in a circle.

PART B: Predicting the Outcome of an Event

The power of physics is that it helps you to make predictions. For each situation below, (a) predict what you believe will happen, and (b) indicate how confident you are in your prediction. Use a scale of 1–5 to indicate your confidence level, where "1" means "I guessed," and "5" means "I am very, very confident." Since we have not yet presented any physics laws, do not be concerned with whether or not your answers are correct. Instead, be prepared to explain why you made the predictions you did.

B1.



A car traveling along a curved road drives over a very slippery patch of ice as shown. When the car is on the ice it loses all traction.

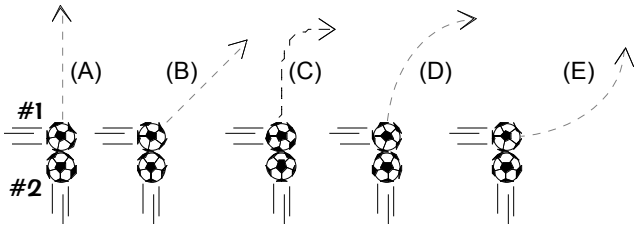
(a) Which of the dashed lines at left best represents the path of the car after it goes onto the ice?

(b) How confident are you in your prediction?

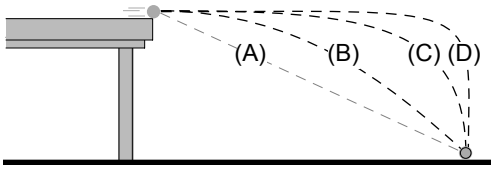
B2. Two soccer balls roll toward each other at right angles and collide as shown (seen from above).

(a) After the balls collide, which dashed line best represents the path of ball #1?

(b) How confident are you in your prediction?



B3.

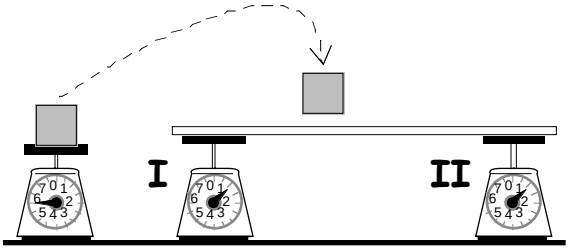


A marble rolls off the edge of a table.

(a) Which of the dashed lines best represents the path of the marble after it leaves the table?

(b) How confident are you in your prediction?

B4. A cube of metal placed on a scale registers 6lb. A wooden board placed symmetrically on two scales registers 1lb on each scale. The metal cube is moved onto the board, one-third of the way from the left end of the board.



(a) What is the new reading on scale I?

(A) 1lb (B) 2lb (C) 3lb (D) 4lb (E) 5lb (F) 7lb

(b) How confident are you in your prediction?

(c) What is the new reading on scale II?

(A) 1lb (B) 2lb (C) 3lb (D) 4lb (E) 5lb (F) 7lb

(d) How confident are you in this prediction?

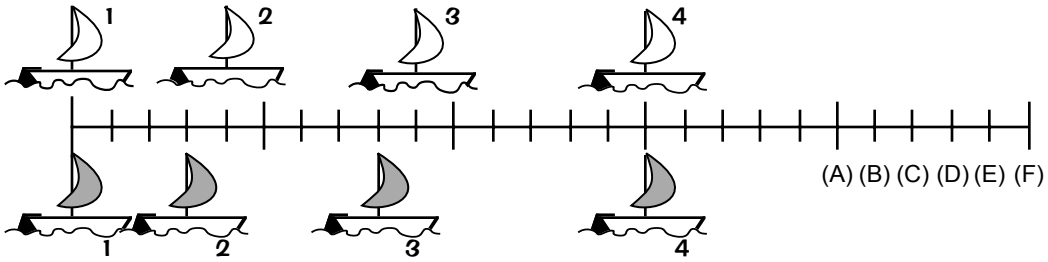
Reflection

R1. As you were working on part A, (a) how did you decide what forces were acting on the objects? (b) How did you decide whether or not an object was accelerating?

R2. In part B, (a) how often did you disagree with your classmates? (b) Why do you suppose your predictions differed from some of your classmates' predictions?

Integration of Ideas

Consider the following situation: Two identical sailboats with different colored sails are traveling to the right in still water. The positions of the sailboats at successive one-second time intervals are shown in the diagram below. You should assume that the sailboats are being pushed along by a steady wind.



I1. Predict where each boat will be after the next time interval. Use the position of the mast as a reference.

(a) White boat: A B C D E F

(b) Confidence: (low) 1 2 3 4 5 (high)

(c) Gray boat: A B C D E F

(d) Confidence: (low) 1 2 3 4 5 (high)

I2. Describe the forces acting on the two sailboats.

I3. Is either sailboat accelerating? Which one? How do you know?

I4. Compare the strengths of the wind forces on the two boats by filling in the two blank spaces in the following statement:

"The wind force on the top (white) sailboat is _____ the wind force on the bottom (gray) sailboat. The wind forces on the sailboats are _____."

(A) greater than / not zero

(B) equal to / not zero

(C) less than / not zero

(D) equal to / zero

(E) Impossible to determine