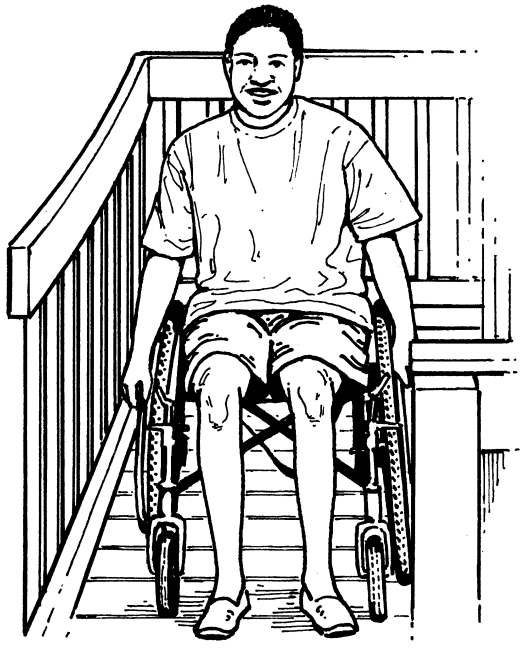
Name _____ Date _____ Class _____

CHAPTER 12 **REAL-WORLD LAB**

You and Your Community

Angling for Access

You and your friends have volunteered to help build a wheelchair-access ramp for the local public library. The design of the ramp has not been decided upon yet, so you need to build a model inclined plane. The model will help you determine what the steepness of the ramp should be.



◆ **Problem** How does the steepness of a wheelchair-access ramp affect its usefulness?

◆ **Skills Focus** making models, measuring, calculating

◆ **Materials**

board, at least 10 cm wide and 50 cm long
wooden block with eye-hook
spring scale, 0–5 N
4 books, about 2 cm thick
metric ruler
marker

◆ **Procedure**

1. Preview the following steps that describe how you can construct and use a ramp. Use the data table on page 113 to record your data.

2. The output force with an inclined plane is equal to the weight of the object. Lift the block with the spring scale to measure its weight. Record this value in the data table.

3. Make a mark on the side of the board about 3 cm from one end. Measure the length from the other end of the board to the mark and record it in the data table.

4. Place one end of the board on top of a book. The mark you made on the board should be even with the edge of the book.

5. Measure the vertical distance in centimeters from the top of the table to where the underside of the incline touches the book. Record this value in the data table as "Height of Incline."

6. Lay the block on its largest side and use the spring scale to pull the block straight up the incline at a slow, steady speed. Be sure to hold the spring scale parallel to the incline, as shown in the picture. Measure the force needed and record it in the data table.

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REAL-WORLD LAB *(continued)*

7. Predict how your results will change if you repeat the investigation using two, three, and four books. Test your predictions.

8. For each trial, calculate the ideal mechanical advantage and the actual mechanical advantage. Record the calculations in your data table.

◆ Data Table

Number of books	Output Force (N)	Length of Incline (cm)	Height of Incline (cm)	Input Force (N)	Ideal Mechanical Advantage	Actual Mechanical Advantage
1						
2						
3						
4						

◆ Analyze and Conclude

Write your answers on the back of this sheet or on a separate sheet of paper.

1. How did the ideal mechanical advantage and the actual mechanical advantage compare each time you repeated the experiment? Explain your answer.

2. Why do you write ideal and actual mechanical advantage without units?

3. What happens to the mechanical advantage as the inclined plane gets steeper? On the basis of this fact alone, which of the four inclined planes models the best steepness for a wheelchair-access ramp?

4. What other factors, besides mechanical advantage, should you consider when deciding on the steepness of the ramp?

5. Apply Suppose the door of the local public library is 2 m above the ground and the distance from the door to the parking lot is 15 m. How would these conditions affect your decision about how steep to make the ramp?

◆ Getting Involved

Find actual ramps that provide access for people with disabilities. Measure the heights and lengths of these ramps and calculate their ideal mechanical advantages. Find out what the requirements are for access ramps in you area. Should your ramp be made of a particular material? Should it level off before it reaches the door? How wide should it be? How does it provide water drainage?