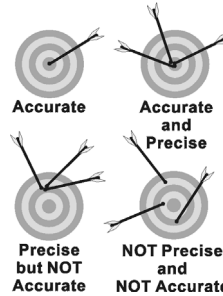


I.1 Time and Distance

UNIT 1: Forces and Motion

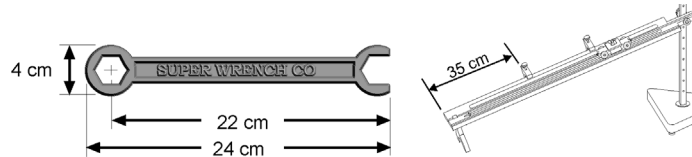
4 Reflecting on what we learned

- a. Resolution means the smallest interval that can be measured. Try using one photogate to determine the resolution of the timer. Give your answer in seconds and tell how your observations support your answer.
- b. The words *accuracy* and *precision* have special meanings in science that are a little different from how people use these words every day. The word *accuracy* refers to how close a measurement is to the true value. The word *precision* describes how close together repeated measurements are. When measurements are precise they are close to the same value. It is possible to be precise but not accurate. Which is likely to be more precise: time measurements made with a stopwatch or measurements made with photogates?



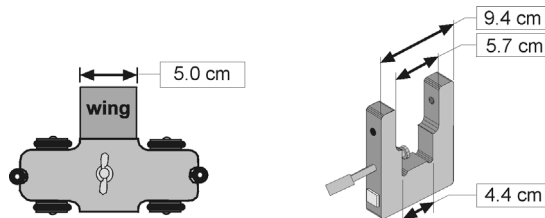
5 Dimensions and diagrams

Think about how often you have to describe how big something is or where something is. It is often said that a picture is worth a thousand words. Because pictures are so much better at describing location or size, a language of pictures has developed to communicate length or position. Learning to read diagrams is important in science. It is also important in everyday life because diagrams explain how to put together almost every product you buy that requires assembly.



Drawings with little lines and arrows indicate distance or size. The lines, arrows, and numbers are called *dimensions*, and they tell you how big and where things are. In the example, the length of the wrench is 24 centimeters. The center of the hole in the wrench is 22 centimeters from one end. The round end has a diameter of 4 centimeters. In the second example, the photogate is placed 35 centimeters from the end of the ramp.

Measure the dimensions of the car and the photogate as shown on the diagram. Write the dimensions in the appropriate boxes.



Accuracy, resolution, and precision

You can use the following scenarios where the concepts of accuracy, precision, and resolution are applicable.

What is the resolution of a cash register? **One cent**

Which of these measurements has higher resolution: 1 cm, 1.1 cm, 1.16 cm?

1.16 cm because it has 2 decimal places.

Can a clock be precise but inaccurate?

Yes. If the clock is fast by 2 minutes, it will always be fast by 2 minutes so it is very precise. But, the time is wrong by 2 minutes, so the clock is inaccurate.

Making a super-size inch ruler

Start with a sheet of paper, and cut a 1-inch wide strip (1 inch x 11 inches). Fold the strip in half and unfold it again. Make a mark on the fold. This mark indicates 1/2 of your sheet. Fold in half and half again. Unfold it and mark the two new folds with shorter lines; these marks indicate 1/4 and 3/4 of your sheet. Refold and fold a third time to make 8 parts. Unfold and mark the 1/8 segments with shorter lines than the 1/4 inch ones. Repeat to get 1/16 lines if possible.

Have each student make a ruler. Then have each student measure the width of his or her hand with their super-sized inch ruler. They may have to add fractions to get the measurement.

Example Answers

4a. The resolution of the timer is 0.0001 seconds because this is the shortest time you can measure and display.

4b. Photogate measurements are more precise because they are not dependent on human reaction time.