

Investigation 1.1

Measuring Time

How do we measure and describe time?

In science, it is often important to know how things change with time. The DataCollector allows us to make accurate, precise time measurements by performing many different functions. You will explore several of these functions, including the use of a photogate.

In this investigation, you will learn how to use the Data Collector to time events in stopwatch mode and then with a photogate in timer mode.

1 Stopwatch mode

In stopwatch mode, the DataCollector is used to measure time intervals. The stopwatch icon indicates the DataCollector is in stopwatch mode. The clock is started and stopped by tapping start/stop. To reset the clock, tap reset. The display shows time in seconds, and then it changes to show minutes and seconds for times longer than one minute.

1. At the DataCollector home screen, choose stopwatch mode.
2. Practice starting, stopping, and resetting the stopwatch.
3. Start and stop the stopwatch as quickly as you can. Who in your group can get the shortest time? Each group member should perform several trials. Find the average time for each group member.

a. Does this stopwatch measure time to the nearest tenth, hundredth, or thousandth of a second?

b. What was your average start/stop time? What is the average start/stop time for the entire class?

c. In general, what does your start/stop time represent? (*Hint: What would you call the time it takes your body to send a signal from your brain to a muscle?*)

d. Does everyone in the class have the same average start/stop time? Why or why not?

e. What variables could affect start/stop time?

- f. When you start and stop the stopwatch repeatedly, do you always get the same time? Why or why not?

- g. Could this stopwatch be used to time a marble falling from a table down to the floor? Why or why not?

2 Using the photogate

1. Connect a single photogate to the “A” input with a cord.
2. From the DataCollector home screen, choose CPO timer mode. There are four different functions for this mode displayed at the bottom of the screen. Choose interval by tapping the interval function button “I.” A photogate icon at the top of the screen indicates a photogate is connected to the DataCollector. The word *interval* next to it indicates the interval function of timer mode has been selected.
3. The photogate uses a light beam to start and stop the DataCollector. You can not see the beam because it is an infrared light beam. Try blocking the light beam with your finger and observe what happens to the t_A value on the screen.
4. Which group member can get the shortest time for t_A ? Use your finger, a pencil, or some other object, as long as you don’t do anything that would damage the photogate.

3 Thinking about what you learned

- a. What action do you take to start and stop the DataCollector? Be very specific in your answer. Someone who has never seen the photogate before should be able to read your answer and know what to do with the light beam to make the DataCollector start, and what to do to make it stop.

- b. If you block the light beam several times in a row, does the DataCollector add each new measurement to the last one or does it start at zero every time you break the beam? Your answer should provide observations for evidence.

- c. Does t_A display time to the nearest tenth of a second, hundredth of a second, thousandth of a second, or some other fraction of a second? Explain.

- d. What was the shortest time for t_A in your group? How does this time compare to the shortest stopwatch time your group achieved?

- e. Suppose you are timing how long it takes a marble to fall from a table to the floor. Could you use the DataCollector with the photogate to find the time? Why or why not?
