Stopwatch
Student Activity

Name ______________

Class ______________

Open the TI-Nspire document *stopwatch_en.tns.*

What comes to mind when you hear "On your mark, get set, GO!"? Most often, these words indicate the beginning of a measured event. The word "GO" signifies the start of a time measurement, an interval separating two points. Time can be measured in large intervals such as years, months, and days, or it can be measured in very small intervals such as minutes, seconds, and hundredths of seconds. The tool used to measure time depends on the event. For example, athletes who race short distances are timed using an instrument that *accurately* measures very small intervals, like a stopwatch.

Stopwatches are designed to measure the amount of time *elapsed* from beginning (when you turn it on) to end (when you turn it off). In science, stopwatches are used when time must be measured precisely and with a minimum of complications, such as in laboratory experiments. To ensure accuracy, it may be necessary to calibrate or adjust a stopwatch time measurement. Calibration aligns stopwatches to a known standard of accuracy, ensuring that the measurements are repeatable within hundredths of a second.

Digital stopwatches allow displays of both total elapsed time and split times. Total elapsed time is the total length of time from when the stopwatch starts to when it stops. Split times (or just *splits*) are intermediate measurements taken while the elapsed time is also being measured. You hit a button causing the stopwatch to record a time within the elapsed time. Split times are useful in science when individual events need to be measured within a larger series of overall reactions. For example: measuring the initial rate of reaction compared to the experiment's entire reaction rate.

You will use a stopwatch tool to measure time for a series of experiments. On page 1.1, you will see directions explaining how to use the stopwatch tool. You will need an extra piece of notebook paper, a marker, and a partner to complete some of the experiments.

Move to page 1.2.

Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

Part 1: How To Use The Stopwatch

1. Press or enter to activate the stopwatch.
2. Press to reset the stopwatch to zero.
3. Press and observe the stopwatch. Now there are two new symbols on the bottom.
4. Press to pause the stopwatch.
5. Press to record a split time. Pressing L + + will also record the split time.
6. After pressing , the symbols at the bottom of the page will return to and .

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With a partner, experiment with the stopwatch tool.

Q1. One at a time, start the stopwatch and try to hit the pause button at exactly **0:00:6.73**. Record your stop times in the table.

	Time
Student 1	
Student 2	

Q2. Were either you or your partner able to stop the time at exactly 0:00:6.73? Why or why not?

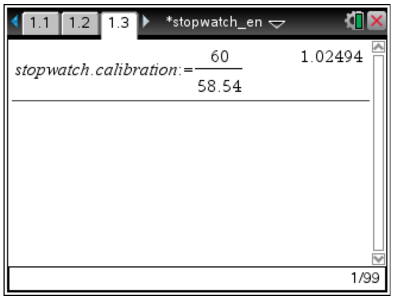
The time display on the stopwatch tool reads left to right.

- The single numeric digit at the far left represents hours.
- The next two numeric digits represent minutes.
- The next two numeric digits represent seconds.
- The last digits to the far right represent hundredths of seconds.

Example: Stopwatch reading — 1:07:49.73

1 hour, 7 minutes, 49 seconds, and 73 hundredths of a second

Stopwatch Calibration



Your teacher might ask you to calibrate the stopwatch tool against a real stopwatch. Follow these directions for calibration:

1. Run the stopwatch tool with a real stopwatch. Stop the tool when the real stopwatch reaches 60 seconds.
2. Insert a *Calculator* page. Divide the time on the real stopwatch by the time on the stopwatch tool.

   For example, if the tool shows 58.54 seconds when a real stopwatch shows 60 seconds, then the calibration factor is 60/58.54 ≈ 1.02494.
3. Store the value by pressing ctrl sto→, type **stopwatch.calibration**, and press enter.
4. Move back to the stopwatch on page 1.2 and press C to set the calibration factor.

Part 2: Total Elapsed Time

In pairs, use the stopwatch tool to determine the total elapsed time it takes for each person to complete the tasks in questions 3 and 4.

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- Record each reaction time EXACTLY as it reads on the stopwatch tool.
- Make sure one person is completing the task while the other person is starting and stopping the stopwatch.
- Each person must complete the task twice before switching with the other person.
- Remember to reset the stopwatch in between each measurement.

Q3. Using a plain sheet of paper and a marker, record the time it takes to draw a large number "8" using your dominant writing hand.

	Trial 1	Trial 2
Student 1		
Student 2		

Q4. Now draw a large number “8” using your non-dominant hand.

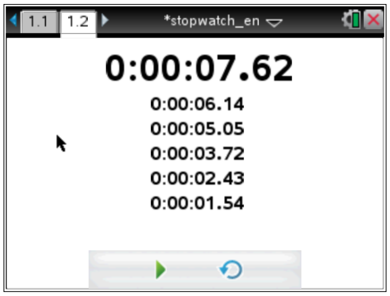
	Trial 1	Trial 2
Student 1		
Student 2		

Q5. Was it possible to get the same measurement twice on either of the tasks? Why or why not?

Part 3: Split Times

When using split readings on the stopwatch tool, the stopwatch must first be running, and then press , the split button. Each time the split button is pressed, it records another split. Up to six split times can be displayed.

- Using the same partner, determine the split times for the same tasks that you completed in Part 1.
- Each person will complete a total of six trials. **DO NOT** reset in between each trial. On the sixth trial, press .
- Record all times starting from the bottom, (the first split), and moving to the top, (the last split), which is the experiment’s **total elapsed time**.



An *example* of how to record the split times in a table is shown below:

	Split 1	Split 2	Split 3	Split 4	Split 5	Split 6 (Total time)
Student	0:00:01.54	0:00:02.43	0:00:03.72	0:00:05.05	0:00:06.14	0:00:07.62

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Q6. On the same piece of paper with your number "8" drawing, add a start line somewhere on the "8." This line will be where you will start and stop each of the split readings.

Trace the number "8" six times, from the start line and then back to it. Each time you hit the start line your partner will press . After the sixth time, your partner will hit the key to stop the stopwatch. Record all your times in the data table.

	Split 1	Split 2	Split 3	Split 4	Split 5	Split 6 (Total time)
Student 1						
Student 2						

Q7. Now trace the number "8" using your non-dominant hand.

	Split 1	Split 2	Split 3	Split 4	Split 5	Split 6 (Total time)
Student 1						
Student 2						

Using the data you collected in Q6, calculate the elapsed time differences between each split. To do this, take the last elapsed time and subtract the previous split time. See the example below, which shows how to calculate the difference between split 5 and 6 (total elapsed time).

Example: Split 6 = 7.62 sec. Split 5 = 6.14 sec. Time difference = 7.62 – 6.14 = 1.48 sec

Q8. Press to open the Scratchpad .Complete the following data table based on your data from Q6 of Part 2.

Elapsed Time Difference	**Student 1**	**Student 2**
Between Split 1 and 2		
Between Split 2 and 3		
Between Split 3 and 4		
Between Split 4 and 5		
Between Split 5 and 6		

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Student Inquiry

Using your knowledge of stopwatches, answer the questions 9 and 10.

Q9. Do you think that stopwatches are more or less accurate than clocks? Explain your answer:

Q10. Think of a scenario in which time measurement accuracy would be used in everyday life. Describe in detail how a stopwatch could be used in this scenario.

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