

Reaction Time: “*Quick Communication*”

GOAL

The goal of this lesson is for students to experience the body reacting, while also increasing their awareness of body systems in the context of the scientific method.



Set-up:

- Distance/Time chart
- Rulers (class set)
- Reaction Time poster
- Dry erase marker
- Student Worksheet “Reaction Time Part II”



PROCEDURE

Engage (10 minutes) Introduce Gravity

- Review the concept of the dropped ruler and the reaction time necessary to catch the ruler.
- Student volunteers may read their work from last week.

Explore (10 minutes) Galileo’s Law of Free Fall

- Ask students, "How can we measure our reaction times?"
- Ask students, “What do you remember about Galileo's law of free fall?” (All objects fall at the same speed, in the absence of wind resistance).
- "What is speed and how do we measure it?"
- Think of the speed that you drive a car. "What two units of measurement are used to describe the rate of a moving car?" Speed has two components: distance and time (miles/hour).
- Show the students the ruler once again, and ask them, "How can we use this ruler to measure our reaction time?" Students should recognize that we have a distance component, but not a time component.
- Students should hypothesize methods for measuring time. Ideally, one student will suggest using a stopwatch.
- Have two student volunteers come to the front of the class. One student will catch the ruler as the teacher drops it, while the other student measures the reaction time. This demonstrates that our reaction times are less than a second, which is too short to be measured with a clock, watch, or stopwatch.



PROCEDURE

- Though this method for measuring reaction time is theoretically possible, it is simply too difficult to measure our reaction times manually.
- Introduce students to the distance time chart created by scientists. Discuss that we will be using this chart instead of calculating reaction times ourselves. We are able to use this chart since we know that all objects fall at the same rate in the absence of wind resistance (Galileo's Law).
- Discuss the use of milliseconds on the distance time chart. Ask students how many milliseconds are in one second. Ask students to brainstorm what they can react to in less than a second. Ex: pulling a hand quickly away from a hot object.

Explain (30 minutes) Reaction Time Experiment

- Review technique/methods for measuring ruler catch distances. Stress the importance of standardization.
- Students should round up to the first whole number above their finger/thumb every time they take a measurement. Also, students should keep the same distance between their finger and thumb and the ruler each time they take a measurement.
- Review the distance time chart and how to calculate reaction times.
- Distribute the reaction time worksheets and complete the top portion on recording data with the students.
- Before beginning the experiment, students make predictions regarding which hand will be better at catching the ruler (faster). Teachers can use this opportunity to reinforce prediction/hypothesis formation. “How is a prediction different from a guess?”
- Students work in pairs to practice catching the ruler and determining their reaction times.
- Explain to students that they will each have the opportunity to catch the ruler 3 times (each hand). Then they will record the 4th catch distance and reaction time for each hand. They will record these measurements on their worksheet as their official reaction times.
- * *If students are able, the three trial catch distances can be averaged to determine a more accurate estimate of reaction time. This is a good opportunity to introduce averaging if this topic is new to students.*
- Distribute rulers and begin experiment.
- Students conclude by reflecting on whether their prediction was correct or incorrect and why.



PROCEDURE

Evaluate (10 minutes) Reaction Time Sequence Worksheet

- Volunteer students can share their experiment results with the class.
- Teacher and students discuss differences between left and right hands. "Why do you think one is faster than the other?" (Greater practice and use of one hand.) "Did you get faster at catching?" "Do you think we can improve our reaction times with practice?"
- Discuss reasons why the students' time might not have improved, like they were too excited or nervous to concentrate.
- Students complete a handout describing the reaction process and put steps in sequence.
- See if any students are able to narrate the reaction time sequence.

Math Extensions

- Find class averages for left versus right hands.

Writing Extension

- Relate structural characteristics of the human hand to human behavior. Humans are animals. Our reaction time is a skill we developed as predators. How do we use our reaction time in daily life? Sports, machinery, games, catching objects, etc. Think of times we need to grab hold of something quickly. How is your reaction time important to you?
- Assess the invention of tools and techniques to solve problems.
- How do today's tools and inventions take into account reaction time in their design? Brainstorm examples. Stoplights, car brakes and roads all have reaction time built into their design.

On-line Extension

- The Neuroscience for Kids website has on-line reaction time experiments that would be a great supplement to this lesson (particularly for students who finish early).
- Go to <http://faculty.washington.edu/chudler/chreflex.html> and scroll down to the "How Fast Are You?" section for 3 different on-line reaction time experiments.



- **Key Cognitive Skills:**
Predicting, Observing, Recording, Questioning, Measuring, Collecting data, Recording data & Interpreting data
- **Specific Outcomes:**
 - Student take quantitative measurements of their reaction times.
 - Students will become familiar using millisecond increments.
 - Students record results and expand on their observations.

PROJECT 2061 BENCHMARKS FOR SCIENTIFIC LITERACY

1A The Scientific World View

Results of similar scientific investigations seldom turn out exactly the same way.

2C Mathematics Inquiry

Numbers and shapes - and operations on them - help to describe and predict things about the world around us.

12A Values and Attitudes

Keep records of their investigations. Offer reasons for finding and considering reasons suggested by others.

12D Communication Skills

Use numerical data in describing and comparing objects and events.

6C Basic Functions

The brain gets signals from all parts of the body telling it what is going on there. The brain also sends signals to parts of the body to influence what they do.

Distance and Time Chart

Catch Distance	Reaction Time	
(in centimeters)	Seconds	Milliseconds
5	.100	100
6	.107	107
7	.114	114
8	.121	121
9	.128	128
10	.135	135
11	.142	142
12	.149	149
13	.156	156
14	.163	163
15	.170	170
16	.177	177
17	.184	184
18	.191	191

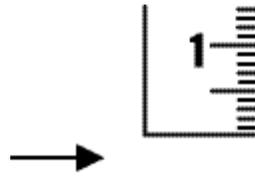
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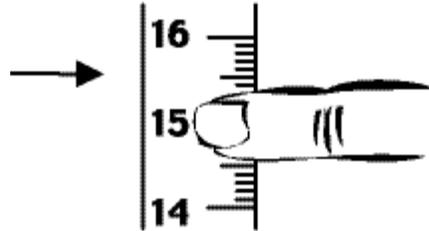
Brain Explorers Reaction Time Experiment Record Sheet

Things to remember when measuring your catch distances on your ruler:

- Start with the “0 cm” end of the ruler at the bottom, & have your partner hold the ruler just above your fingers.



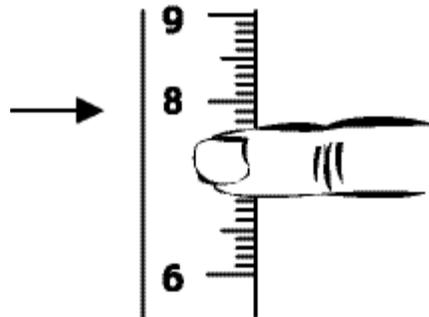
- After you catch the ruler, record the number right above your thumb. What number would you record for this “catch distance”?



- a) 14 cm
- b) 15 cm
- c) 16 cm

- Example: Which ruler “catch distance” would you record?

- a) 7 cm
- b) 8 cm
- c) 9 cm



- If your catch distance is 13 cm, what is your reaction time?

- a) 144 milliseconds
- b) 177 milliseconds
- c) 156 milliseconds

Make a prediction:

I think my reaction time will be faster with my (right/left) _____ hand.

Record your “catch distances” in the spaces below. Then use the “distance & time” chart to find how long it took you to catch the ruler.

Right Hand

	Catch Distance		Reaction Time (milliseconds)
1		1	
2		2	
3		3	
4		4	

Left Hand

	Catch Distance		Reaction Time (milliseconds)
1		1	
2		2	
3		3	
4		4	

Use your 4th or last catch distance to determine your official reaction times.

My right hand reaction time is _____ milliseconds.

My left hand reaction time is _____ milliseconds.

“Do you remember your prediction?”

Was your prediction correct? Which hand was better at catching the ruler? Why was one hand faster than the other?
