

PROJECT PROJECTILE

TEACHER GUIDE

LAUNCH



PLANNING

Here's a suggested schedule for this kit! The activities should be completed in order, but you can choose when the lessons take place over time.

ACTIVITY INFORMATION	SECTION (S)	TIME REQUIRED	DAY/ LESSON
ACTIVITY 1: RACING IN THE AIR Drop one ball and throw the other. Which will win the race to the floor? Time required: 1 h	<input type="checkbox"/> Drop and Throw	60 minutes	Day 1
ACTIVITY 2: DESCRIBING MOVEMENT Learn how to explain, predict, and solve problems about motion. Time required: 4 h 30 min	<input type="checkbox"/> One-Dimensional Motion	90 minutes	Day 2 Day 3
	<input type="checkbox"/> Let's Get Kin...		Day 4
ACTIVITY 3: DO...			

SAMPLE

Full schedule
available with
purchase

Total time: 15+ hours

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activity

RACING IN THE AIR

Has your student ever thought about how things move when they're falling? They will drop one steel ball and throw the other straight across, making several observations, including which one will reach the floor first.

DROP AND THROW



WARNING: CHOKING HAZARD - Small parts.
Not for children under 3 years.



PREPARATION AND SUPERVISION

- Do this experiment in a room with a floor that will not be damaged by the impact of the steel balls. Do not let the balls land on tile floors!
- The student will drop one ball and throw the other straight out from the edge of a table, making sure to release the balls at the exact same time.

MULTIPLE AGES AND ABILITIES:

This experiment could be easier if you have two students do it instead of one. Just make sure they coordinate (through a countdown or some other strategy) to release the balls at the same time. You could even have them do 10 trials with one dropping and one throwing, and then another 10 trials where they switch roles.

- The balls should hit the floor at the same time.
 - If their timing is off when releasing them, that can affect the results. Therefore, they are asked to perform the action 10 times (or do 10 trials).
- They should also make some observations about what the balls are like as they move through the air: how fast they go at the beginning and end, what the path of their motion looks like, and how far they go.



THINK ABOUT IT!

Question 1: How did your prediction of which ball would reach the floor first compare to your results?

Answer: Answers will vary.

How to Help: Encourage your student to say more than "it was right" or "it was wrong." What led them to make the prediction they did? Were they surprised by the results?

Question 2: What are two ways you could modify or extend this experiment to learn more about falling objects?

Answer: Answers will vary but may include things like:

- Using a different ball in place of one or both of the steel balls.
- Trying it at a greater height.
- Launching the balls at different angles.
- Roll one ball instead of throwing it.

? **Question 4:** A snail crawls 0.5 m north, then 2.2 m south. The trip takes 120 seconds.

- What was the snail's speed?
- What was the snail's velocity?

Answer:

- a. The snail's speed was 0.0225 m/s (from 2.7 m / 120 s).
- b. The snail's velocity was 0.0142 m/s south (from 1.7 m / 120 s).

How to Help: Review the equations for speed and velocity as needed.

? **Question 5:** Use the data you collected in the Distance and Displacement Movement exercise to calculate your speed and velocity.

- What was your speed?
- What was your velocity?

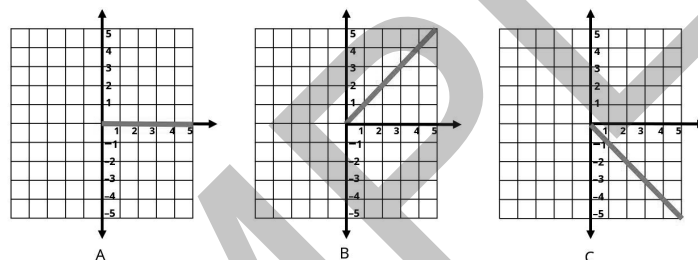
Answer: Answers will vary.

How to Help: Help your student use the equations for speed and velocity applied to their own data.

? **Question 6:** Make a graph of position vs. time for the following situations:

- A car is at rest for 5 s.
- A car moves 5 m to the right at a constant velocity and it takes 5 s.
- A car moves 5 m to the left with a constant velocity and it takes 5 s.

Answer:



How to Help:

- Thinking of motion graphically is a valuable skill. The graphs in this question (position vs. time) can be used to find the displacement (ending position minus the starting position), and the slope is the velocity.
- While we haven't yet mentioned them in this kit, it is also possible to make velocity vs. time graphs, for which the slope is the acceleration.

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Changes in "How Fast"

- In this sub-section, acceleration (a vocabulary term) is introduced as a change in velocity over a period of time, or the rate of change of velocity.
- The different types of acceleration are shown in a chart; these can be difficult to comprehend without practice. Encourage your student to talk them through and even relate them to mathematical operations like adding two negative numbers.



THINK ABOUT IT!

? **Question 1:** What is the acceleration of a boat that is going 15 m/s west and slows down to a stop in 10 s?

Answer: The acceleration is +1.5 m/s².

How to Help:

- Use the equation for acceleration as shown in the Student Workbook, with $v_f = 0$ m/s, $v_i = -15$ m/s, and $t = 10$ s.
- Make sure your student is using the appropriate sign for the direction. A west direction should have a minus sign, and its being subtracted from the initial velocity of 0, meaning the change in velocity is positive.



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Kit	SU-PROJEC
Instructions	IN-PROJECT
Revision Date	3/2021