CONTROLLING COLLISIONS

TEACHER GUIDE

ACCELERATE

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: GOLF BALL GLIMPSE View time lapse photos of a golf ball colliding with steel. Time required: 30 min	☐ Surprisingly Squishy	30 minutes	Day 1
ACTIVITY 2: ENERGY AND IMPACT Do an experiment to find out how the starting height affects the force of impact at the end of a ramp. Time required: 2 h 30 min	☐ Reaching New Heights	60 minutes	Day 2
	☐ Two Types of Energy	30 minutes	Day 3
	☐ Energy Transfer and Collisions ☐ Show What You Know	60 minutes	Day 4
ACTIVITY 3: BOUNCING BACK Learn about the two types of collisions and observe how the type of material changes what happens during and after impact. Time required: 1 h 45 min	☐ Roll and Rico[illegible]		Day 5
ACTIVITY 4: ENGINEERIN[illegible] **TRANSFER**			

Total time: 14+ hours

2 REACHING NEW HEIGHTS

CONTENT

• Your student will be doing an experiment in which they roll a wood ball down a DIY ramp that's placed at different heights.
• They will fill in a data table and make a line graph based on it. The outline of the graph is provided, but they may need help in plotting the points if they haven't done that before.

☑ PREPARATION AND SUPERVISION

■ The experiment requires a flat, smooth surface (like a table or wood floor) that is at least 1 meter (100 centimeters) long and has an obstacle at the end (like a wall, stack of books, baseboard, or heavy furniture).
■ Be sure to save the materials for future activities when the experiment is complete.
■ If you don't have a long, smooth surface available, or if your student wants a second set of measurements, an alternative version of the experiment is provided in the Student Workbook. Instead of rolling the ball down the ramp, it can be dropped from different heights.

THINK ABOUT IT!

Question 1: As the height of dropping or releasing increased, the bounce-back distance (circle one) increased / decreased.
Answer: The bounce-back distance should increase with increasing dropping/releasing height.
How to Help: *Point your student to their experimental data and review the definitions of increase and decrease, if needed. The bounce-back distance increased as the ramp was raised.*

Question 2: How does the line on the graph help show the answer to #1 (what does it do)?
Answer: The line on the graph goes up as the height is increased.
How to Help: *Going "up" on the graph means the value is greater, or increased.*

Question 3: Bouncing back further means that the wall or floor acted on the ball with (circle one) more / less force.
Answer: Bouncing back further means there was more force in the collision.
How to Help:
• Movement takes energy, and energy is transferred with force. More movement means more energy, which also means more force.
• If your student hasn't previously learned about force, let them know it is an interaction between two objects (not just a push or pull as in the common definition, although those are types of forces).
• You can relate this to everyday life: when you want something to move more, you have to apply more force to it.

Question 4: Other than bouncing back further, was there any other evidence of the amount of force? If so, what?
Answer:
• The ball moved faster when released from greater heights.
• The ball made a louder sound when it hit the wall after being released at greater heights.
• You might also have noticed the obstacle moving slightly if it wasn't fixed in place (if you used a stack of books, for instance).

activity 3

BOUNCING BACK

In the last activity, your student learned how energy changes before and during a collision. Now, they will observe how the types of objects and what they're made of affect those changes.

LEARNING GOALS:

- ✓ **I can ask questions and predict what happens to energy when objects collide.**
- ✓ **I can use evidence to argue that energy is transferred to or from an object when its kinetic energy changes.**

ROLL AND RICOCHET

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CONTENT

• Your student will perform an experiment in which they test how different types of balls (each with different elasticities) behave in a collision, complete a data table, and make a bar graph.
• Remind them to answer the "Predict" questions before doing the experiment.
• If your student has never made a bar graph, they might need help drawing the bars based on their data.
• You could point out to your student that the balls may have different momentums resulting from their different masses, but that the differences in the elasticities are large enough to make that insignificant.

☑ PREPARATION AND SUPERVISION

■ Your student will again need a flat surface ending in an obstacle, or they can use the alternative experiment provided (dropping the different balls from the same height). The alternative experiment has the added benefit that the balls will all be going the same speed when they hit the floor.
■ Materials for this activity are needed from the kit (they're listed in the Student Workbook).

MULTIPLE AGES AND ABILITIES:

If you want to involve other students, allow them to bounce the different balls, but make sure they are all released from the same height. You can make a marking on a wall or drop them from the height of a fixed object, like a chair or table.

REFLECT

? Question 1: Check the predictions you made. How well did they match with your observations?
Answer: Answers will vary.
How to Help: *The student should describe how well the predictions and observations matched in sufficient detail, and possibly offer a reason why they believe they were correct or incorrect.*

ACCELERATE

Science Unlocked

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Kit	SU-CONCOL
Instructions	IN-CONCOLT
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