

Energy and Motion: Bumper Coasters

In this hands-on lesson, students will explore how energy can be stored as height and what happens to objects when they collide. Students will build paper roller coasters, experiment to learn about energy and motion, and form conclusions based on evidence. Students must build their roller coaster track prior to the virtual lesson. Please see "how to" video that will be provided following lesson confirmation.

4-PS3-1 Use evidence to construct an explanation relating the speed of an object to the energy of that object.

4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.

You will need to provide the following supplies for this lesson:

- 8-1/2 x 11 cardstock or paper to make roller coaster tracks - 2 sheets/student
- Tape (scotch or masking) - students will need access to tape when making their roller coaster tracks. They will also need 2 small pieces of tape for setup when we are ready to do our experiment.
- Scissors - students will need when building roller coaster tracks
- Marbles - 4 per student is best, but if you don't end up with enough, students could share/take turns for their last experiment
- Disposable cup - 1/student - any size larger than a Dixie cup
- Students will need the following during lesson: tape, pencils, rulers, roller coaster tracks, disposable cup

Teacher preparation prior to the lesson:

- Ensure you have the above supplies
- Have students create their roller coaster tracks using the "How to" video that I sent. If you haven't received that video, please let me know!
- Students will be taping their roller coaster tracks somewhere along a wall or possibly to their desk....depending on desk design. So with COVID rules, please have a place that each student can go when time to experiment. We will be taping their tracks approximately 20 cm (8 in.) from the floor.
- Make copies of experiment sheets attached (1 copy/student)

Program Connection Information

Please use an external microphone (conference style) rather than the integrated one in the computer for the audio for your class and locate it centrally in the room. It can be difficult for the Greenbush teacher to hear the students using the computer microphone and therefore it reduces the interactive nature of the lesson. It is fine to use the computer webcam for your video source.

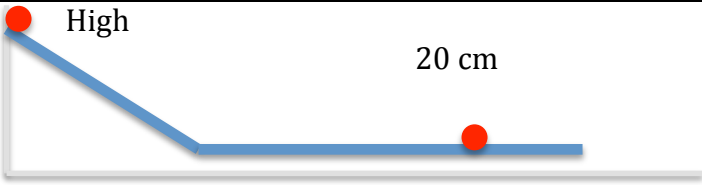
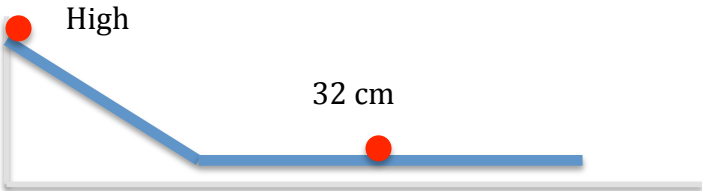
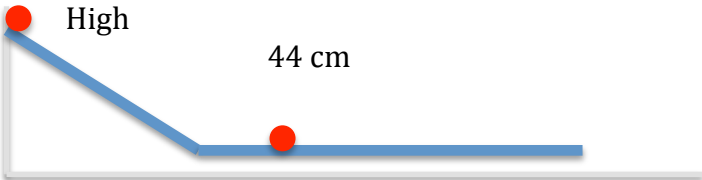
All classes will take place using Zoom desktop video. If your building is already set up to use a desktop video application with a computer, simply open a browser and enter <https://greenbush.zoom.us/j/2326746414> in the URL space. You may need to download Zoom launcher software (free download) if you don't already have it. This needs to be done in advance of the lesson.

If using a Polycom video conferencing unit (or any legacy type video conferencing unit) to connect to a ZOOM conference, make sure the unit is in "encrypted mode" then dial the following IP on the internet: 162.255.37.11 or 162.255.36.11 and once connected, they will ask for a MEETING ID: enter 232 674 6414 (for Lisa at Science Center).


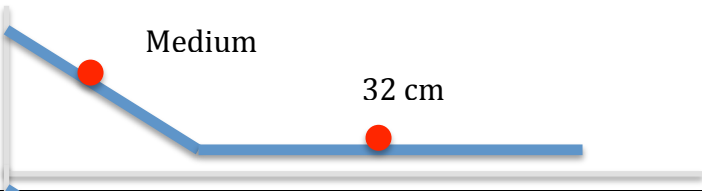
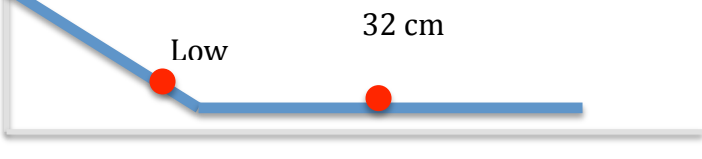
It's always a good idea to touch base with your district technology facilitator prior to your program to make sure all systems/equipment are in place and operational and that there aren't any firewalls in place that might prevent you from connecting to Zoom.

Once you connect, you will enter a Zoom waiting room. Your Greenbush teacher will admit you into the final meeting room.

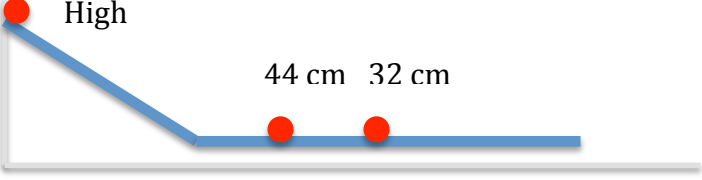
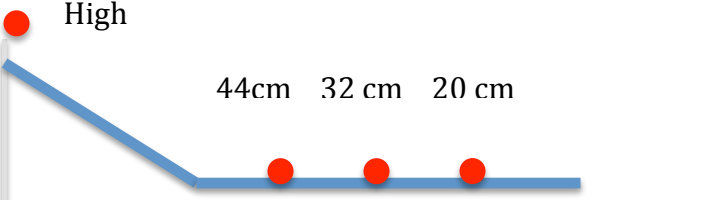
If you have questions, please email me at lisa.little@greenbush.org

DISTANCE EXPERIMENT: Always release the marble at the "High" mark. Change the distance of the bumper marble from the alligator.	Trial 1	Trial 2	Trial 3	Trial 4
	Eaten Safe	Eaten Safe	Eaten Safe	Eaten Safe
	Eaten Safe	Eaten Safe	Eaten Safe	Eaten Safe
	Eaten Safe	Eaten Safe	Eaten Safe	Eaten Safe

DISTANCE RESULTS: Moving the Bumper Marble farther away from the alligator (**always/sometimes/never**) kept the Hill Marble from getting eaten. Currently the Bumper Coaster has (**too much/just enough/too little**) energy.

HEIGHT EXPERIMENT: Change the height where you release the marble. Always place the bumper marble 32 cm from the alligator.	Trial 1	Trial 2	Trial 3	Trial 4
	Eaten Safe	Eaten Safe	Eaten Safe	Eaten Safe
	Eaten Safe	Eaten Safe	Eaten Safe	Eaten Safe
	Eaten Safe	Eaten Safe	Eaten Safe	Eaten Safe

HEIGHT RESULTS: Moving the Hill Marble lower on the hill (**always/sometimes/never**) kept it from getting eaten. Currently the Bumper Coaster has (**too much/just enough/too little**) energy.

COLLISION EXPERIMENT: Always release the marble at the "High" mark. Change the distance of the bumper marble from the alligator.	Trial 1	Trial 2	Trial 3	Trial 4
	Eaten Safe	Eaten Safe	Eaten Safe	Eaten Safe
	Eaten Safe	Eaten Safe	Eaten Safe	Eaten Safe

COLLISION RESULTS: Adding more Bumper Marbles (always/sometimes/never) kept the Hill Marble from getting eaten. Why do you think this happens? Explain your results in terms of energy:
