



Science Objectives

- Students will develop an understanding of momentum.
- Students will compare mass and velocity of one object to another to confirm the conservation of momentum.
- Students will measure velocity and mass of two dynamic carts as they push away from one another.

Vocabulary

- conservation
- momentum
- velocity
- mass

About the Lesson

- This lesson involves setting up a dynamic cart track.
- As a result, students will:
 - Attach the CBR 2 to the carts and measure the mass of the whole system.
 - Place the carts on the track with the motion detectors pointing in the direction each cart will be traveling. There should be a large target at the end of each ramp (a book standing at the end of the ramp works well).
 - Start a sample and trigger the carts.
 - Select the linear section of the graph generated while the carts were moving away from one another and strike the data outside of the selection and find linear curve fit to determine the velocity of each cart.

TI-Nspire™ Navigator™ System

- Send *Conservation of momentum Lab.tns* file.
- Monitor student progress using Screen Capture.
- Collect *Conservation of momentum Lab.tns*.
- Analyze student response using Class Analysis.

Activity Materials

- 1 plunger dynamic Cart
- TI-Nspire Technology
- TI-Nspire Lab Cradle
- 2 CBR 2's
- Dynamic Cart Track
- 1 regular dynamic cart
- 1 to 2 kg balance



TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point

Tech Tips:

- Make sure the font size on your TI-Nspire handhelds is set to Medium.
- You can hide the function entry line by pressing **ctrl** **G**.

Lesson Files:

Student Activity

Conservation of momentum Lab.pdf

Conservation of Momentum Lab.doc

TI-Nspire document

Conservation of momentum lab.tns

Visit www.sciencenspired.com for lesson updates and tech tip videos.



Data Collection Set-Up

Students need to connect the CBR 2 to the carts and weigh the whole system. The cart and the CBR 2 will be the mass when calculating momentum.

Students should manage the cables of both CBR 2's to give the least amount of drag. This will be a source of error later in their experiment.

Tech Tip: Start the sampling before the students release the carts.

Discussion Points and Possible Answers

Tech Tip: Use TI-Nspire Navigator to collect screen shots and watch students' progression.

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1. Enter the mass of each cart.

Sample Answers: Values will vary depending on the carts used.

Move to page 1.7.

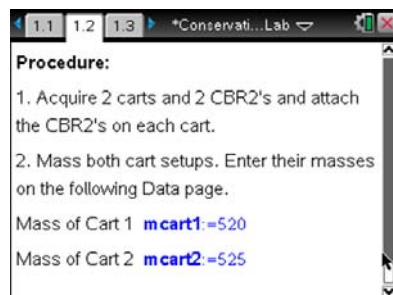
2. The slope of the line represents the _____.

Answer: the velocity of the cart

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3. Enter the velocity for each cart in vcart1 and vcart2. The velocities should be close to one another depending on the mass of each cart.

Sample Answers: Values will vary.





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4. Calculate the momentum of each cart.

Note: Differences in momentum can be equated to drag of the CBR 2 cords, students holding the carts, and friction of the wheels on the carts.

Sample Answers: Values will vary.

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5. How does the velocity of Cart 1 compare to Cart 2?

Answer: If the masses of each cart are nearly equivalent, then the velocities should be very similar.

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6. How does the momentum compare between Cart 1 and Cart 2?

Answer: The momentum should be nearly equal.

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7. If the mass of cart 1 is doubled, what should happen to the carts?

Answer: Cart 1 will go slower than cart 2.

8. If the mass of cart 1 is doubled, the momentum _____.

Answer: will be the same for both carts.

Teacher Tip: Collect the student files using TI-Nspire Navigator for discussion of momentum.



Wrap Up

After the students have finished the lab, look back at their answers, and discuss the differences in their results. If they didn't get that the momentum of both carts is equal, discuss reasons that the values might not be the same (friction, cord drag, etc). Ask some questions about increasing the mass of only one cart and what would happen to velocities and the momentum of the carts.