Conservation of Momentum Exploration

SCIENCE NSPIRED

TEACHER NOTES

Science Objectives

- Students will use an animation to explore the concept of momentum.
- Students will develop an understanding of how mass affects velocity.
- Students will compare the relationship between the mass of two objects and their velocities to further understand conservation of Momentum.

Vocabulary

- mass
- velocity
- force
- Newtons
- momentum

About the Lesson

- This lesson involves students animating two masses, observing their velocities, and comparing the products of the mass and velocity of each cart to one another.
- As a result, students will develop an understanding that the product of mass and velocity, i.e., momentum, for each cart is the same.

TI-Nspire™ Navigator™

- Send out the *Conserv_of_Momentum_Exploration.tns* file.
- Use Class Capture to observe student progress throughout the activity.
- Use Live Presenter to allow students to share their results and conclusions.

Activity Materials

- Compatible TI Technologies: TI- Nspire™ CX Handhelds, TI-Nspire™ Apps for iPad®, TI-Nspire™ Software

Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials

Lesson Files:

Student Activity

- Conserv_of_Momentum_Exploration_Student.doc
- Conserv_of_Momentum_Exploration_Student.pdf

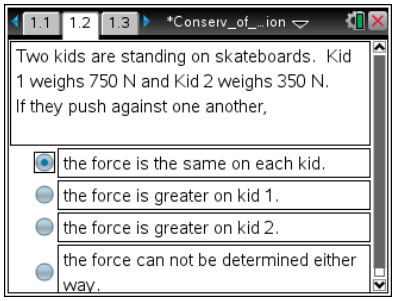
TI-Nspire document

- Conserv_of_Momentum_Exploration.tns

Discussion Points and Possible Answers

Have students read the background information on the activity sheet before starting the activity.

Move to pages 1.2 – 1.3.



Have students answer questions 1 and 2 in the .tns file, the activity sheet, or both.

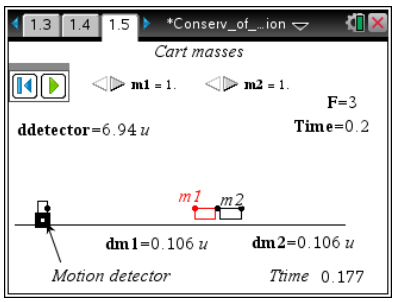
Q1. Two kids are standing on skateboards. Kid 1 weighs 750 N, and Kid 2 weighs 350 N. If they push against one another, _____.

Answer: A. the force is the same for each kid.

Q2. Two kids are standing on skateboards. Kid 1 weighs 750 N, and Kid 2 weighs 350 N. If they push against one another, _____.

Answer: B. kid 2 will have a greater velocity.

Move to pages 1.4 – 1.5.



1. Have students read the directions, and then move to page 1.5,

2. Students are to select the play button and observe the two carts, m1 and m2, as they move away from each other.
   - **ddetector** is the distance to the motion detector.
   - **dm1** is the distance from the center point to cart 1.
   - **dm2** is the distance from the center point to cart 2.

Tech Tip: The play button is located in the upper right-hand corner of the screen.

Move to pages 1.6 – 1.7.

Have students answer questions 3 and 4 in the .tns file, the activity sheet, or both.

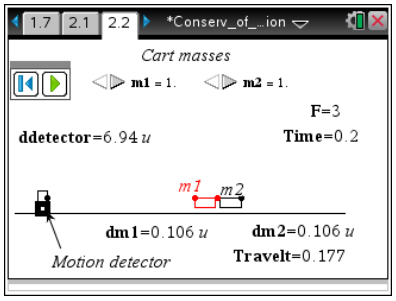
Q3. With a force pushing on each of the carts, the position between the starting point _____.

Answer: C. is the same for each cart

Q4. If the masses are the same, the carts will move away from the center point by the same distance each time.

Answer: A. Always

Move to pages 2.1 – 2.3.



3. Have students read the directions, and then move to page 2.2 to explore the simulation.

4. Students need to select the right arrow button ▶ of m1 to increase the mass of cart 1 to 2 units. Then they can select the play button. Students should observe the changes to the data.

5. Have students move to page 2.3 to observe the graph produced from the two carts. Have them determine a linear regression for the graphs.

Tech Tip: To create a best fit line, select **Menu** or **> Analyze > Regression > Show Linear (mx + b)**. You may need to back-out to the main Tools Menu to see the desired menu option.

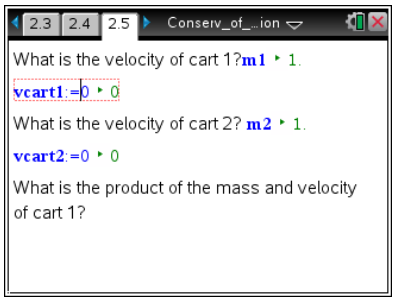
Move to page 2.4.

Have students answer question 5 in the .tns file, the activity sheet, or both.

Q5. What does the best fit line through the data on the graph represent?

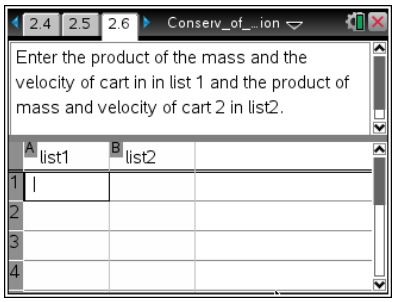
Answer: B. Velocity

Move to pages 2.5 – 2.6.



6. Have students select the MathBox containing **vcart1** and enter the velocity of cart 1. Then they are to select the MathBox containing **vcart2** and enter the velocity of cart 2.

7. Move to page 2.6 and determine the product of mass and velocity of cart 1. Enter it in List 1. Determine the product of mass and velocity of cart 2 and enter it in List 2.



Move to pages 2.7 – 2.8.

Have students answer questions 6 and 7 in the .tns file, the activity sheet, or both.

Q6. Will the products of the velocity and the mass for each cart equal one another?

Answer: A. Always

Q7. Move back to the animation of the carts and reset. Change the mass of cart one and run the simulation again. Do you still agree with your last answer?

Sample Answers: Answers will vary.

TI-Nspire Navigator Opportunity

TI-Nspire Navigator can be used to assess the students' progress as they go through the exploration. Making a student the Live Presenter can help to get the point across to the group.

Wrap Up

Reinforce the idea that if two objects push against each other their velocity and mass multiplied together will equal one another.

Assessment

Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved. The Slide Show can be utilized to give students immediate feedback on their assessment.