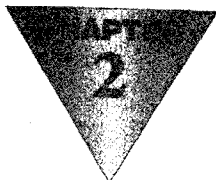


Newton Scooter Scoring Rubric

Category	4	3	2	1
Planning	<p>Student thoroughly considers the forces that would affect the vehicle. Sketch of the vehicle shows ALL forces that influence the motion of the vehicle. Vehicle is turned in on time.</p>	<p>Student adequately considers the forces that would affect the vehicle. Sketch is useful with some information missing. Vehicle is one day late.</p>	<p>Student considers some of the forces that would affect the vehicle. Sketch of the vehicle is rough. Many of the forces are not included. Vehicle is more than one day late.</p>	<p>Student minimally considers the forces that would affect the vehicle. There is not sketch. Minimal effort put into planning vehicle construction.</p>
Vehicle Construction	<p>Student follows all project rules, and work shows evidence of having thoroughly tested and modified the vehicle. The vehicle travels the target distance of 1.5-3 meters. Carries quarter.</p>	<p>Student follows most of the project rules, and work shows evidence of having adequately tested and modified the vehicle. The vehicle travels the target distance of 1.5-3 meters. Carries quarter.</p>	<p>Student follows some of the project rules, and it is difficult to determine if the vehicle was tested or modified. The vehicle travels more than 3 meters. Does not carry quarter.</p>	<p>Student did not follow many of the project rules, and the work shows no evidence that the vehicle has been tested or modified. Vehicle does NOT make it 1.5 meters. Does not carry quarter.</p>
Project Presentation	<p>Presentation is thorough and well organized. Student communicates all appropriate features of the vehicle, forces acting on the vehicle, and the process of testing and modifying their vehicle.</p>	<p>Presentation is adequate. Student communicates most of the appropriate features of the vehicle, forces acting on the vehicle, and the process of testing and modifying their vehicle.</p>	<p>Presentation is appropriate but is hard to follow. Student communicates some of the features of the vehicle, forces acting on the vehicle and the process of testing and modifying their vehicle.</p>	<p>Presentation is inadequate. The student leaves out most of the required information. The student has a vehicle to demonstrate. There are no supporting documents.</p>
Project Participation	<p>Student participates in all aspects of the project. ALL of the supporting assignments. (e.g. sketches, worksheets, detailed diagram) Student has planned, built a vehicle, and presented it to the class.</p>	<p>Student participates in most aspects of the project. Most of the supporting assignments. (e.g. sketches, worksheets, detailed diagram) Student has planned, built a vehicle, and presented it to the class</p>	<p>Student participated in some aspects of the project. Supporting assignments are incomplete or missing. Evidence of planning is minimal, apparent effort is minimal, and the presentation is weak.</p>	<p>Student does not participate in most aspects of the project. All of the supporting assignments are missing. There is not evidence of planning or effort in construction. Presentation is inadequate.</p>
Written Work	<p>Student thoroughly answers all questions for the project. Answers are clear, correct and written using complete sentences. Grammar and punctuation are proper.</p>	<p>Student answers most questions. Answers are fairly clear and mostly correct. Some of the answers may not be written in complete sentences.</p>	<p>Student answers some questions. Answers may not be clear or correct. Student does not use proper grammar or punctuation. Answers are not written in complete sentences.</p>	<p>Student does not answer the questions for this project.</p>



Newton Scooters

◆ Introduction

Imagine what would happen if you and a friend were standing on roller skates and you gave your friend a forward push. What would happen to you? Would you stand still or would you travel backward? The backward motion that you would experience can be explained by Newton's third law of motion, which describes an equal and opposite reaction to every action.

In this project, you will use Newton's third law of motion to design a vehicle. This vehicle must travel forward 1.5 meters by pushing backward on the floor, the air, or some other object. At the close of this project, you will demonstrate your vehicle and explain its features to the class.

◆ Project Rules

- ◆ Have your teacher approve your vehicle design plans before you begin construction of your vehicle.
- ◆ Your vehicle must use Newton's third law of motion to move forward; it must move forward by pushing backward on the floor, the air, or some other object.
- ◆ You must build your vehicle from scrap materials. Don't use a ready-made vehicle.
- ◆ Your vehicle must travel forward 1.5 meters and completely cross the finish line. The path of your vehicle should stay within a width of 1 meter.
- ◆ You are not allowed to interfere with the movement of your vehicle. You cannot give your vehicle a push as you launch it, and you cannot help it in any way as it travels from the starting line to the finish line.
- ◆ You cannot use any form of electricity or the pull of gravity to move your vehicle. This means that you cannot use a downhill ramp to get your vehicle started.
- ◆ You may use a "track" such as a toy car track or a string running from the starting line to the finish line to guide your vehicle. Not only will this help reduce friction, but it may also help you to keep your vehicle within the boundaries.
- ◆ Your vehicle does not have to move along the ground. If your vehicle moves through the air, you could use a string stretched between two chairs as a "track" to guide your vehicle.

Name _____ Date _____ Class _____

CHAPTER 2 PROJECT OVERVIEW *(continued)*

- ◆ For the class presentation, you must have diagrams of your vehicle that illustrate the forces that act upon it. You should also be able to explain any modifications that you made to improve the performance of your vehicle.

◆ Suggested Materials

Here are some ideas for materials to build your vehicle: recycled materials from home, toys or building-block sets, balloons, springs, straws, fishing lines, paper towel rolls

◆ Project Hints

- ◆ Be creative! Don't limit yourself to vehicles that have wheels. Think about other ways that you could get your vehicle to move a distance of 1.5 meters. The rules state that the vehicle has to stay within a width of 1 meter, but it is allowed to leave the ground!
- ◆ What happens if you inflate a balloon and release it into the air? Can you use Newton's third law of motion to explain this movement? How could you use the balloon's movement to push your vehicle? Can you think of any other objects like this that you could use to push your vehicle?

Newton Scooter Diagram

Each Newton Scooter MUST be accompanied by a detailed side-view diagram of your actual Newton Scooter that show ALL forces that affect the motion of your scooter. The forces that you should include are:



- 1. Action and reaction forces**
- 2. Gravity and what acts against gravity**
- 3. All different types of fluid friction**
- 4. Sliding friction**
- 5. Rolling friction**

- **There should also be an arrow that shows the direction of motion of your vehicle.**
- **Your arrows should be the right size to suggest that your vehicle is in motion in the direction you indicate. (Your arrows of friction should be much smaller than the reaction force.)**
- **Remember, Action and reaction forces are equal and opposite.**
- **Your diagram must be an exact representation of your vehicle that you have already built.**

On the back of your diagram you **MUST** include the answers to the following questions written using complete sentences in the form of a paragraph.

1. What provides the action force?
2. What provides the reaction force?
3. Does the motion of your vehicle travel in the direction of the action force or the reaction force?
4. What propels your vehicle forward?
5. What kinds of friction act to stop the motion of your vehicle?
6. Is the anti-gravity force greater than, equal to, or less than gravity? How can you tell?
7. What provides the force that opposes gravity?
8. Did your vehicle travel between 1.5 and 3 meters the first time you tested it?
9. What modifications did you make to improve the performance of your vehicle?
10. Which type of friction affects your vehicle the most?
11. Why do you think that type of friction?
12. What force has the greatest effect on the motion of your vehicle and how can you tell?
13. What materials did you use?
14. How much time did you spend testing and modifying your vehicle? (present your answer in hours actually working)
15. What would you do differently next time?

Don't forget that the Newton scooter starts on Wednesday, November 16. Be ready!