

Finley Elementary Design Challenges- Washington STEM Grant

SE LASER - STC Kit the STEM Design Challenge developed for : Motion and Design

STEM Design Challenge Project Title: *Rolling Fast Vehicle Company Wind Powered Vehicles Challenge*

Adapted by: Lorianne Donovan and Kristen Peters

STEM Design Challenge Project Placement

Placement: After lesson 13

Pacing: 2-3 days (1 or 2 on designing and testing) (Possible 3rd day on presentations)

Overview: Students have spent time learning about different ways to move the vehicles they have designed, (push force, falling weight, rubber bands, sails, and propellers). These young engineers will now use a box fan (simulating wind) to design a vehicle that will successfully travel through an obstacle course. EXTENTION – Students use the predetermined price sheet for parts to determine the cost of the vehicle they built and tested.

Objectives:

- Students discuss and design a vehicle that will travel through the obstacle course successfully.
- Students implement their design plans by building testing and evaluating their vehicles.
- EXTENTION – Determine the cost of the vehicle.

STEM Design Challenge Problem:

Students read the official memorandum from the “*Rolling Fast Vehicle Company*” which asked for vehicle prototypes that can meet a set of design requirements using wind power to move the vehicles. The students will read the memo and highlight the design requirements. Next the students will work in groups of 3 or 4 to discuss, plan, build, and test a vehicle. The engineering teams will perform three trials to test the speed of their vehicle prototype and record results. When a successful vehicle prototype can travel through the obstacle course 3 times successfully then students will present that design to the “*Rolling Fast Vehicle Company*”. This can be completed in an oral presentation to class or a technical drawing can be made and submitted with the three trial data gathered through testing and send back in a report to the “*Rolling Fast Vehicle Company*”.

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Materials List:

- K'Nex pieces, (rods, connectors, wheels, tires)
- Data table included below
- Cost Sheet (for EXTENSION page 13-A of Motion and Design Manual)
- Box fan (1-4 depending on class size and # of obstacle courses created)
- Memo (included below)
- Graph paper – Technical Drawing

Instructional Plan: (Teacher Directions)

1. Organize K'Nex materials for students to use.
2. Make obstacle course (see diagram below)
 - Speed bumps (straws or dowels on tag board)
 - Ramp (folded tag board with yard or meter stick in middle for support)
 - Finish line arch (Tag board tri-folded in to arch)
3. Begin class by distributing and reading together the memo from “*Rolling Fast Vehicle Company*”. Encourage students to highlight specific design requirements to guide in the design process.
4. Organize students in to groups of 3-4 creating engineering teams.
5. Allow students to design and begin testing vehicle. Teacher can determine how much time to allow based on the groups of students’ success in the Motion and Design unit thus far. Some classes may be more advanced or other may need more time and guidance. Each teacher will need to make that determination based on their current students’ needs.
6. Students use data table to record modifications and data on travel speed success.
7. When three successful trials of speed data are collected students will create a technical drawing of the final vehicle to be attached to the data table and turned in to the teacher.
8. If choosing to complete the extension the engineering teams will now complete the cost sheet for the price of their vehicle. This math extension can also be used as a challenge for the engineering teams that might finish more quickly.

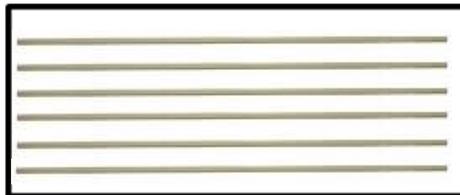
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Resources: (Websites, videos, books, recipes, memos, etc....)

BOX FAN
↕ 4 feet
Speed bumps (1ft)
↕ 3 feet
Ramp (1ft)
↕ 3 feet
Arch & Finish line
↔ 3 feet wide

Speed bumps – Tag board with straws or dowels 1 ½ inches apart glued to tag board.

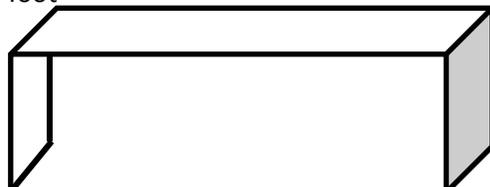
Tag board is 3 feet by 1 foot



Ramp is tag board 3 feet by 1 foot folded in half with yard stick under the fold for support.



Arch and Finish line is folded tag board 5 feet by 1 foot



Evidence:

- Data table included
- Technical Drawing
- Cost Sheet if adding the math extension use page 13-A from the Motion and Design Manual

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Engineering Team : _____

Name of Vehicle : _____

Data Table:

Vehicle Designs	Modifications or changes made	Time in seconds			Average Speed
		Trial 1	Trial 2	Trial 3	
Vehicle A					
Vehicle B					
Vehicle C					

Technical Drawing on graph paper should be attached



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Memo from: *Rolling Fast Vehicle Company*

To: 4th Grade Vehicle Engineers

Subject: Development of a wind powered vehicle



The *Rolling Fast Vehicle Company* is on the lookout for the next big vehicle design. As the price of fuel continues to rise and be unsteady, the *Rolling Fast Vehicle Company* is in the beginning stages of developing a wind powered vehicle. Our company has heard that your class has been studying the motion and design of various vehicles powered by a variety of technologies such as pushing, a falling weight system, rubber band, sails, and propellers. Our company would like you to work in small engineering teams to design a wind powered vehicle prototype that can travel through and obstacle course that will test your vehicle's sturdiness, accuracy, and speed.

Each vehicle must successfully travel through a series of obstacles to be considered for development. Please collect data on speed and include a technical drawing or present a report on your vehicle's success. The first obstacle will be a row of speed bumps. The second obstacle will be a ramp. The third obstacle challenge is to travel far enough to make it under the arch and finish line in a reasonable amount of time. At no time may your vehicle veer off the course or it will be disqualified.

If time allows a detailed cost sheet of the price of your successful vehicle design would be appreciated.