

Junkyard Wars: Wind Machines

Revised By Duc Tran, Environmental Science Institute: 10/2010

From “Junkyard Wars: Wind Machines” by Ann L. Hammersly, a Physics teacher at Chaparral High School in Scottsdale, Arizona

http://school.discoveryeducation.com/lessonplans/programs/jyw_windmachines/

GRADE LEVEL: 6 – 12th

LENGTH: 1 or 2 class periods

SOURCE: Discovery Education

TEKS

Middle School (Grade: 6 – 8th)

Grade 6: 1A, 1B, 2A, 2B, 2C, 2D, 2E, 3C, 4A, 8C

Grade 7: 1A, 1B, 2A, 2B, 2C, 2D, 2E, 3C, 4A

Grade 8: 1A, 1B, 2A, 2B, 2C, 2D, 2E, 3C, 4A

High School (Grade: 9 – 12th)

Grade 9 – 12: 1A, 1B, 2E, 2F, 2J, 3A

OBJECTIVES

1. Investigate the effect of wind direction on sail angle.
2. Compare & contrast the tailwind speeds of 2 different sail orientations.

MATERIALS

1. Low friction toy cars (20 – 30 cm in length)
2. Lightweight, sturdy cardboard, mat board, foam board, or plastic for sails
3. Duct or masking tape
4. Protractor
5. Dowel rods (0.25” or similar) for mast and boom (optional)
6. Fans

ACTIVITY

Divide the class into groups of 3 or 4 and tell each group that they will be investigating the effect of wind direction on sail angle for maximum speed of a land yacht. Each group will be in charge of designing their own sail and the sail will be attached to the mast. There are 2 parts to the experiment.

Part 1: The sail should be placed perpendicular to the wheels, splitting the car into a front and back half. Students will be measuring the speed of the land yacht, with a 0° tailwind and a 180° headwind. Keep the fan stationary and measure the time it requires for the land yacht to travel a given distance.

Part 2: Change the sail orientation to 45° relative to the wheels. Keep the fan stationary and measure the time it requires for the land yacht to travel a given distance.

DATA COLLECTION

1. Have the students write descriptions and draw pictures of their design.
2. Have students document their time data and distance traveled.
3. Have students test their boats for 3 – 5 trials with each sail orientation so they can obtain an average speed.

CLASS DISCUSSION

Have each group talk about their challenges and discoveries. Also, have the students talk about the tailwind speeds of the 2 different sail orientations.

Pull class data to see which land yacht traveled the fastest.

EVALUATION

Students' work will be evaluated on a basis of 100 points. Students will be graded on their cooperativeness during experiment; participation in class discussion; data collection – descriptions and drawings; summary of the experiment and its findings; responses to questions concerning the activity.

Sample Questions

1. What sail shape works the best? Why is that?
2. What are some important design elements that would be universal to all land yachts?
3. How do you determine the speed of your land yacht? What is the speed of your land yacht?

VOCABULARY

Boom

Definition: A long pole or spar attached perpendicularly from the mast that holds and extends the foot of a sail.

Context: Use a boom on your sail to increase the amount of area exposed to the fan's wind.

Headwind

Definition: A wind moving in the opposite general direction to a vehicle.

Context: Conduct a study measuring the speed of the land yacht at different wind angles, with a tailwind being 0° and 180°.

Mast

Definition: A long pole or spar that rises vertically from the keel or deck of a ship and supports the sails, boom, and rigging.

Context: Position the sail's mast so that it is perpendicular to the wheels.

Tailwind

Definition: A wind moving in the same general direction as a vehicle.

Context: Conduct a study measuring the speed of the land yacht at different wind angles, with a tail wind being 0° and a headwind 180°.