Wind Racing

Description:

Project Gear up for an exciting workshop where creativity meets the power of the wind! Students will discover the fascinating concepts of wind power, energy, thrust, and drag in a fun and engaging way. They'll put their engineering hats on to design, build, and test their very own land wind racers. Will their creations speed across the finish line or take an unexpected turn? There's only one way to find out—let the winds of science guide the way!

Time	Suggested Age	Suggested Group Size
Preparation: 15 minutes	☐ Elementary	✓ Individual
Activity: 120 minutes	☑ Middle School	☑ 2-5
	☑ High School	□ 6+
	☐ Adult	

Materials & Preparation:

	Tools & Materials	Space Requirements	Supplemental Files
	Per person:	✓ Indoor ✓ Outdoor	The following files are available on the
,	1 straight straw (for blowing)	*Indoor recommended	AFS website by searching for the project title: Wind Racing-Senior.
	Per Group: Small block of wood 4-6 straws Single hole punch Scissors Presentation: Yard stick or measuring tape Painters tape or chalk 3 sails (Diagrams #1, #2, and #3) Small block of wood	Size Needed: • Workspace with tables and chairs to build vehicles • Open area 15 feet long for testing	*Wind Racing Presentation-senior level (pptx) *Wind Racer Vehicle Instructions (pdf) *Wind Racer Template (pdf)
	Materials for Building Vehicles:		

Hard candies with a center hole (Wint O Green Lifesavers® work well)

Straight straws (correct diameter to fit through the candy holes), plus different sized straws Paper (variety of sizes and weights)

Clear tape, paper clips, small binder clips, rubber bands, glue

Craft sticks, string

Crayons or colored pencils for decorating the vehicles

Preparation:

- Mark the testing zone with a starting line and marked 1 foot increments using painters tape or chalk.
- Fold and label 3 pieces of paper for the "sails" according to Diagrams #1, #2, and #3.
- Prepare a projector and appropriate projection surface if using the Wind_Racing-senior.pptx Microsoft PowerPoint® file.

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Background:

Thrust and Drag

Ask: How does the wind make things move?

- Wind has a type of energy (power) called kinetic energy (energy of motion).
- It's harder to walk against the wind you have to use more energy to walk forward. It's easier to walk with the wind you can use some of the wind's energy to help you walk forward.
- Two types of forces affect movement: thrust (forward energy) and drag (resistance to movement). Thrust can come from captured wind energy. Drag can be caused by resistance from water (for example, a sail boat), air resistance (for example, and airplane), or ground friction (for example, a car or land sail racer).
- To make something move forward, thrust must be stronger than drag.

Demonstration: Show the block of wood sitting on a smooth surface.

Ask: What would it take for the wind to move this block of wood?

Demonstrate creating "wind" by blowing through a straw to show the block doesn't move.

Ask: What would need to change for the wind to move this block of wood?

Answer: Increase the thrust or reduce the drag.

• Demonstrate how to reduce drag by using rollers (straws) under the block.

Participant Action: Let the participants try to move the block with and without the rollers.

- Which way has less drag and is easier to push?
 Suggest further experiments:
 - What happens if more than one person blows on the block at the same time?
 - What happens if the straws are spaced further apart?
 - What happens if the block is set on its side or end?
 - How do thrust and drag explain what is happening?

Ask: How could we capture more of the wind energy to move something?

Answer: Add a sail.

Suggestion:

Use the PowerPoint slides or photos of windmills, sailboats, and land sailing.

Variations:

If you have limited time, eliminate one of the demonstrations.

If you have additional time, you can include more instruction or experimentation regarding thrust and drag.



Demonstration: Show the three "sails" lined up on a smooth surface.

Ask: Which one will move the furthest with one puff of wind?

Blow through the straw on each piece of paper. Explain:

- Sail #1 has no sail to capture the wind energy (not much thrust) and the most drag (the whole sheet rubs against the floor).
- Sail #2 has a small surface area for the wind to push against (this is a tiny sail, giving a little more thrust) and less drag (a smaller area rubs against the floor).
- Sail #3 has the largest sail (the most thrust) and the least drag.

Project:

Show pictures of vehicles that use wind energy to move (balloon, sail boat, land sail racer).

Explain: Land sailing and sailboat racing both use wind to power the racers and are competitive sports. Engineers understand how to harness the wind and reduce drag to get the most energy (thrust) out of the wind power.

Today you will be an engineer and build a land racer. You need to build a racer that moves across the track using only wind as the source of power. You will get to test your vehicle to see how successfully it races.

Participant Action: Provide each group with scissors and a hole punch, and show them the available building materials. Encourage them to design their vehicles on paper and then build and test them.

Variation:

Experiment with how and where to blow on the sail to maximize thrust.

Testing:

Participant Action: As each group finishes their racer, they can move to the testing zone.

- Test the racers by setting them at the starting line and blowing on the sail through a straw.
- Measure the total distance the racer moves.
- After initial testing, groups can make improvements and test again as time allows.

Variations:

Hold races to test which vehicle goes the furthest or fastest.

Experiment with other sources of thrust such as a fan, canned air, etc.

Give the participants the instructions and template (available as supplemental files) to build the sample wind racer. Discuss the similarities and differences between this vehicle and the one they designed.

Wrapping

Ask: Did you get the outcome you were looking for?

Up:

- What could have changed the outcome?
- What did you learn about thrust and drag?
- Do you have follow up questions?

More Resources:

- Landsailing Oregon's Alvord Desert by Oregon Field Guide https://www.youtube.com/watch?v=OcoCU-1X7Q
- Let's Go Land Sailing! by Outdoor Nevada S2 Ep 1 Clip https://www.youtube.com/watch?v=lx2TN35RWxg
- The Physics of Land Sailing by Shirley Robertson (CNN)
 https://www.cnn.com/videos/sports/2014/08/14/spc-mainsail-land-sailing-c.cnn
- Speedy Sails by Edinburgh Science Festival https://www.youtube.com/watch?v=F-iDqJMz4CY
- Young Engineers: Wind-Powered Sail Car Easy DIY STEM Activity for Kids by STEM Inventions https://www.youtube.com/watch?v=mvTV1irGk6M
- Land Sailing: Experiments and Background Information by Julian's Science Experiments https://www.juliantrubin.com/encyclopedia/aviation/land_sailing.html



Find more aviation projects and activities at http://www.aviationfirststeps.org.

Instructions	for	building	g racer

Diagram #1

Diagram #2

Diagram #3

