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IEEE Lesson Plan:

Downhill Skiing

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Lesson Focus

Students will learn about the engineering design process and about friction and forces. Students will work in teams to design a skier out of everyday items that can race to the bottom of a classroom ski ramp the fastest.

Age Levels

- 5-8

Objectives

Students will learn about

- friction
- the engineer design process

Alignment to Curriculum Frameworks

See attached curriculum alignment sheet.

Internet Connections

- TryEngineering (www.tryengineering.org)
- NBC News Downhill Science: Alpine Skiing (http://nbclearn.com/portal/site/learn/cuecard/47275)

Recommended Reading

- Downhill Skiing by Cynthia Amoroso (ISBN-13: 978-1567664560)

Optional Writing Activity

- Students can write a paragraph about the safety equipment skiers use.

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For Teachers: Teacher Resource

Anticipated Learner Outcomes

As a result of this activity, students should develop an understanding of:

- friction
- the engineer design process

Materials

- Stopwatch
- Ski Ramps (2) (smooth wood or plastic boards about 5 x 40 inches)
- Student Materials:
  - 4 craft sticks and plastic straws
  - plastic wrap (2 sheets 8x12 inches)
  - 4 pipe cleaners
  - scotch tape
  - aluminum foil (2 sheets 8x12 inches)

Procedure

1. Explain the challenge and have students work in teams of two.
2. Pass out the student sheets and present information on the various concepts, especially friction. Give examples of how these terms apply in your classroom.
3. Present the video so students can learn about the forces that impact skiing and then lead a discussion on how the terms on the vocabulary sheet related to the video they watched.
4. Review the engineering design process with all the students and explain to the student teams that they will be designing two skiers using the provided materials and then choose the one which they think will achieve the goal of reaching the bottom of the ski ramp first.
5. Distribute materials and allow students to test their designs on the ski ramp before deciding which skier to enter in the race. Allow about 25 minutes for building and testing prior to the race.
6. Using a stop watch, allow students to run the ski race and keep a chart to determine which team's design achieved the goal of reaching the bottom of the ramp fastest while staying intact. Note: the ski ramp should be safely secured at about a 45 degree angle. Also, students are not allowed to push the skier down – instead they simply let go.
7. Winning skiers race against other winners until there are three teams left earning bronze, silver, gold.

Time Needed

- 60 minutes

Tips

- The ski ramp should be as smooth as possible, or choose a plastic ramp instead.
- Make sure the wood board is well secured on the shelf.

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Student Resource:

Student Vocabulary

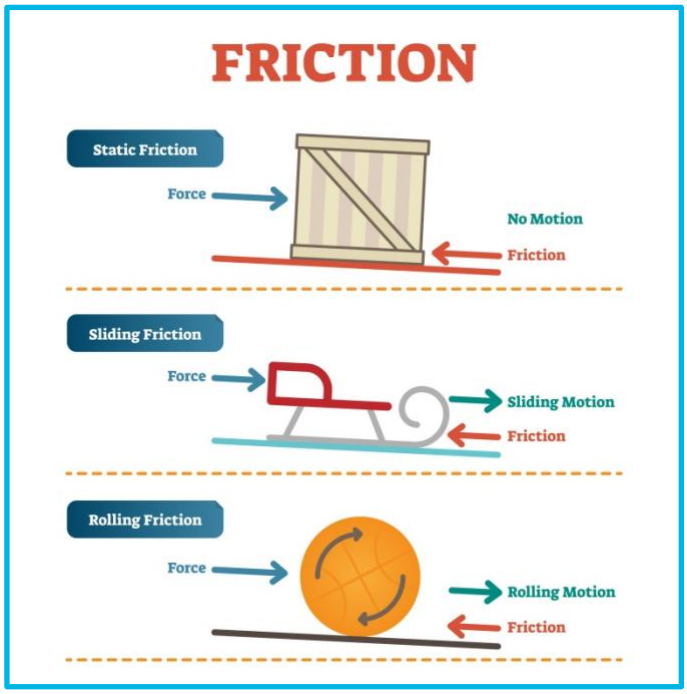
Force
A push or pull acting on an object

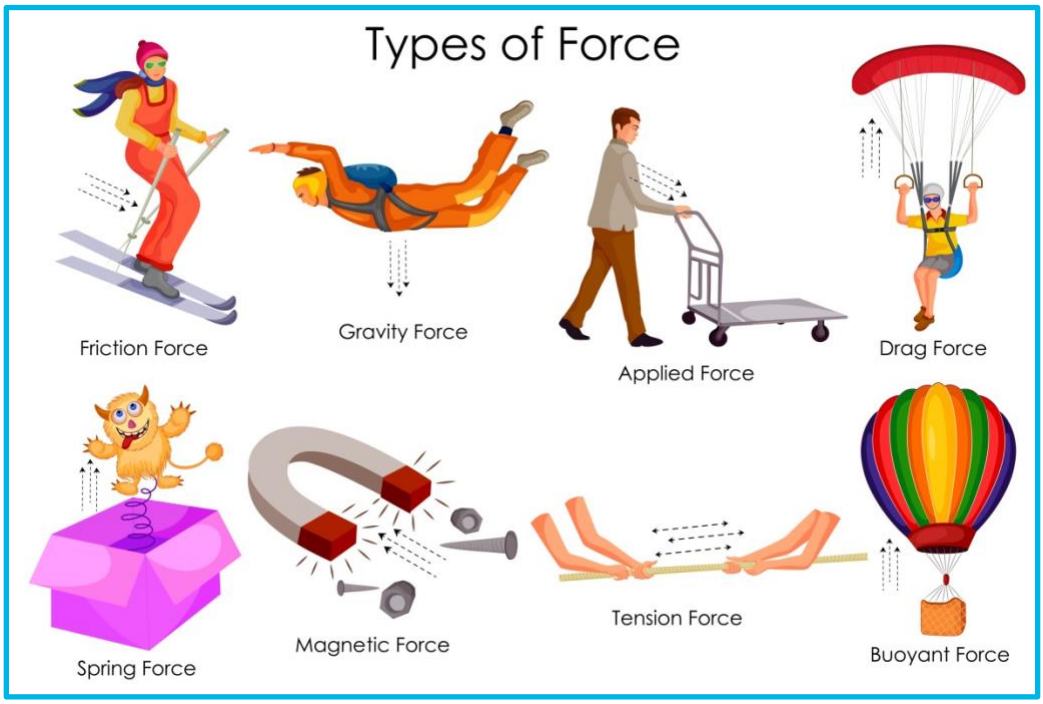
Acceleration
Increasing the rate or speed of something

Gravity
The force that pulls an object toward the center of the earth

Friction
Resistance of one object when moving against another

Wind Resistance
A force an object will need to overcome to move through the air





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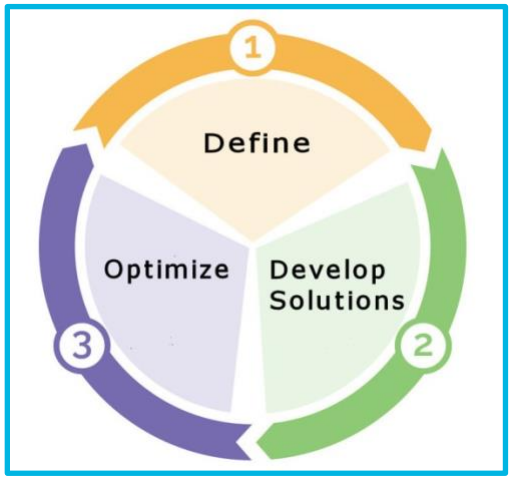
Student Resource:

The Engineering Design Process



1. Define
What is the problem you want to solve? What is your challenge?

2. Develop Solutions
Think about all the possible options you can identify to solve the challenge. Brainstorm as many solutions as possible.

3. Optimize
Compare your solutions, test them, and consider which one will do the best job of solving the problem.

And, throughout....Communicate
At each step in the process talk with your team members so everyone can contribute ideas and be a part of the process. Good communication is very important to the engineering design process.

Your Challenge

1. Define
Your challenge is to develop a skier out of materials provided that can race down a classroom ramp the fastest. You will not push the skier from the top of the ramp, but just let it go and let gravity move the skier down.

2. Develop Solutions
As a team, look at the materials you have to work with, and consider lots of solutions to the challenge. Be sure to talk about options and consider the materials. Consider the vocabulary words, like friction, and how they might apply to this challenge.

3. Optimize
Agree on which two design solutions are most likely to work, then build both and test them on the ramp. Choose which design your team will use to enter into the classroom race. Then enjoy the race and see what other designs worked well to meet the challenge.

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For Teachers: Alignment to Curriculum Frameworks

Note: Lesson plans in this series are aligned to one or more of the following sets of standards:

- U.S. Next Generation Science Standards (www.nextgenscience.org)
- U.S. Common Core State Standards for Mathematics (www.corestandards.org/Math)
- International Technology Education Association's Standards for Technological Literacy (http://www.iteea.org/TAA/PDFs/xstnd.pdf)
- Computer Science Teachers Association K-12 Computer Science Standards (http://csta.acm.org/Curriculum/sub/K12Standards.html)

◆Next Generation Science Standards - Grades K-2 (Ages 5-8)

K-2-ETS1-1 Engineering Design

- Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2-ETS1-2 Engineering Design

- Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

◆Standards for Technological Literacy - All Ages

Design

- Standard 8: Students will develop an understanding of the attributes of design.
- Standard 9: Students will develop an understanding of engineering design.
- Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

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