

Lesson Plan

Iron Dog Racers

Developed by:

Laura Wright – 2016 Iditarod Teacher on the Trail™

Discipline / Subject:

Science

Topic:

Newton's Laws of Motion, Potential and Kinetic Energy - Science

Grade Level:

4th grade – can be modified to any grade

Resources / References / Materials Teacher Needs:

1. Balloon racer requirement sheet (attached)
2. STEM planning guide (attached)
3. Potential and kinetic energy posters (attached)
4. Study Jams video:

<http://studyjams.scholastic.com/studyjams/jams/science/forces-and-motion/action-and-reaction.htm>

Lesson Summary:

Students will learn about potential and kinetic energy and Newton's Laws of Motion. They will then use the Third Law of Motion to design and create balloon racers using the guidelines sheet and the STEM design sheet. They will put their racers to the test with a race day.

Standards Addressed:

Texas State Standards – TEKS

(6) Force, motion, and energy. The student knows that energy exists in many forms and can be observed in cycles, patterns, and systems. The student is expected to:

1. (D) Design an experiment to test the effect of force on an object such as a push or a pull, gravity, friction, or magnetism.

Next Generation Science Standards - NGSS

ETS1.B: Developing Possible Solutions

▪ Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (Secondary to 2-LS2-2)

PS3.A: Definitions of Energy

- The faster a given object is moving, the more energy it possesses. (4- PS3-1)
- Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2), (4-PS3-3)

PS3.D: Energy in Chemical Processes and Everyday Life

- The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)

ETS1.A: Defining Engineering Problems

▪ Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (Secondary to 4-PS3-4)

PS2.A: Forces and Motion

- For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). (MS-PS2-1)
- The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2)

Learning Objectives: 1. Understand potential and kinetic energy and create and showcase Newton's Third Law of Motion with a balloon racer	Assessment: 1. STEM design sheet filled in with prototype 2. Balloon racer guidelines and grading sheet 3. The Third Law of Motion paragraph
Procedural Activities 1. Show the students the Study Jams online video about the Third Law of Motion: 2. http://studyjams.scholastic.com/studyjams/jams/science/forces-and-motion/action-and-reaction.htm 3. Show the potential and kinetic energy posters and discuss stored energy and energy on the move with the Happy River Steps from the Iditarod Trail as an example 4. Hand out the balloon racer guidelines and grading sheet to the students and review the requirements and the due date 5. I gave my students 2 weeks to complete the activity 6. At home they found ways to create wheels and axles and adapted designs to race farther and faster. They could not use toy wheels, and instead they had to create wheels out of household items. 7. On the due date we had a formal race day to showcase the Third Law of Motion with all our racers together	
Materials Students Need: 1. Balloon racer requirement sheet (attached) 2. STEM planning guide (attached) 3. STEM materials to create the balloon racers; balloons, straws, materials for wheels and axles are required along with a "vehicle" for the racer such as a small box. 4. Decorative items are optional; stickers, glitter, figurines, etc.	

Technology Utilized to Enhance Learning:

1. Study Jams online video from a computer whole group:

<http://studyjams.scholastic.com/studyjams/jams/science/forces-and-motion/action-and-reaction.htm>

Other Information:

1. This project can be completed at home or school
2. The paragraph can be handwritten or typed and emailed to the teacher if possible

Modifications for Special Learners/ Enrichment Opportunities:**Modified:**

1. Create the racers at school
2. Hand out the same materials for each student to use
3. Create the racer in small groups of students

Enrichment:

1. Ask students to use only recycled materials

See below for posters and attachments:

STEM Challenge

problem

imagine

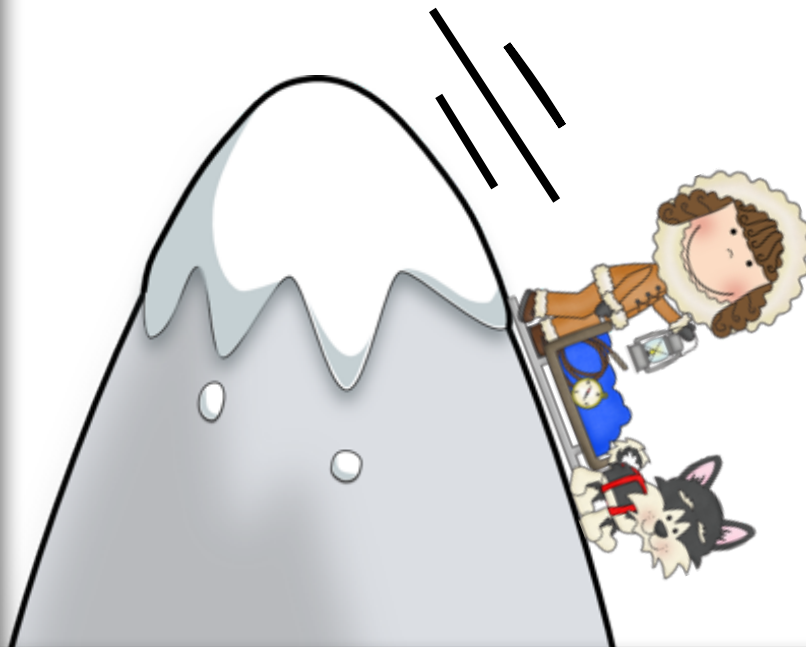
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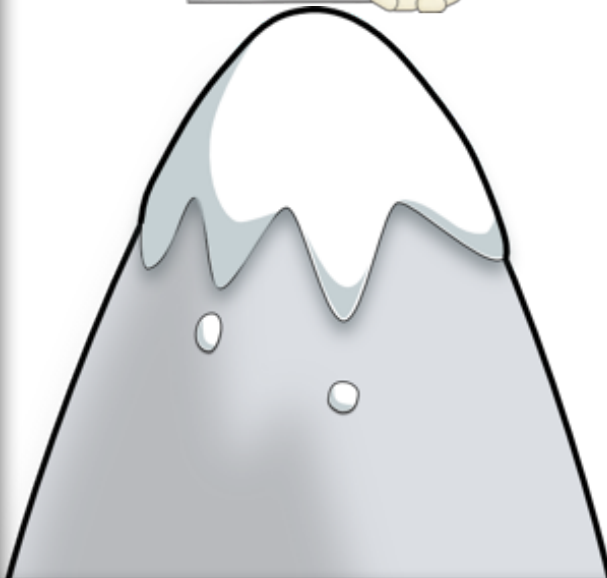
improve

name →

Kinetic Energy



Potential Energy





Balloon Iditarod

“Iron Dog” Snowmobile Racers

We are learning about forces and motion in science. Now it is time to experiment! Your job is to create an Iditarod balloon “Iron Dog” snowmobile. Follow the guidelines below to make your creation.

Guidelines:

1. Balloons **MUST** power the snowmobile.
2. You can build the snowmobile out of anything.
3. It must have at least three wheels. Wheels are defined as anything that is round and goes around.
4. The wheels **CANNOT** be wheels from a toy car. They must be made out of something that was not originally meant to be wheels.
5. The snowmobile may not leave the ground.
6. The snowmobile must be capable of traveling at least $\frac{1}{2}$ meter.
7. Write a paragraph explaining how kinetic energy, potential energy, and Newton’s three laws play into the motion of your snowmobile (this can be **NEATLY** handwritten on notebook paper or typed). You can also email it to me!
8. You must do this project on your own. Parents can help you get materials and brainstorm some ideas with you, but snowmobile construction and the written portion of this project must be done by you at home.

You will be given a grade based on your participation in the race and completion of your Balloon Racer:

Balloon Snowmobile Racer completed on time	/20
Followed guidelines for building the racer	/30
Snowmobile traveled at least $\frac{1}{2}$ meter	/15
Written portion: clear explanation of how kinetic & potential energy and Newton’s 3 laws relate to project	/35
Total Points	/100

Balloon Racers and papers are DUE: _____