

Project Ideas for Physical Science: Forces and Motion

Place-based education involves students in local culture, ecology, landscapes, opportunities, and experiences so that they can connect the science concepts they are learning to something that they know already, and to something that matters to them. Research shows that place based education helps students learn, invites students to become active citizens, transforms school culture, and connects schools with the community*. These project ideas are included to get teachers and students thinking about ways to make science education relevant to the place in which they live. This is only a starting place; the list is certainly not exhaustive, and teachers are invited to continue adding, sharing, and building the list.

These ideas were developed with the Yukon Flats School District in mind. Other districts using the Yukon Flats curriculum resource should adapt the list of ideas to fit their own district and region.

*Place-based Education Evaluation Collaborative. 2010. The Benefits of Place-based Education: A Report from the Place-based Education Evaluation Collaborative (Second Edition). Retrieved 5/16/11 from <http://tinyurl.com/PEECBrochure>.

Project Idea: Travel
What are some examples of questions students can investigate, and projects students can do, related to the forces and motion?
<p>Why do some boat designs work better in lakes, rivers, open ocean?</p> <p>Build a vessel that will hold the most pennies and still float (buoyancy). Apply your knowledge to design a riverboat for a heavy cargo load.</p> <p>Compare friction between dry and icy surfaces. How can you increase friction when walking on ice?</p> <p>Compare the speeds of various boat hulls.</p> <p>Paddlewheel boats and steam engines – how did they work?</p> <p>What are the forces that you need to consider when piloting a boat on a river?</p> <p>What are the various forces that sled dogs have to overcome to make a sled move swiftly?</p> <p>How can a musher increase or decrease the friction of a sled, depending on the conditions?</p> <p>Where is the best place to position the bridle on a dog sled, and why?</p> <p>Why are the strongest dogs used as “wheel dogs” positioned right in front of the sled?</p> <p>Compare sled design for different uses and different cargo loads.</p> <p>How do snowshoes distribute force?</p> <p>How do the aerodynamics of a vehicle affect its gas mileage?</p> <p>How does a helicopter work? How does the speed of the rotor affect the lift?</p> <p>Compare propellers, rotors, and different kinds of blades.</p> <p>Investigate the forces involved in airplane flight.</p> <p>Design gliders to go faster, or farther.</p> <p>Develop safety devices to prevent injuries on snow machines.</p>
<p>Possible Resources:</p> <p>Village Science by Alan Dick http://www.ankn.uaf.edu/publications/vs/</p> <p>Physics of a Boat Launch http://auto.howstuffworks.com/auto-parts/towing/vehicle-towing/boat/launching-a-boat5.htm</p> <p>Riverboat Simulator http://www.physicsclassroom.com/shwave/rboat.cfm</p> <p>How to Build Sleds http://www.inquiry.net/outdoor/winter/gear/sleds/</p> <p>Newton’s Second Law of Motion applied to Dog sleds http://science.howstuffworks.com/science-vs-myth/everyday-myths/newton-law-of-motion3.htm</p> <p>Physics of Mushing http://helenx1004.tripod.com/physicsofmushing/ (no source information)</p> <p>Civil Air Patrol Alaska http://www.akwg.cap.gov/</p> <p>Principles of Flight, Level 1 http://www.allstar.fiu.edu/aero/princ1.htm Level 2 http://www.allstar.fiu.edu/aero/princ2.htm</p> <p>K-8 Aeronautics Internet Textbook http://wings.avkids.com/</p> <p>NASA Aeronautics Tutorial http://virtualskies.arc.nasa.gov/aeronautics/index.html</p>
Connections to other units and concepts: Year 3 Physical Science Energy

Project Idea: Shooting and Hunting

What are some examples of questions students can investigate, and projects students can do, related to the forces and motion?

What is the relationship between the size or weight of a bullet and the force it has when it hits its target?

Muzzle velocity versus impact velocity.

What are the forces involved in recoil?

How can you determine the range of a rifle bullet?

How does the design of bows and arrows affect their range and their speed?

Study force applied by various sizes of traps.

How does the shape of a bullet determine its impact?

How does gravity combine with other forces to determine the path of a bullet or an arrow?

Possible Resources:

Village Science by Alan Dick <http://www.ankn.uaf.edu/publications/vs/>

Physics of Shooting a Bow <http://www.petersenshunting.com/content/physics-shooting-bow>

How physics affects rifle shooting <http://www.fishinghuntinginfo.com/how-physics-affects-rifle-shooting/>

Alaska Hunter Education <https://secure.wildlife.alaska.gov/index.cfm?adfg=he.main>

Connections to other units and concepts: Physical Science Year 3 Energy

Project Idea: Village technology

What are some examples of questions students can investigate, and projects students can do, related to forces and motion?

How do fish wheels work?

What forces are involved in casting, reeling in a fish, pulling a net?

How does can you determine how much weight a bridge will support?

What kinds of tools were used traditionally for moving and lifting things? How were logs moved?

How do you find the center of gravity for a tree, and use that knowledge to help you fell the tree?

Using gravity and overcoming gravity in design of water or oil lines.

Pumps (overcoming gravity?)

What are the best angles, widths, and/or shape to shoot for when sharpening a knife blade (or an axe or an ice pick)? Does this differ according to the material you will be cutting?

Possible Resources:

Village Science by Alan Dick <http://www.ankn.uaf.edu/publications/vs/>

Fun and Learning about Bridges <http://www.bridgesite.com/funand.htm>

Best Knife sharpening angles http://www.ehow.com/how_4540198_best-knife-sharpening-angles.html

Physics of a Water Wheel (Fish Wheel) http://ffden-2.phys.uaf.edu/211_fall2010.web.dir/Brooks/a-common-water-wheel-in-alaska.html

Connections to other units and concepts: Physical Science Year 3 Energy

Project Idea: Sports and Fun

What are some examples of questions students can investigate, and projects students can do, related to the forces and motion?

Basketball - which shots are most efficient?

How is friction involved in basketball?

How does ski wax affect the friction your skis? Compare waxes.

Bicycles – momentum, simple machines, gears, mechanical advantage

Native Youth Olympics: simple machines, levers, forces involved, mechanical advantages.

How does the shape, sharpness, and length of a blade affect the way that you ice skate?

Do helmets really protect against a crash? (presumably tested with a simulant, like a watermelon)

What is the best air pressure for a basketball?

How does momentum affect the distance you can jump?

What are the physics of efficient kicking for martial arts or Native Youth Olympic?

What launch angle helps you throw a ball the farthest?

How does temperature affect the friction of your skis?

Possible Resources:

Physics of Basketball <http://physics-of-sport.net/basketball.html>

Native Youth Olympics <http://www.anchorage.net/764.cfm>

Physics of Sledding <http://www.anchorage.net/764.cfm>

Physics of Bicycling <http://physicsofbicycling.homestead.com/>

Connections to other units and concepts: Physical Science Year 3 Energy, Life Science Year 1 Body Systems