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| Lesson Plan Title: Friction and a Toboggan | |
| **Developed by:** Martha Dobson, 2011 Iditarod Teacher on the Trail™ created Jan. 2017 | |
| **Discipline / Subject:** Science | |
| **Topic:** Friction | |
| **Grade Level:** Sixth-Eighth grades | |
| **Resources / References / Materials Teacher Needs: Per pairs of students:** plastic toboggan sleds, 20 pounds of weight (books), access to different surfaces such as grass, concrete or asphalt, carpet, tile or linoleum, gravel, dirt, sand. Native Alaskan site: [**http://www.ankn.uaf.edu/publications/VS/dogsleds.html**](http://www.ankn.uaf.edu/publications/VS/dogsleds.html), | |
| **Lesson Summary: HYPOTHESIS:** Friction will be greater on some surfaces and lesser on other surfaces. | |
| **Standards Addressed: (Local, State, or National)**  1. [CCSS.ELA-Literacy.RST.6-8.3](http://www.corestandards.org/ELA-Literacy/RST/6-8/3/) Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.  2. [CCSS.ELA-Literacy.RST.6-8.4](http://www.corestandards.org/ELA-Literacy/RST/6-8/4/) Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.  3. [CCSS.ELA-Literacy.RST.6-8.9](http://www.corestandards.org/ELA-Literacy/RST/6-8/9/) Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. | |
| **Learning objectives:**  1. The learner will explore friction and the effects of various surfaces on friction.  2. The learner will define static and kinetic friction.  3. The learner will perform and summarize an experiment in the scientific method. | **Assessment:**  Method of assessment for learning—Assess the accuracy of the scientific method and written record of the experiment. |
| **Procedural Activities**  1. Students work in pairs. NOTE: If there aren’t enough toboggans for all the pairs to do this simultaneously, organize this experiment as a station. Enlist adult volunteers to supervise it or other students who are doing activities at other stations. 2. Go to the first surface to be used. Load the toboggan with 20 pounds of weight. Students should discuss and identify why 20 pounds of weight is used (to make the energy required of them to cause the toboggan to change from a static friction to a kinetic energy more noticeable to the students).  3. Each student pulls the toboggan on its surface until it just begins to move. Emphasize the constant of using the same amount of energy; they pull only until it starts to move. (No jerking hard, no digging in their feet to pull, no running, etc.) Students rate their own effort as more or less effort required to move the sled. The partner records what the student reports.  4. Repeat this on the each surface that has been chosen to test.  Each student represents their own data in a chart labeled More Effort to Move and Less Effort to Move, recording the surface in the appropriate column. *See chart below.*  5. Collate the individuals' data into one chart. EXAMPLE: Carpet surface required less effort. Write Carpet in the Less Effort to Move and then use tally marks to represent the number of students reporting Carpet as requiring Less Effort to Move.  6. Students discuss the collated chart and point out observations and any unexpected information the chart reflects.  7. **QUESTIONS** to talk about: Remember that the variable is the surface the toboggan is on.  • What quality does a surface have that caused you to use less effort to move the toboggan? (Smoothness, slickness. These qualities mean less friction.)  • Is less friction advantageous or not advantageous? (Race car drivers want to have more friction so they can drive the cars faster or hold the turns in the race track better. A sled dog team wants more friction for the same reasons.)  • Can friction become so great that it is not advantageous? What surfaces during a sled dog race could be advantageous for a team? In 2014, there was little to no snow in the Dalzell Gorge; it was bare dirt and roots. Teams traveled much faster, and out of control, on that surface. Discuss the friction on that trail in terms of the dogs and sled. (Friction on bare dirt was greater for the sled and greater for the dogs. The greater friction for the dogs enabled them to go faster.)  • What could be done to a sled to increase friction to slow the team? (Wrap the runners with chain.) What can be done with a dog team to decrease their effect on the speed? (Disconnect some of the tuglines from the dogs to the gangline in order to reduce the amount of the dog’s energy transferred to the gangline.)  8. **Summarize** the experiment in regards to friction. Summaries should contain correct scientific language. Younger students can use a word box to help them write their summaries while older students write summaries without the aid of a word box. | |
| **Materials Students Need:** plastic toboggan sleds, 20 pounds of weight (books), access to different surfaces such as grass, concrete or asphalt, carpet, tile or linoleum, gravel, dirt, sand. Native Alaskan site: [**http://www.ankn.uaf.edu/publications/VS/dogsleds.html**](http://www.ankn.uaf.edu/publications/VS/dogsleds.html),  Pencil, paper. | |
| **Technology Utilized to Enhance Learning:** Computer, one-to-one technology as available to record information as an option to paper and pencil. Also use computer to access the University of Alaska Fairbanks publication listed above. | |
| **Other Information** Scientists have to be able to write clearly in order to communicate the results of their work to others. In this summarizing  activity, students practice writing clearly to communicate. Another job area, technical writing, requires clear, concise writing, usually in an industry like computers or engineering. Technical writers work with journal articles, instruction manuals and other documents that clearly communicate information to others. http://www.bls.gov/ooh/Media-and-Communication/Technical-writers.htm  Going to this link takes you to a site outside of our website.  We are not responsible for content | |
| **Modifications for special learners/ Enrichment Opportunities** Students work in pairs.Video students moving the toboggans. Create a video montage. Display the individual charts and summaries. Invite a scientist or technical write to speak to your class. | |

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| More Effort to Move | Less Effort to Move |
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**WORD BOX:** friction, static friction, kinetic friction, effort, constants, variable, toboggan, weight, and the names of the surfaces used