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|   Lesson Plan Title: Friction and Sleds  |
| **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:** small paperback book, string, large paperclip bent open so that each end has a hook, metal nuts to hang on the paperclip hook, a desk with a smooth surface, a piece of sandpaper the size of the book, masking tape. Use heavier nuts to reduce the number required. Native Alaskan site: [**http://www.ankn.uaf.edu/publications/VS/dogsleds.html**](http://www.ankn.uaf.edu/publications/VS/dogsleds.html),  |
| **Lesson Summary: HYPOTHESIS:** The sandpaper surface creates more friction, requiring more washers’ weight to move the book. |
| **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. Place one washer at a time on the paperclip hook until the book begins to move. (Question for students: What type of friction is exhibited when the book is on the desk top, not moving? What friction does that change to when the book begins to move?)2. Count the number of washers required to move the book and record the number.3. Put the sandpaper on the desk, taping the bottom of it to the desktop. Put the book on the sandpaper.4. Add washers again, until the point that the book begins to move. Count the number of washers used and record the number.5. Partners should create a bar graph representing the data they gathered. For younger students, work with the class as a whole creating a bar graph showing the numbers of washers used on the relative surfaces. Then, they can make their own bar graph. Older students should be led to state what information the bar graph should include and how to design the graph, as well as creating a bar graph of their data. |
| **Materials Students Need:** small paperback book, string, large paperclip bent open so that each end has a hook, metal nuts to hang on the paperclip hook, a desk with a smooth surface, a piece of sandpaper the size of the book, masking tape. Use heavier nuts to reduce the number required. 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** This experiment gives the students a chance to discuss why the same size book was used, the same kind of washers, the same 2 surfaces, and the same placement of the book from the desk edge (controls or constants: Only one thing in an experiment can change, otherwise one is not sure what the experiment measured.) Students should identify the variable in this experiment (the surface the book lay on) |
| **Modifications for special learners/ Enrichment Opportunities** Students work in pairs.Weigh nuts used and use the weight versus the number of nuts to cause a change in friction. |