

# Snowshoes Are Mandatory

**Developed by:** Sid Lucas

**Discipline / Subject:** Life Science/STEM

**Topic:**

Adaptation

**Grade Level:**

7-12

**Resources / References / Materials Teacher Needs:**

- 1) Internet access (Specific web sites and/or articles containing data can be found ahead of time and provided for students if research is not a learning objective for this activity).
- 2) Calculators
- 3) Meter Sticks/Measuring tape
- 4) Large poster board/Construction paper
- 5) Equation for determining surface area of an ellipse (oval).

**Lesson Summary:**

Students will answer the question, “Who is best adapted to stay on top of the snow in an arctic environment?” Students use scientific media to determine the average weight and average surface area of the paws/hooves of various arctic animals. The surface area to mass ratios are compared to quantify and rank how well adapted each animal is with respect to their ability to travel upon a snow covered landscape. Students can apply their discoveries by using their ratios to design the dimensions of a custom snowshoe capable of making them equally adapted to any of the studied animals.

**Standard’s Addressed: (Local, State, or National)**

- 1) Use evidence to explain the process by which natural selection leads to adaptations that result in populations dominated by organisms that are anatomically able to survive and/or reproduce in a specific environment.
- 2) Understand ratio concepts and use ratio reasoning to solve problems.
- 3) Show how the ideas and themes of science can be used to make real-life decisions about life-styles and use of resources.

<p><b>Learning Objectives:</b></p> <ol style="list-style-type: none"> <li>1) Students can obtain the data necessary to determine surface area to mass ratio of various arctic animals.</li> <li>2) Students can use data to quantify how well adapted an animal is.</li> <li>3) Students can apply new understanding to real-world problems.</li> </ol>	<p><b>Assessment:</b></p> <p>Method of assessment for learning</p> <ol style="list-style-type: none"> <li>1) Checklist for required resources and completed data chart.</li> <li>2) Check accuracy of ratio calculations and ranking of animals.</li> <li>3) Check student calculations, measurement, and completion of model snowshoe.</li> </ol>
<p><b>Procedural Activities</b></p> <ol style="list-style-type: none"> <li>1. Design and record a data table to collect species' name, average mass (lbs.), average surface area of paw/hoof (in<sup>2</sup>), mass to surface area ratio (lbs/in<sup>2</sup>), and adaptive rank.</li> <li>2. Obtain resources that provide average mass and average surface area of paw/hoof for Arctic Wolf, Caribou, Snowshoe Hare, Wolverine, and Polar Bear (students can be required to find all data, or grouped to share data).</li> <li>3. Record data for each animal, and calculate weight to surface area ratio (Students should note that each of the animals are placing total mass on 4 legs).</li> <li>4. Use ratios to determine how well adapted each animal is for staying on top of snow, and rank each animal.</li> <li>5. Use the surface area of an ellipse equation (<math>\pi ab</math>) (see link <a href="http://math.about.com/od/formulas/ss/surfaceareavol_8.htm">http://math.about.com/od/formulas/ss/surfaceareavol_8.htm</a> ) to design the dimensions of a set of snowshoes necessary to achieve the ratio required to equally adapt the student to one or more of the selected animals.</li> <li>6. Choose the dimensions of a model set of snowshoes that would make the most reasonable set for the student (<b>Special Note:</b> Heavier students will most likely find that the dimensions for the best adapted animal will result in unusually large snowshoes; this may lead to sensitivity or embarrassment for some students).</li> <li>7. Measure and trace out the dimensions of the snowshoe on large poster board or large construction paper.</li> <li>8. Cut out snowshoe pattern. Record student name, animal name, and adaptive ratio on the pattern.</li> <li>9. Student snowshoes can be posted and displayed on classroom wall or ceiling.</li> </ol>	

**Materials Students Need:**

- 1) Internet for searching web sites and/or scientific articles (requirements for resources can be adjusted from basic web sites to scientific journals, depending on students' level of development).
- 2) Student journal for designing a chart to organize recorded data and calculations.
- 3) Calculators
- 4) Meter Sticks/Measuring tape
- 5) Large poster board/Construction paper
- 6) Equation for determining surface area of an ellipse (oval).

**Technology Utilized to Enhance Learning:**

Internet

**Modifications for Special Learners/ Enrichment Opportunities**

Requirements can be altered according to student development. Teacher can determine quantity of information and level of resources needed for diverse learners. Students can work independently or collaboratively.

Motivated students can collaborate with Technology Education or work independently to design and create a functional pair of custom snowshoes.