



Gold Seal Lesson

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Grade Span			ICLE Application Model			
K-4	5-8 XX	9-12	A	B	C	D XX

Instructional Focus:

Basic Concepts and Knowledge

Students develop an understanding of scientific concepts using facts, theories, principles, and models.

Science as Inquiry

Students demonstrate knowledge and skills necessary to perform scientific inquiry.

Statistics and Probability

Students use statistics and probability to analyze given situations and the results of experiments. Students communicate the reasoning used in arriving at a conclusion.

Performance Task

You work for a company that makes cold weather camping gear. Your task is to rate different types of materials for their insulating ability and make recommendations about which ones would work well in different products (coats, sleeping bags, thermoses and food containers, etc.) To do so, you need to do the following:

1. Choose three different materials or insulation types (examples: wool, down feathers, plastic, Styrofoam, cotton, aluminum foil).
2. Design a method to rate each for their insulating ability. You can do this any way you want, but you must design an experiment that (1) compares the different materials under similar conditions and (2) creates a numerical rating system to compare the different materials. You will probably test materials that are of different weights and thicknesses, so your rating system should control for this.
3. Carry out the testing procedure, making notes about what you tested, how you tested it, and what the results were.
4. Using your rating system, rank the materials according to their insulating ability.
5. Draw a graph or chart to present your results.
6. Compare your results with the results of other students or groups. Do they agree? (If your results say cotton is warmer than plastic, do other results say the same thing?) If not, look at the notes from the other experiment, choose one way your results disagree, and write three reasons they might disagree, based on differences in the experiments.
7. Design another experiment that would show which results are correct.
8. For the material you rated as the warmest, recommend two products to use it in and two products NOT to use it in. Give your reasons.

Teachers' notes:

While students will most likely be familiar with some materials such as plastic and aluminum foil, they may not be aware of the differences in the materials their clothes are made of (e.g., cotton wool, down, polyester, etc.). These differences can either be introduced at the beginning and treated as different materials to be tested, or students can use a catch-all description ("cloth") and be introduced to the differences as possible explanations for differences in results.

ICLE Essential Skills

Know and apply the principles of scientific inquiry. (Implicit in this statement are the processes of prediction, estimation, developing hypotheses, drawing conclusions, evaluation, and following ethical principles and professional procedures.)

(Not Ranked) (s 114)

Plan and apply real or hypothetical models and constructions to facilitate investigation and learning and the solution to practical problems. (Not Ranked) (s115)

Make observations using senses and instruments. Inferences and interpretations are arrived at based on observations. Classify observable properties and organize observations in a meaningful and logical way. (s5)

Exhibit good data management skills by collecting, organizing, and graphing data. (s19)

Know how to obtain accuracy and precision using common measuring devices. (s33)

Scoring Guide:

Experiment design (20 Points)	<ul style="list-style-type: none"> • Tests different materials under same conditions • Uses some system to measure or describe insulating power that can be used for all materials (measuring temperature, 5-point scale ranging from "very warm" to "very cold") • Uses repeat trials to ensure validity • Identifies and attempts control other threats to validity
Execution (note-taking) (20 Points)	<ul style="list-style-type: none"> • Notes show experiment conducted according to plan • Notes include pertinent information, such as items tested (cotton blanket, down jacket, sheet of plastic), their characteristics (weight, thickness, etc.), time spent in cold temperature, other conditions (wind, rain, etc.) and results
Graph (10 points)	<ul style="list-style-type: none"> • Presents data on all four materials • Presents rating differences clearly and accurately • Consistent with notes • Formatted properly
Comparison and analysis (20 Points)	<ul style="list-style-type: none"> • Student provides three possible explanation for differences in results • Explanations based on differences in experiment design (number of trials, testing conditions, method of measuring insulating power, etc.) • Explanations are logical and plausible
New experiment design (20 Points)	<ul style="list-style-type: none"> • Controls for sources of differences identified by student • Is feasible
Recommendations for product use (10 points)	<ul style="list-style-type: none"> • Student considers factors in addition to insulating power that would influence usefulness (flexibility, weight, cost, durability, etc.)

Keywords

English Language Arts	Mathematics	Science
Reading	Algebra	Earth Science
Writing	Geometry	Life Science
Communications	Statistics Data collection Data display Graphs Statistics in daily life	Chemistry
Literature	Calculus	Physics Conservation of energy Scientific research Statistics
Other	Trigonometry	Other
	Other	