

Sample formative assessment about materials that also measures student's abilities to design a fair test and ask a testable question.

Story A – Designing a Hat

A small business decides they want to start making winter hats, or stocking caps, that keep your head really warm when it gets cold outside. They have many different materials they could use such as cotton and wool, but they don't know for sure which material will keep their bodies the warmest. They need your help to move forward!

Part I – Designing Investigations

1a. How could you test which materials would be best for keeping your head warm? What would you measure? What would you need to do to make sure the test was fair?

After a discussion about the kinds of materials they could use to make hats out of, the class splits into four groups in order to answer one the following investigation questions:

- Group 1: What materials help keep your head the warmest?
- Group 2: How does the type of material, cotton or wool or polyester, affect the temperature change of your head after five minutes in the cold?
- Group 3: How does the temperature of your head change if you where a hat outside?
- Group 4: How does the temperature change affect the material the hat is made out of, cotton or wool?

1b. Which group's question do you like the best and what about it makes it the best?

1c. Which group's question do you least like and what makes it difficult to carry out?

Name _____

Materials and Properties Data Sheet

[illegible]

2-PS1 Matter and its Interactions

<https://www.nextgenscience.org/dci-arrangement/2-ps1-matter-and-its-interactions>

Performance Expectation	Connections to Classroom Activity
2-PS1-1: Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.	Students plan and conduct a variety of property tests to determine which materials are suited to design a medical grade bandage.
2-PS1-2: Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.	The data yielded from the various property tests is used to determine which material and testing processes should be used to inform the potential design of a medical grade bandage.
Science and Engineering Practices	
Planning and Carrying Out Investigations	Students need to control multiple variables while also determining what data to collect and how to collect it.
Analyzing and Interpreting Data	After conducting a variety of simple tests and answering the question “Which material is the strongest, most flexibly, most absorbent?” students must determine which materials and associated tests should be promoted to design a medical grade bandage.
Disciplinary Core Idea	
PS1.A: Structure and Properties of Matter Different properties are suited to different purposes.	Students will conduct three properties tests to determine which is best suited for the design of a medical grade bandage.

Crosscutting Concepts	
Structure and function	Students will observe and record how the shape and stability of a structure is related to an intended purpose (i.e. function).
Patterns	Students will produce and interpret numerical data in order to uncover how effective a given material performs during a particular property test. The findings from this pattern analysis will inform their design of a solution to a given problem.
Engineering, Technology, and Application of Science Standards	Connections to Classroom Activity
K-2-ETS1-1: Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.	Students will likely need to research how bandages are made along with the needs of those that use bandages.
K-2-ETS1-3: Analyze data from tests of two objects designed to solve the same problem to compare strengths and weaknesses of how each performs.	Students will ultimately propose a <i>design process</i> for the development of a medical grade bandage. Additionally, they may have specific suggestions for material type of the bandage given the data collected/analyzed via the property tests they conducted.
Common Core State Standards Connections: ELA/Literacy	Connections to Classroom Activity
W.2.7: Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-PS1-1)	Students' collective endeavors developing various absorbency tests will need to be observed and reported out.
Common Core State Standards Connections: Mathematics	Connections to Classroom Activity
2.MD.D.10: Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.	If students are required to run an absorbency test four different materials (e.g., cotton, cloth, paper, etc.) then they can also be asked to report out the results these tests via bar graphs. Analysis would also be facilitated via the creation of this graph.

