WEEK 5 Lesson 1

Science and Engineering: Matter and Its Interactions

Planning an Experiment to Test Hardness

Big Ideas	Materials have observable properties. The properties of materials impact how they are used for specific purposes.
Guiding Questions	How do we design an experiment so that it is fair?
Content Objectives	I can consider the properties of materials to design an experiment to test hardness. (2-PS1-1.) I can consider different ways to collect data about the hardness of solid materials. (Practice 3, 2-PS1-2)
Language Objective	With my partner, I can explain an idea for a fair test. (SL.3.2.a)
Vocabulary	**accurate**: true **hardness**: the property of resisting pressure and scratching resist: to withstand or hold up against **valid**: follows rules **variable**: a part or feature that could change
Materials and Preparation	● 1-gallon ziplock plastic bags, one for each pair of children ● samples of all materials used in previous weeks (wood, stiff paper, ● cardboard, fabric, metal, plastic, styrofoam, aluminum foil, rubber), ● enough for each pair of children to have a collection ● samples of any other interesting materials ● pennies, a few for each pair of children ● blunt pencils, one or two for each pair of children In each bag, prepare a kit of varied materials. These kits do not need to all contain the same materials. ● Science and Engineering packets ● writing and drawing tools ● chart paper and markers ● Create the following chart.

	A Fair Experiment to Test Hardness Tool: Pressure: Materials to test: Results:

Opening 10 minutes	*Last week we conducted an experiment to test the flexibility of different materials. Remember how all the materials were the same size and shape and how we added the same amount of weight to each material? This is a very important part of designing an experiment: having most things be the same each time. In the experiment we conducted, why do you think it was important to set each material up the exact same way and to use just pennies, not other kinds of coins? What might have happened if we had used different weights for each material?* Allow time for a short discussion, helping children consider the concept that having multiple variables does not yield definitive results. Introduce the concept of controlling variables while designing an experiment. *When professional scientists and engineers design experiments, they want those experiments to be fair so they get accurate, or true, information. In an experiment, fair means that all of the variables, or parts, are kept the same except the one thing that's being tested. In our last experiment, the thing we were testing, the variable that changed, was the material.* Give children a few minutes to talk together as a group or with partners about this concept. *Pretty soon we will begin designing a chair that will meet the needs of learners. We want to choose materials with the right properties so we have the right kind of chair. We want to design a chair that people can use for a long time, not one that will break or wear out quickly. So, in this case, we want to know which materials will last a long time.* *Today we are going to design a new experiment. We're going to test materials for hardness. When we say hardness, we mean the material's ability to resist scratching and pressure. I'm not going to tell you how to do this; I'm going to ask you to design the experiment. Remember, you have to make it a fair experiment so you get accurate information about the hardness of different materials.* Explain that today's time will be spent deciding how to conduct the experiment and that children will conduct the experiment during the following lesson. *First, you'll work with your partner to think about a fair experiment. Here are your materials. There are some materials you will be testing to see how hard they are, and other items you might use as tools for scratching the materials to test them. The more pressure you need to apply to a material before it scratches, the harder the material is.* Review the materials and come up with a plan to test hardness. In

	designing your experiment, it will be helpful to think and talk about the properties of the materials you have. Then record your ideas in your packets. [Show the appropriate page.] *After about ten minutes, we'll get back together to talk about your ideas and make a final plan for the experiments.* Distribute the bags and packets, and send children to work.
Investigation 30 minutes	In pairs, children inspect the materials in their bags and discuss plans to make an experiment for hardness. They record these ideas in their packets, listing materials and describing a procedure in drawings and words. As children work, circulate and prompt their thinking about the materials, experimental fairness, and recording their plans.
Closing 10 minutes	Bring the group back together, with partners sitting together with their packets. *We all need to agree on a fair experiment to test hardness. We will need to decide which materials we will test, what tool we will use, how much pressure to apply (how much scratching to do), and how we will record what we find out.* Ask a few pairs of children to share their plans. Ask classmates to offer feedback. *Is this experiment fair? Will it give us the information we need? Why or why not? If not, what could be changed to make it fair?* Refer to the chart. *Now that we've heard some of your ideas, let's try to decide all together how this experiment will work best. Remember, to be fair, we will want to change only one variable. For this experiment, to test the hardness of materials that might be useful for making a chair, the only variable that is changing is the material we are using. The tool we use to scratch and the amount of pressure we apply needs to be the same throughout the experiment.* Walk through the chart one section at a time. *Determining pressure is a bit tricky. How could we describe the right amount of pressure to use each time? About as much as you use when you write with a pencil on a piece of paper? What about when you tap your friend gently on the shoulder? What is the right amount of pressure to test hardness?* Listen to, paraphrase, and synthesize children's ideas. Be sure to identify variables as they are introduced. Act as a scribe, and guide the group toward consensus for how to conduct the following day's experiment.
Standards	**2-PS1-1** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

	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.
Assessment	This experience will require a good deal of listening and negotiation on the part of the children. Pay attention to children's understanding of the concept of fairness in an experiment. Assess how well they explain their thinking.

Notes