

Comparing Brand X

1 The following steps will walk you through the Chapter 1 Project. Use the hints as you guide your students through discussions, observations, and conclusions.

◆ Chapter Project Overview

- ◆ This project deals with both experimental design and the physical properties of matter. To illustrate how you would conduct an experiment on the physical properties of matter, bring in two different brands of the same product, such as paper towels. Ask students how they would test the paper towels to determine which one cleans up spills better (*measure the absorbency*). Next, have students work out a procedure that you can follow to measure the absorbency of the paper towels. Point out that your experiment should produce measurable data that you can record. In addition, stress the importance of designing a procedure that will give reproducible results. In other words, anyone who correctly follows the procedure should get the same or nearly the same results as any other person.
 - ◆ After introducing the project, have students brainstorm about a few products that they might use in their experiment. They should also begin to think about the physical properties of these products, and how they could compare different brands.
 - ◆ Have students read the Chapter 1 Project Overview, pages 8–9. Review the project's rules, and hand out the Chapter 1 Scoring Rubric, page 12, that you will use for scoring students' work. Discuss with students what is expected of them.
 - ◆ Set interim dates for the Check Your Progress at the end of Sections 1, 3, and 4. Encourage students to copy the dates in the Project Time Line.
- ◆ Distribute copies of the Chapter 1 Project Worksheet 1, page 10. This worksheet will help students work on their experimental designs and data tables for recording their observations. Remind students to refer to the hints in the Chapter 1 Project Overview as they plan and carry out the project. Students can work with a partner as they make their plans.
 - ◆ Once students have written out their procedures, distribute copies of Chapter 1 Project Worksheet 2, page 11. Pair students with a new partner. Have them read through the questions on this worksheet before reviewing their partner's procedure. These questions will help them to evaluate their partner's design as they perform the experiment.
 - ◆ The new partners should now conduct their classmate's experiment exactly as written in their procedure. Allow time in class for the partners to discuss their findings. The partners should create two graphs—one for each of the experimental designs. Both students should record their findings for the same experiment on the same graph. Allow students time to discuss whether the results of their experiments were reproducible. If any results differed, ask students why they think the differences occurred.

◆ Materials and Preparation

- ◆ Some possible materials include batteries (measure how long they can operate), adhesive tape (measure strength of the adhesive by adding weight to a tape loop stuck to a surface), oils, syrups, or ketchups (measure viscosity by timing it as it runs down a sloped surface), and spaghetti sauce (measure volume of water in the sauce by passing it through filter paper and collecting the liquid).

CHAPTER 1 PROJECT *(continued)*

- ◆ Encourage students to suggest and use other materials as well, but make sure that they consider the cost of the products. They also need to obtain enough materials for two students to conduct each experiment three times.
- ◆ Check Your Progress—
Section 1 Review
- ◆ Students can plan their work with their first partner, then you can check students' experimental designs. Make sure that they have considered how they will measure, record, and interpret their data. Also, be sure that they will be able to conduct multiple trials of their experiment in the time allotted. Check students' procedures for potential safety hazards.
- ◆ Check Your Progress—
Section 3 Review
- ◆ Make sure that students have obtained their materials and have begun to conduct their experiments. Also, be sure that their written plans reflect any modifications that they have made to their experimental procedures. Periodically, check their data tables for completion.
- ◆ Check that students are conducting multiple trials with the same product. They should repeat each experiment at least three times, record their results for each trial, then record the average result of the three trials.
- ◆ Check Your Progress—
Section 4 Review
- ◆ Assign students new partners. The partners should exchange procedures and materials. Make sure that they conduct each other's experiments exactly as written in the procedures.
- ◆ Allow students time in class to meet with their partners to exchange findings and critique each other's procedures. Students may be surprised to find that their experimental procedures were not as easy to follow as they expected. They should realize that the procedure must be clear enough so that each person who follows it will perform exactly the same steps. Only in this way will their procedure give reproducible results. Make sure that the students modify their procedures to fix any problems that may have arisen.
- ◆ Chapter Project Wrap-Up
- ◆ Allow students time in class to meet with their partners and create one graph for each of the experimental procedures. It is important that both students plot their trials for the same set of experiments on the same graph. If they use separate graphs, it will be more difficult to compare data because students may use different scales.
- ◆ The students should make brief presentations to the class. In their presentations, students should briefly explain their final experimental procedure, summarize their findings, and compare their findings with those of their partner's. They should suggest reasons that their partner's trials may have resulted in different data (e.g., unclear procedure).
- ◆ Extensions/Options
- ◆ Cost is often very important to consumers. In their experiments, students may have shown which brand is best, but is it the most cost-effective? Have the students include a cost comparison as part of their project. They will need to do some calculations, such as cost per unit, to discover which brand is actually the best product for the money.

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In this chapter, you will examine some of the properties of matter. All products (food, electronics, household goods, crafts, etc.) are examples of matter. These products all contain properties that we, as consumers, find important. We usually purchase these products based on our experience with their properties. For example, we buy the brand of cookies that tastes the best and the paper towels that absorb the most water. How do we know which product is best? Our past experiences with these products usually help us to decide. How accurate are our opinions about these products? In this project, you will be designing and conducting scientific experiments to help answer these questions.

You will begin this project by choosing a product, such as paper towels, and a property of this product that you feel is important, such as absorbency. You will work with one partner to design an experiment to test three different brands of your product. In your plan, you will describe the step-by-step experimental procedure that you will use, as well as how you intend to measure, record, and interpret your data. You will then conduct three trials of your experiment, collect data for these three trials, and draw conclusions. Finally, you will be paired with a new partner with whom you will exchange procedures and materials. You will then analyze his or her products as directed by his or her procedure. Finally, you and your partner will compare your findings, and you will give a brief presentation to the class.

◆ Project Rules

- ◆ Your plan should include your step-by-step procedure, information about how you intend to measure, record, and interpret your data, and any data tables that you intend to use.
- ◆ Have your teacher approve your plan before you obtain your products and begin your experiments.
- ◆ You must conduct at least three trials of each experiment, record the data from each trial, then record an average based on all trials.
- ◆ Make sure that you obtain enough samples of each product so that both you and a classmate may conduct at least three trials of each experiment.
- ◆ When using your second partner's procedure, you must follow it exactly as written. You cannot modify it in any way.

CHAPTER 1 PROJECT OVERVIEW *(continued)*

◆ Suggested Materials

- ◆ You may choose any product that you want to study. Some examples include batteries (measure how long they work); adhesive tape (measure strength); oils, syrups, and ketchups (measure how fast they flow); spaghetti sauces (measure volume of water they contain); and laundry detergent (measure cleaning ability). Make sure you pick materials that are easy to obtain, inexpensive, and will allow you to obtain measurable results.

◆ Project Hints

- ◆ When developing your plan, it may be helpful to obtain a sample of the product and make a practice test using your procedure. This way you can test your plan before going further.
- ◆ Consistency is important in scientific work. You will need to conduct at least three trials with each of your products, analyze the individual results, and find the average of the results.
- ◆ To ensure that your second partner will be able to reproduce your results, have a different student read through your procedure. Then ask this person what steps they would perform if they were to conduct the experiment. Make any necessary changes based on this person's responses so that your procedure is clear and easy to understand.

◆ Project Time Line

Task	Due Date	Teacher's Initials
1. Chose product and properties to test.	_____	
2. Complete Worksheet 1 and experimental design.	_____	_____
3. Complete all trials using student's own procedure.	_____	
4. Complete student consultation and Worksheet 2.	_____	
5. Complete all trials using the partner's procedure.	_____	
6. Meet with partner and make graphs of all data.	_____	
7. Present summary of project to the class.	_____	

CHAPTER 1 PROJECT

WORKSHEET 1

Designing Your Experiment

Answer the following items on a separate sheet of paper. When the tasks have been completed, you are ready to get your teacher's approval and begin the Chapter Project.

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1. What product will you be studying?
2. What property of this product will you test?
3. What three brands will you examine?
4. How will you obtain these products? How much will this cost?
5. Write a step-by-step procedure detailing the experiment that you will conduct to test your products. Make sure that you explain how you will collect and record your data (that is, what measurements you will make).
6. Create a table, similar to the one below, in which you will record your data.

Brand	Volume of Water Absorbed			Average Volume	Observations and Comments
	Trial 1	Trial 2	Trial 3		
Brand X	10 mL	11 mL	9 mL	10 mL	The paper towel absorbed 10 mL of water.
Brand Y	7 mL	5 mL	7 mL		I knocked over the beaker with the water in it, so the measurement in trial 2 is not accurate.
Brand Z					

CHAPTER 1 PROJECT

WORKSHEET 2

Evaluating Your Partner's Experiment

Read through the following questions. Then review your partner's procedures, and complete this worksheet on a separate sheet of paper. After you have answered all of the questions, meet with your partner to discuss your answers.

Student presenting experimental design:

Reviewer's name:

Product to be studied:

Three brand names to be compared:

Property to be compared:

Comment on the experimental design in the following areas:

1. What variable is your partner measuring?
2. What other variables are being kept constant?
3. Is the procedure easy to understand? Are there any steps that are unclear?
4. Does the experimental design allow for more than one trial? How many times will each brand be tested?
5. Can the testing be completed in one class period?
6. Does the procedure measure the chosen property? What will be measured? What is the unit of measurement? What tool is needed to make these measurements?
7. Is the data table for the experiment well organized? Does it allow room to record measurements for each trial and an average measurement?
8. Are adequate safety precautions being followed? What safety equipment or procedures are needed?
9. How much material is needed for each trial? Is the cost of these supplies reasonable?
10. Give suggestions for improving the experimental design.

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In evaluating how well you complete the Chapter 1 Project, your teacher will judge your work in four categories. In each, a score of 4 is the best rating.

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	4	3	2	1
Identifying a Property and Choosing a Product to Test	Student has identified a specific property and three brands of a product to study. Property can be tested in the time allowed.	Student has identified a property and three brands of a product to study. Property can probably be tested in the time allowed.	Student has identified a property and two brands to study. Property probably cannot be tested in the time allowed.	Student has identified a property, but only one brand of a product to study. Property cannot be tested in the time allowed.
The Experimental Procedure	Experimental design is clearly written and easy to follow. Procedure will give reproducible results. Data table is constructed to record and analyze all measurements.	Experimental design is written fairly clearly and can be followed with minimal difficulty. Procedure will give reproducible results. Data table is constructed to record and analyze most measurements.	Experimental design is somewhat unclear and hard to follow. Results may not be reproducible. Data table is constructed to record and analyze most measurements, but the table is difficult to understand.	Experimental design is difficult to understand. Results are not reproducible. Data table is not constructed to record and analyze measurements.
Presentation and Written Results	Presentation and written analysis are thorough and well organized.	Presentation and written analysis are mostly complete and fairly well organized.	Presentation and written analysis are somewhat incomplete and unorganized.	Presentation and written analysis are incomplete and poorly organized.
Working Cooperatively	Evaluation of partner's experiment is effective. Provides useful feedback both orally and in writing.	Evaluation of partner's experiment is mostly effective. Provides useful feedback both orally and in writing.	Evaluation of partner's experiment is somewhat effective. Provides some useful feedback either orally or in writing.	Evaluation of partner's experiment is minimally effective. Fails to provide useful feedback either orally or in writing.