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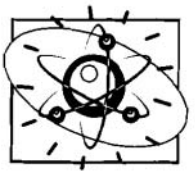
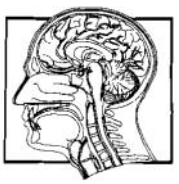
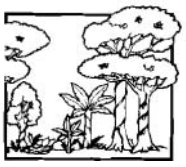






Introduction

Science fair—when spoken in a classroom or curriculum meeting, these two words can create a wide range of emotions. Some sigh and exclaim, "Oh, no! Not again!" Others proclaim, "Oh, boy, I can't wait to get started!" No matter which side of the fence you're on, a science fair allows students to explore scientific inquiry. Their hands-on projects promote scientific literacy by engaging them in the science process.

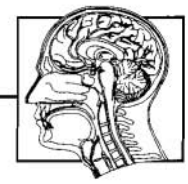
Science fairs vary from school to school in the level of competition. But the importance of science fairs is in students learning to move beyond simple recall using someone else's information and entering an environment that encourages them to ask their own questions. They use the scientific method to accumulate information from which they can derive answers to their questions. A science fair encourages students in a particular way of thinking and processing information. This cognition extends to other areas as students become more aware of the world around them. In addition, students will begin to see science as a multistepped process instead of a book of facts. Because the experiments generally extend over a period of time, students learn that finding answers involves both patience and a proper method of data collection.

This book provides science fair project ideas for students and teachers. Experiments give step-by-step procedures based on the scientific method. This approach allows students to carry out experiments and to learn how scientists discover all those facts they read in their science textbooks.

In the beginning of the book are several pages to help students understand the steps of the scientific method, as well as how to collect and communicate data in the most appropriate format.

The "Baffling Liquid Challenge" (p. 16) gives teacher information to help you guide students through an experiment. After that, they begin working independently. Extensions and alternatives at the end of each project give students more options. The book ends with a presentation guide to help students present their findings. Even the most wonderful experiment may not receive the recognition it deserves if it is not displayed and organized in the right way.

A great way to choose experiments for the science fair is through brainstorming. Brainstorming helps the teacher discover what students are curious about. All topics mentioned during brainstorming, such as plants, cars, bugs, electricity, and even music, should be recorded. Next, ask your students to think of questions related to each topic. Questions can range from why certain bugs live in certain areas to why dogs hear higher notes than humans do. Brainstorming not only generates excitement and anticipation about the science fair, but it also helps students identify their areas of interest.



Do You Measure Up?

Step One

MAKE AN OBSERVATION. Do you wonder how forensic scientists and anthropologists can tell how tall a person was by examining the person's bones? With 206 bones forming the human skeleton, it's not surprising that scientists can gain a lot of information by studying bones. Forensic scientists and anthropologists can estimate the heights, ages, and builds of deceased animals and people by looking for relationships and patterns in the skeletal systems of living animals and people. The length of certain bones helps scientists determine the height of an individual by using a mathematical formula. Discernable differences between the bones of males and females allows scientists to identify the sex of skeletal remains. Bones are more than just a framework to hold a body upright and protect its organs. Bones also provide scientists with valuable information that can be used to reconstruct the past.

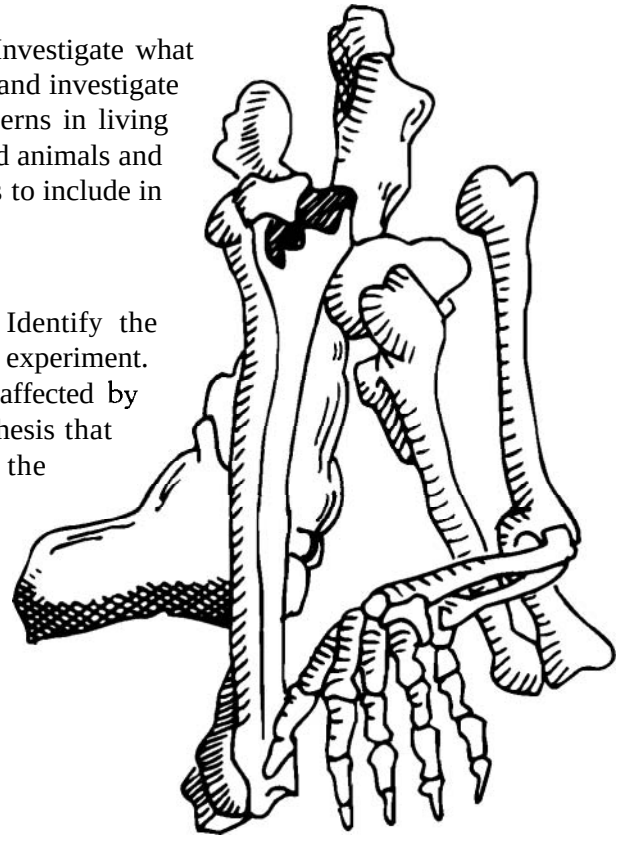
Step Two

STATE THE PROBLEM AND POSE IT AS A RESEARCH QUESTION. Determine if the formulas used by anthropologists and forensic scientists to infer the height of an individual based on her or his skeletal remains are valid. You will conduct a demographic study with some of your classmates as subjects to compare actual heights with calculated heights.

- What is the effect you observe?
- What is the possible cause of the effect?
- How can it be posed as a research question?

Step Three

CONDUCT YOUR RESEARCH. Investigate what anthropologists and forensic scientists do and investigate how they look for relationships and patterns in living things to draw conclusions about deceased animals and people. Write a summary of your findings to include in your presentation.



Step Four

FORMULATE A HYPOTHESIS. Identify the independent variable that changes in your experiment. Identify the dependent variable that is affected by what you change. Write a testable hypothesis that predicts the relationship between the independent and dependent variables. Your hypothesis may predict that all of the formulas you test provide the same level of accuracy, you may predict that one formula is more accurate than the others, or you may predict that none of the formulas provide an accurate calculation.

Step Five

DESIGN AND CONDUCT YOUR EXPERIMENT.

A. Identify the variables you will keep the same during the experiment. Consider using the same recipe, the same nonleavening ingredients, the same oven, and observing the same characteristics for each batch of cupcakes.

B. Materials: flour, sugar, butter, eggs, milk, vanilla, baking soda, baking powder, yeast, measuring cup, measuring spoons, 2 mixing bowls, wooden spoon, 32 cupcake liners, a permanent marker, 1 six-holed cupcake pan, and an oven

C. Procedure

1. Label cupcake liners with the leavening agents shown below. You will make 4 cupcakes with each leavening agent.
   - A. 2 tsp. baking powder
   - B. 1 tsp. baking soda + 1/2 tsp. vinegar
   - C. 2 tsp. baking soda
   - D. 1 tsp. baking soda + 1 tsp. baking powder
   - E. 1 tsp. dry yeast
   - F. 1 whipped egg white
   - G. No leavening agent (control)
2. Preheat oven to 350°F. Line the muffin tin with 4 cupcake liners for the first leavening agent. Put 1/8 cup water in the empty cups of the pan.
3. Follow the recipe below to make the batter for 4 cupcakes.

Cupcake Recipe

a. Measure 1/2 cup + 1 tablespoon + 1 teaspoon of flour into a mixing bowl.

b. In another bowl, cream 1/2 cup sugar with 1/2 cup butter until smooth.

c. Add 1/2 cup of milk and 1 egg to the creamed sugar and butter. Mix well with a wooden spoon.

d. Add test leavening agent to the flour. Mix the dry ingredients with the moist ingredients using a wooden spoon until the batter is smooth. Do not overmix.

e. Spoon the batter into the cupcake liners until the liners are 2/3 full.

f. Bake the cupcakes for 15 minutes.

g. Remove the cupcakes from the oven and let them cool on a wire rack.

D. Collect Data.

After the cupcakes cool, fill in table 5.6 (p. 120). Repeat the procedure with the other 5 leavening agents and with no leavening. Complete your observation table.