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SCIENCE FAIRS AND SCIENCE FAIR PROJECTS

THE GAME PLAN

To understand what a science project is and how it works. To understand what a science fair is and what happens at a science fair.

What Is a Science Fair Project?

A science fair project is different from any other type of project you work on at school. It is an independent educational activity that encompasses a variety of skills, many of which you have to teach yourself as you go along. A science fair project gives you hands-on experience and knowledge in your own independent field of study of a particular topic in science, math, or engineering. It is a challenging extracurricular assignment that allows you to use your own ideas to investigate a scientific problem or question that interests you according to a process called the **scientific method** (defined more fully in the box on the following page).

A science fair project is *not* a book report; a term paper; a history project; a collection; a demonstration of a well-known scientific fact, principle, or discovery made in the past; or a display of something in science or nature. Don't be confused by science projects that you may see in books or on the Internet that are designed specifically to demonstrate certain scientific principles. Those projects might provide instructions on how to build or construct various items, such as a windmill, a camera in a box, a battery, or an electromagnet or motor, or demonstrate how things like magnetism, air resistance or drag, or electrolysis work, and so on. Although those projects are wonderful to sample in your free time or as classroom projects, they are not the same as a science fair project. A true science fair project poses a specific scientific question, the subject of which is studied and tested in order to arrive at a credible answer or a better technique or final product. To give you an example, a science fair project usually presents a question, a problem, or a purpose in one of the following cause-and-effect formats:

What is the effect of A on B?

How does A affect B?

To demonstrate, just substitute A with one of the following terms:

- water content
- humidity
- temperature
- light

and substitute B with one of the following:

- bean plants
- earthworm behavior
- rusting
- heat conduction

Once you can identify a science fair project topic, you need to know how to work with that topic to scientifically answer the question that is being asked. Simply put, you use the scientific method, which is a way of thinking and approaching a science project topic.

The Scientific Method: The Blueprint

A **science project** may appear in many different forms, so it is helpful to understand the blueprint behind a science project: the scientific method. This method is a way to study a scientific problem in order to answer a proposed question or develop a better technique or final product through repeated tests and observations in a controlled environment. The scientific method consists of the following elements: problem or purpose, hypothesis, research and procedure, experiment, and analysis of results or conclusion. The following list defines each element of the scientific method and provides a basic example of how to work with a topic according to this method.

An Illustration of the Scientific Method

1. *Problem or purpose:* The question or **problem** you are seeking to solve.
   Example: Does listening to classical music influence memorization ability?
2. *Hypothesis:* Your observation or educated guess about what might take place through your research and experimentation, or your estimated solution to the problem and the results you expect to achieve from your experiment.
   Example: Since it is known that piano and singing instruction increases abstract reasoning skills in children (known as the Mozart effect), I believe that listening to classical music increases memorization ability.
3. *Research and procedure:* The process by which you gather information. This may include consulting reference materials and mentors or professionals in the scientific field you are studying, or other people or organizations related to your subject who will help you understand your topic. You will then use this information to formulate a procedure that will test your hypothesis through an experiment.
   Example: Through reading various articles and consulting with a professor of psychology at a local university, you may have learned about studies that have been conducted on the Mozart effect in terms of cognitive development. You may have learned about short-term improvement of spatial reasoning ability in human subjects that have been exposed to music by Mozart. Your **research** may have led you to wonder if memorization ability would also be improved by listening to Mozart's music.
   At this stage, you would try to develop an experimental plan to test or answer your

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query. You would need to identify what you are testing (for example, the ability of children to memorize) or the **dependent variable**—that aspect of the experiment that is being tested; how you will test it (for example, playing Mozart's *The Marriage of Figaro* while students memorize) or the **independent variable**—that aspect of the experiment that is being changed or manipulated; what controls will be used (for example, the ability of students to memorize without music) the **control** being that part of the experiment that is not altered or changed; and how the results will be observed and measured.

Example: Two groups of seventh-grade students will be tested. Group I (the test group) will be asked to study the periodic table of the elements and the corresponding symbol for each element during a one-hour period while listening to the Mozart classic *The Marriage of Figaro*. Group II (the control group) will be asked to study the same material during a one-hour period of silence. At the end of one hour, each group will be given a written test to see how many elements they can recall when given the corresponding symbol for each.

4. *Experiment:* The process by which you carry out the procedure you outlined during the research and procedure stage to test your hypothesis. You will conduct tests using variables and controls and collect data results. An experiment is usually repeated several times to make sure consistent data results are obtained.
5. *Analysis and conclusions:* The stage where you analyze your data results in order to form a solution to your proposed question and proof or rejection of your hypothesis.

   Example: Based on the data obtained from this test, it appears that the introduction of classical music during study time does not have any effect in increasing memorization ability.

At this point, you will need to look at how the results may have varied among different students and trials. Are there ways that the experiment can be improved for future study of the problem?

While a science fair project is modeled on the blueprint of the scientific method, which gives you the opportunity to think and work like a scientist, keep in mind that it also provides you with many more learning opportunities and skills. You will learn how to investigate; network (meet people and make connections); conduct interviews; follow rules and guidelines; use various scientific procedures, tools, and equipment; analyze **data**; draft an **abstract**; write a **report**; prepare a **display**; and speak in public, all in one assignment! Yes, a science project is a big assignment. However, when we break down this process into workable bite-size pieces, the task not only seems more manageable but becomes fun and rewarding. With work and dedication, the experience you will gain and the skills you will achieve from this extraordinary activity will reap you many rewards.

What Is a Science Fair?

Every spring, thousands of students in grades 5 through 12 prepare science fair projects for competitions held by school districts, regions, and states. These fairs are

public exhibitions of the students' projects to recognize their work and to stimulate interest in science. Professionals from the scientific community often judge the science projects. Students who participate can earn valuable experience along with educational grants, scholarships, and other prizes. Additionally, many college recruiters give science fair project participation high marks in considering an application for college admission.

Most regional and state **science fairs** are affiliated with the **Intel International Science and Engineering Fair (ISEF)**. This prestigious science fair competition is held in May every year in a major U.S. city. The ISEF includes some twelve hundred top science fair projects from high school students around the globe who are winners from state and regional Intel ISEF–affiliated fairs. This annual event is administered by Science Service, Inc., a national nonprofit group based in Washington, D.C. Science Service also administers the **Discovery Channel Young Scientist Challenge** (for students in grades 5 through 8) and the very prestigious Intel Science Talent Search (for high school students).

If you would like more information about the Intel ISEF, the Intel Science Talent Search, the Discovery Channel Young Scientist Challenge, or an affiliated science fair in your area, contact

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— Exercises —

1. Look at the following project topics and determine which are science fair projects and which are not. What can be done with those topics that are not science fair projects to change them into workable science fair projects?
   - Does the design of an air glider affect its performance?
   - How radar works.
   - Do fat-free potato chips contain more oil than regular potato chips?
   - A study of the history and extinction of dinosaurs.
   - An examination of the types of seashells found off the New England coast.
   - Can a simulated volcano be built?
   - Does a correlation exist between aroma and the Mozart effect?
   - How does the human eye work?
   - What nutrient is best for cultivating yeast?
   - What method of water purification is most efficient?

2. Take the following basic project topics and determine the process for handling them using the scientific method. Think about how you would form a hypothesis statement, how and where you would research the topic, ways that you might develop a procedure for an experiment, and how you would collect your data. (You may need to conduct some minor preliminary research in order to work with the topics.)

Which antacid tablet will neutralize the most stomach acid?

Hypothesis:

Research and Procedure:

Experiment:

Analysis and Conclusions:

Does natural or artificial insulation work best?

Hypothesis:

Research and Procedure:

Experiment:

Analysis and Conclusions:

At what pH level does bacteria grow best?

Hypothesis:

Research and Procedure:

Experiment:

Analysis and Conclusions: