Student Handbook

Greater
Philadelphia
Homeschool
Science Fair

GPHSF Student Handbook

Table of Contents

Science Fair Rules & Guidelines 3
- Project Guidelines 3
- Science Fair Rules 4

Steps to Preparing a Science Fair Project 4
- Choose a Topic 4
- Review the Literature 5
- Select a Question 5
  - A Controlled Experiment 6
  - Demonstrations vs. Experiments 6
- Form a Hypothesis 7
- Test the Hypothesis 8
- Prepare the Results 8
- Explain the Results 8
- Draw Conclusions 8

Presenting Your Project 9
- Visual Display 9
- Oral Presentation 10
- Written Report 11
  - Grades K to 5 11
  - Grades 6 to 12 11
  - Sample Abstract 12
- Logbook/Scientific Notebook 13

About Parent Participation 14

Sample Judging Sheet 15

Much of the information contained in this booklet has been adapted from *Not Just Another Science Fair*, by Laura Vazquez, *et al.*, and is used by permission. Additional information has been adapted from the International Science & Engineering Fair Rules & Guidelines and from various publications by Delaware Valley Science Fairs, Inc.

Compiled by Lisa Swieson, GPHSF Director.

Visit the GPHSF web site:
www.fair.science-resources.org

Science Fair Rules & Guidelines

Project Guidelines:

1. All project work must be done at home under parental supervision or at an institutional site under the direction of a qualified scientist.

2. ***Eligibility***: Each student may enter only one project which covers research done over a maximum and continuous 12-month period beginning no earlier than January of the previous year. In addition, students must have been homeschooled for the duration of the project. Projects entered in this or another science fair during the previous school year are ineligible. Continuation of a project from a previous year is permitted, as long as the entered project presents new research conducted during the current school year.

3. 6th to 12th grade students (4th to 12th in Philadelphia and Chester counties) wishing to enter a project in a county science fair should fill out the ISEF forms (1, 1A, Research Plan Attachment, & 1B at minimum) and return them to the GPHSF Director with the registration form by December 1. A parent should sign as the sponsor of the project.

4. Students must do their own projects. Parents should not do the project for the child! Remember, each child will be judged on his or her knowledge of the subject. For more details, see page 14.

5. Two or three students may work together to complete a single project. However, they will be judged at the grade level of the oldest student. Each student in the team must fill out a registration form.

6. ***Restricted Topics:*** If your project deals with a restricted topic, it will require additional paperwork. Copies of required paperwork should be submitted before **December 1** in order to obtain approval before commencing. (Remember: you keep the originals!) Guidelines and forms (in PDF format) for all grades are available online at **www.fair.science-resources.org/restrictedtopics.htm** or at **www.sciserv.org**). If you do not have Internet access, please contact the GPHSF Director to request forms for such projects. General guidelines, adapted and condensed from the ISEF rulebook, follow:

   a) *Human Subjects:* With appropriate documentation [Human Subjects Form(s)], normal physiological and behavioral studies may be carried out on people. Projects must be carefully selected so that neither physiological nor psychological harm can result from the study. In many circumstances, a consent form—signed by the parent of a subject younger than 18—will be necessary for each subject before testing. These include: 1) ingestion or application to the skin of any substance; 2) exercise beyond normal activity; 3) invasion of privacy or emotional stress (e.g., any type of survey); 4) minors as subjects. Please contact the GPHSF Director to get information about who should sign human subjects forms before you mail them in.

   b) *Animal Experiments:* All science fair experiments involving vertebrate animals must follow strict rules regarding procurement, housing, husbandry, etc., and must be pre-approved by a veterinarian. Consider using lower orders of life, such as protozoa or insects, which can reveal much basic biological information and, being invertebrates, are not subject to vertebrate animal restrictions.

c) *Experiments with Pathogens*: Anything that can be cultured (grown on a food source, like mold or bacteria) is considered potentially pathogenic. Experiments which involve culturing such life forms may not be carried out in the home; these must be done in a laboratory setting under the supervision of a trained scientist. (However, it is permissible to study whether certain conditions inhibit growth of *food* molds in the home.)

d) *Other Restricted Experiments:* Experiments involving human or animal tissue (including bodily fluids), recombinant DNA, controlled substances, or hazardous substances or devices are prohibited for grades K though 5. (An exception may be made for animal tissues like bones or eggshells purchased from a reputable grocery store. Paperwork is still required.) Such experiments are allowable for grades 6 to 12 with appropriate ISEF documentation and prior approval.

Science Fair Rules:

1. All projects must be checked in by the time indicated on the information sheet you will receive after registration.
2. The GPHSF Committee reserves the right to refuse the display of any item which it deems potentially hazardous, including but not limited to:
   a) Any liquid – including water – in an open container
   b) Flames or highly combustible materials
   c) Dangerous, sharp, or poisonous materials
   d) Living organisms
   e) Human or animal body parts or bodily fluid
   f) Batteries with open-top cells
   g) Laboratory or household chemicals
3. Electricity will not be available at the fair.
4. No parent or visitor may be present while a project is judged. (Judges will wear ribbons, so it will be clear when a project is being judged.)
5. Ribbons and prizes for outstanding projects will be awarded at the Awards Ceremony.
6. The decision of the judges is final. The criteria given on the Science Fair Judging Sheet (see back cover) are used for all projects, and a computer program normalizes results before awards are assigned.
7. All exhibits must be removed by the time indicated on the information sheet provided each year. Exhibits not removed will be discarded.

Preparing a Science Fair Project Using a Scientific Method

A. Choose a Topic

Choose something you are interested in and want to learn more about. Make sure your ideas are not too broad. For example: "I want to investigate what plants need to grow," rather than "I want to study plants."

B. Review the Literature

After the topic has been selected, start the research process. Because this will help you understand and predict what will happen during your experiment, even young students should do at least some research. Encyclopedias are a good place to start, but don't rely on them exclusively! Go to the library. Find recent books and scientific journal articles, and check the Internet. Contact companies who might be doing research in your chosen field; they often have information they could send you, or you could interview one of their scientists. Notes and bibliography from all of this research can be recorded in the logbook/scientific notebook.

For grades 6 to 12 only: This preliminary research, written up in the format of a short paper, becomes the bulk of the introduction of the project report (see page 11). Parents: Some science fair sponsors require this short research paper of their students *before* they continue with their question and hypothesis, rather than putting it off and writing it with the rest of the project report after experimentation. This is recommended but is up to you.

C. Select a Question

Now that you have done some research, you should have a question or two in mind: "I wonder what would happen if…?" You want to select a question that you can answer by conducting an experiment. Sometimes you can find good science fair questions in books, but be careful! Many books suggest science fair questions that are really demonstrations. Make sure that you cannot answer the question with a simple yes or no. Also be sure that you will change something and measure something when answering the question. If you cannot figure out what you will be changing in doing the experiment, you probably have a demonstration question and not an experiment question. (See the GPHSF web site for hundreds of sample project questions and links to sites with more!)

Be creative! There are many experiments familiar to adult scientists, which are nevertheless new to children who are just beginning their work in science. These familiar experiments, when they are done well, make fine science fair projects. However, creativity is an important element of any science experiment. In a science fair, students earn points for using creativity in their choice of a question or in their approach to the answer. Students are encouraged to try a new way of testing something or to design a procedure in a better or unusual fashion. Even if you are not sure whether a new method will work, the judges will appreciate your effort in thinking of something new and different. Such topics can make excellent science fair projects if they are done using a scientific method.

As you choose your experiment, consider several things:

1. You must be able to perform a controlled experiment (defined below) using a scientific method.
2. Demonstrations and models, while good learning tools, are not experiments. For example, a model showing how a human heart works is not appropriate. (See next page for more details.)
3. Make sure the equipment you will need to do your experiment is readily available.
4. Consider the time needed to complete the experiment. For example, experiments involving living things (plants, animals, bacteria…) are unpredictable and take longer, so they must be started early.

Demonstrations vs. Experiments. While demonstrations and models can help you learn many important concepts, this science fair requires students to do an experiment following a scientific method. Here are some examples of questions that do not require an experiment but can be answered by reading a book or making a model.

1. Can I grow bread mold? This can be shown by simple demonstration.
2. Do plants need light to grow? This question can be answered by a simple "yes" or "no" and a demonstration.
3. How does a battery work? This question can be answered by a model or demonstration.

Do not pick these kinds of questions! Instead, turn these demonstrations into experiments as the following questions do:

1. What is the effect of different temperatures on growing bread mold?
   Manipulated Variable: Temperature
   Controls: Light, moisture, kind of bread, location of sample
   Measurement of Responding Variable: Amount of mold (area)
2. Under what kind of light do plants grow best (grow lights, fluorescent light, sunlight)?
   Manipulated Variable: Kind of light
   Controls: Kind of plant, location, moisture, kind of soil, size of pot
   Measurement of Responding Variable: Height of plant
3. How does temperature affect the life of a battery?
   Manipulated Variable: Temperature
   Controls: Kind and size of battery, type of flashlight, length of time at each temperature
   Measurement of Responding Variable: Length of time the battery will operate a flashlight bulb

NOTE: The judges will be asked to classify the projects as demonstrations or experiments. An experiment must have something that is changed (manipulated variable) and a measurement.

A Controlled Experiment is a necessary part of the process of scientific investigation and contains the following types of variables:

1. **Manipulated (or Independent) Variable:** This is the one variable you will change in your experiment. For example, if you wanted to know how fertilizer affects plant growth, the amount of fertilizer applied is the only variable that you would change. A good experiment will test several concentrations of fertilizer and compare the growth among all groups.
2. **Responding (or Dependent) Variable:** This is the variable that changes as a result of the changes in the manipulated variable. In our fertilizer example, the responding variable would be the size of the plants.
3. **Controlled Variables (or Controls):** These are all the things that you will keep the same in your experiment. Controls in our example would include: the origin of the seeds (they must all come from the same package and should be randomly selected), the amounts of light and water each plant receives, the type of soil used (same type, brand, etc.), the size of the pot, and the temperature.

Also necessary in a controlled experiment are measurements. The manipulated variable should be carefully measured. (You should give each group of plants a precise amount of fertilizer.) Controls should also be carefully measured to ensure that conditions in all test groups are kept constant. The measurements of the responding variable become the results of your experiment. It is usually better to measure changes in time, distance, height, and so on — things you can measure in numbers — but sometimes, you may want to "measure" things by just looking at them and observing change (e.g., changes in color). In our example, the responding variable (plant height) would be measured in centimeters or inches, but differences in color would also be important to observe and document.

Be sure to set aside one group as a control group, which will be subject to all conditions of the experiment except for the manipulated variable. In our example, the control group of plants would be grown under the same conditions as the test plants except that no fertilizer would be given.

D. Form a Hypothesis

Once you have chosen your question, you then form your hypothesis. This is an educated guess or prediction (based on your preliminary research) about what will happen as a result of your experiment. Forming a hypothesis will help you design your procedure, and the experiment will then prove or disprove your hypothesis. If you have done adequate research, forming a hypothesis should be easy. Using questions 1-3 on the previous page as examples, we will write an appropriate hypothesis for each, specifying the variables for each one.

Question 1: What effect does side lighting have on plant growth?

- **Hypothesis:** Because plants need light to grow, they may grow to different heights if light comes from different directions. I believe that top lighting should result in taller plants than lighting from the sides, and that top and side lighting combined would yield the tallest plants.
- **Manipulated Variable:** Direction of light
- **Responding Variable:** Height plant grows in a certain length of time
- **Controlled Variables:** Type of plant, length of time in light, amount of light, size of pot, type of soil, amount of water

Question 2: What effect does the rate of use have on total battery energy?

- **Hypothesis:** Based on my preliminary research, batteries tend to provide more energy when used slowly. Therefore, a flashlight with a lower-wattage bulb would have a greater total light output (in watt-hours) than one with a higher wattage bulb.
- **Manipulated Variable:** Size (wattage) of flashlight bulb
- **Responding Variable:** Time the battery powers a flashlight
- **Controlled Variables:** Kind of battery, kind of flashlight, age of batteries

Question 3: What effect does the shape of a parachute's hole have on its falling speed?

- **Hypothesis:** Shapes that interfere with the passage of air should cause a slower fall if the chute remains stable. Therefore, I believe that a round hole would result in a faster descent than a square or triangular hole.
- **Manipulated Variable:** Shape of the hole
- **Responding Variable:** Time for parachute to fall
- **Controlled Variables:** Hole area, size of parachute, length of fall, shape of the parachute

E. Test the Hypothesis

Plan the details of your experiment, then carry it out:

1. Identify the manipulated and responding variables and your controls.
2. Determine what you will measure and what instrument(s) to use. Metric measurements are often preferable but are not required.
3. In your logbook, list all the materials you will use, including how much or how many of each item, and gather your equipment.
4. Plan how the tests will be done, and list each step of the process—your "procedures." This should be done as a step-by-step list, not in paragraph form. Again, be sure to include measurements: how much, how often, how long.
5. Prepare pages in your logbook for recording measurements (i.e., set up blank tables in which to write your data) and for your comments.
6. As you perform the tests, follow your procedures exactly. It is important that you repeat each test several times so that you can be sure of your results. (Testing something only once does not give accurate results.)
7. Enter all measurements into your logbook. Carefully observe what happens at all times, and write down everything! Remember to record dates and times accurately.

F. Prepare the Results

Group and organize the measurements you have made. Make charts, graphs, and tables to show your results, using numbers wherever possible. Be sure the axes of all graphs are labeled! You may find that you will have to do more tests or perhaps make different measurements if you notice something happening that you cannot explain. If one measurement is very different from all the others, check your comments in the logbook to be sure that nothing unusual happened during that trial. For example, if you accidentally knocked over one of your test plants, your results from that particular plant may not be accurate and you may need to exclude it. This is one reason that it is essential to have a few samples in each test group.

G. Explain the Results

This section is often called the Discussion. It is a good idea to spend some time thinking about your results and talking to other people about them. Think about what the charts, tables, and your comments mean. Note patterns and amounts. Try to explain how or why the results came out as they did. What was the cause? Do the results agree with your hypothesis?

H. Draw Conclusions

What can you say about your experiment? Was your hypothesis correct? What is likely to happen if someone else does a similar experiment? Again, note patterns and amounts in your conclusions. If possible, try to describe how your results might apply to everyday experiences. For example, should you use plant fertilizer, or is it just a waste of money?

Presenting Your Project

Your presentation must include:

- Visual display
- Oral presentation
- Written report
- Logbook/Scientific Notebook (optional for grades K to 5)

Visual Display

Every student must have a visual display to accompany his or her project. Begin by making a small sketch of what you want your display to look like. Things to remember about your display:

1. Your display board should be a self-supporting two- or three-sided display and must be durable and safe. It may be constructed of posterboard, tagboard, corrugated cardboard, plywood, paneling, or pegboard, reinforced to stand securely on its own. Movable parts must be firmly attached.

2. Maximum display size:
   Grades K-5: 36" wide x 30" deep x 72" tall
   Grades 6-12: 48" wide x 30" deep x 72" tall*
   *These dimensions comply with ISEF regulations. Of course, your display *can* be smaller than this.

3. Lettering should be clear and legible. Titles should be readable from two to three feet away. Stencils, precut letters, or large computer lettering are good choices.

4. Use attractive, attention-getting colors. Do not clutter your display with unnecessary information. Be neat and orderly, following the steps of the scientific method in your display:
   a) Title
   b) Question
   c) Hypothesis
   d) Materials & Procedure—photos or drawings may be useful
   e) Results—often best presented in charts or graphs; include statistical analyses where appropriate
   f) Conclusion

5. You may also display items such as models, equipment used, etc. if they enhance your presentation. (Photographs of human subjects may not be displayed without their signed consent.) Please refer to Science Fair Rules (p. 4) for a list of items that may not be displayed.

6. If your project required additional paperwork (see pp. 1-2), this paperwork must be available at your booth, but need not be displayed.

7. **6th - 12th graders entering county fairs:** Your name and/or school must <u>not</u> appear on the front of the display.

Oral Presentation

Every student who is to be judged must give a short oral presentation to the judges. (Students in grades K to 2 may simply answer judges' questions if they prefer.) The talk should be a few minutes long (five minutes maximum). When you give your presentation, include the following information:

1. What is the title of your experiment?
2. What is the question you wanted to answer? (Purpose)
3. Before you did the experiment, what did you think would happen? (Hypothesis)
4. Which books or articles have you read?
5. What materials and equipment did you use?
6. What did you do to answer your question? (Procedure) Be sure to tell the judges what you changed (manipulated variable), and what changed as a result (responding variable). Also mention those things you kept the same throughout the experiment (controls).
7. What happened? (Results)
8. What is the answer to your question? (Conclusion)

Interview: Be prepared to answer questions from the judges, such as:

1. Did you get the results you expected?
2. What caused the results that you found?
3. Would you expect me to get the same results if I followed your procedure and conducted this experiment at my house?
4. Why did you design the experiment this way?
5. Did anything change besides the manipulated variable?
6. What might happen if you changed _______________?
7. If you could do this project over, what would you do differently?
8. Did you do the project yourself? If not, what did your helper do?
9. Could you do other things with this project next year?

It is acceptable to refer to your logbook during your interview with judges to cite findings not recorded on your display board.

Appearance: Good manners, neat clothing, and enthusiasm for what you are doing will help to impress the judges. Some other suggestions:

- Make eye contact with judges
- Stand up straight and to the side of your exhibit
- Don't distract the judges by fidgeting or looking around
- Speak with enthusiasm, clarity, and assuredness
- Relax, smile, and have fun!

Written Report

Three copies of your written report must be turned in or mailed to the GPHSF Director one week prior to the fair, *if your project is to be judged.* Because these reports will be mailed to each judge ahead of time, please keep the following in mind:

- **Please try to be on time.** The judges will not have time to read papers on Saturday morning. Call or email if you will be late.
- **Please do not use an unnecessarily large font size.** This makes your report longer than it need be, which translates into higher postage.
- **Please do not use heavy binders or loose-leaf notebooks.**
- **Please number your pages!**

There are different formats for the written report depending on grade level:

Grades K-5

At the top of the page, write your name and the title of your project. Answer each of the following questions:

1. What is the question I wanted to answer?
2. What did I think would happen? (Hypothesis)
3. What materials did I use?
4. What did I do to answer my question? (Procedure)
5. What are my variables?
   a) What did I change? (Manipulated Variable)
   b) What changed as a result of what I did? (Responding Variable)
   c) What things did I keep the same? (Controlled Variables)
6. What is the answer to my question? Include any ideas that may have influenced the outcome. (Results)
7. What books or other information did I use to help me?

These questions are another way of describing the scientific method for doing an experiment. They are meant to guide you so that your summary explains all of the parts of your experiment. You may type or hand write your summary, but it should be neat and legible – the judges will read it! It can be as long or short as you like (about one page is fine). You may use pictures, drawings, or graphs. Parents may write this summary from a young child's dictation.

Grades 6-12

This report is what the judges will read about your project. It can be as long as you like (three to four pages is fine). You may include pictures, drawings, photos, etc. A table of contents may also be included after the title page.

Your report should include the following sections:

1. **Title Page:** The title of your project should appear in the center of the paper. Your name and grade should be placed below the title.

2. **Abstract:** This brief (250-word maximum) summary should include the (a) purpose of the experiment, (b) procedures used, (c) data, and (d) conclusions. See page 12 for an example of an abstract.

3. **Introduction and Purpose:** The introduction sets the scene for your report. It includes an explanation of what prompted your experiment and a summary of your preliminary research. The purpose includes your hypothesis and what you hoped to achieve.

4. **Materials:** List the materials you used to do the project.

5. **Procedure:** Describe in great detail the methodology used to collect your data or make your observations. This should be detailed enough so that someone would be able to repeat the experiment from the information in your paper. You may include drawings or photos.

6. **Results and Discussion:** Present your raw data thoroughly using tables or a daily log, then show these results in graphs or charts to help the reader understand what you discovered. Include statistical analyses if appropriate. The discussion, or interpretation of results, is the essence of your paper. What could have caused these results? Compare your results with theoretical values, published data, commonly held beliefs, and/or expected results. Include a discussion of possible errors. Other questions you may want to consider: How did the data vary between repeated observations of similar events? How were your results affected by uncontrollable events? What would you do differently if you repeated this project? What other experiments should be conducted?

7. **Conclusions:** Briefly summarize your results and restate your hypothesis. What is the answer to your question? Does it agree with your hypothesis? What practical applications does this project have? Be specific; don't generalize. ("In *this* particular experiment…") Never introduce anything in the conclusion that has not already been discussed.

Sample Abstract:

The purpose of this experiment is to determine whether smoking affects night vision in adults. It is known that rods, the part of the retina responsible for night vision, don't function as well when nicotine and carbon monoxide are present in the body. The test performed is designed to measure the night vision of each subject.

The night vision of thirty-nine smokers and non-smokers was tested. Each subject was asked to put his or her head in a large light-proof box. Three different screens with a number of small holes punched in them were placed over a hole in the front of the box. Each subject was timed in counting the number of holes they saw on each screen using two intensities of light. Averages were calculated and compared for the amount of time taken on each screen and how many dots were seen. The researcher hypothesized that the non-smokers would take less time to see more dots.

In gathering results, it was determined that the non-smokers took much less time on each screen than the smokers. The difference in how many dots were seen was statistically insignificant. For five out of six tests the non-smokers had fewer people whose times exceeded the average for all subjects. These data lead the researcher to believe that there is a definite correlation between smoking and loss of night vision.

8. **Acknowledgments:** Often scientists thank others who have helped them with their research project. This is the place to do so. You should always credit those who assisted you, including individuals, businesses, and educational or research institutions.

9. **Bibliography:** List any books, articles, pamphlets, or other sources of information you used. Different disciplines may follow different referencing formats; check an article from a scientific journal in your field for a sample bibliography. Most importantly, be consistent! A book reference might look like this:

   Smith, J. D. (1989). *A Study of Plant Life*. New York: Johnson Printing Co.

   A scientific journal article reference might look like this:

   Foley, J. D. (1987). "Interfaces for Advanced Computing." *Scientific American*, 257:127-135.

If you can compose your report on a computer, please do so; it will look neater. (Also, as different science fairs may have different requirements for the format of your project report, it will make it easier to change and reprint your report, if necessary.) Before you submit it, ask someone else to proofread your paper and to suggest changes that will make your paper clearer.

Your Logbook (a.k.a. Scientific Notebook)

A logbook is an indispensable part of your science project, and 6th to 12th grade students are required to display it at the GPHSF. Choose an ordinary composition notebook, and use it for nothing else. Everything concerning your project should be written down in your logbook, including:

- Your Name
- Preliminary Research notes
- Bibliography of all books, journals, etc. used
- Information obtained via phone, email or postal mail
- Expenses incurred, if applicable
- Hypothesis
- Materials & Procedures
- All data collected and rudimentary graphs
- Notes about unusual occurrences

Include a dated entry for each day you work on your project, even if no data are collected. Try to record data on a daily basis. It is better to have too much data than not enough! **Make sure you date each entry.** It may be helpful to divide your logbook into sections so that items may be found easily.

About Parent Participation

Although one of the judging criteria is independent work, parents *are* encouraged to discuss the project with the student and provide assistance with research or preparation of the exhibit. Students should be encouraged to do as much as possible on their own. (Judges will try to ascertain whether the student did, in fact, do the work himself.) Students should do the manipulations and measurements in the experiments and should make their own drawings and charts. Hand-drawn charts and graphs are fine—especially for younger students; computer-generated charts and graphs are acceptable only if the student has learned the appropriate software to generate these himself (this would be recommended for high schoolers).

Following is a list of things a parent may do:

- Help plan a research schedule to prevent a last-minute project.
- Help student find appropriate books, scientific journals, or scientists to interview for preliminary research.
- Advise student about potential safety hazards.
- Help student fill out ISEF or other paperwork, if applicable. (Usually, a parent is the sponsor of a homeschooled science fair entrant; as such, you must be the one to sign the paperwork.)
- Instruct in the use of applicable scientific equipment and of data-gathering equipment (scales, rulers, timers, etc.) so that student may conduct the experiment and collect data himself.
- Photograph the experiment for the visual display.
- Proofread project summary or draft(s) of written report. (For younger students, dictation of the project summary is allowed, while older students are expected to write their own.)
- Teach student computer programs, if available, which will enable him to generate his *own* charts, graphs, and display text. (Please do not make these for your child!)
- Help student to focus on gaining skills and doing his best rather than winning a prize. (Isn't that your priority, too?)

Remember that a science fair project can encompass many other subject areas (reading, writing, math, oral & social skills, logic, and art). It's okay to lighten up in these areas during crunch time!

Sample Judging Sheet

Student name and project title *Judging team:* __________

Qualification as an Experiment

A. Were measurements made that allowed for comparisons? ☐ yes ☐ no
B. Was something changed or varied between measurements? ☐ yes ☐ no

If <u>either</u> answer is no, enter the minimum score of 1 for criteria 2, 4, 6, and 8 below.
Use the weighting factors specified to arrive at the final scores for each of these criteria, e.g., the final score for criterion 2 would be 1 X 2 = 2.

Judging Criteria	**Raw Score (1-5)***		**Weighted Score**
1. Quality of project report (grades 6-12) or summary sheet (grades K-5)	________	→	________
2. Student found an inventive way to answer the experiment question *(Check items A & B above to see if a score of 1 is required for question 2.)*	________	x **2** =	________
3. Student made good use of available background information	________	→	________
4. Student planned and executed experiment appropriately in obtaining results *(Check items A & B above to see if a score of 1 is required for question 4.)*	________	x **3** =	________
5. Student recorded data in appropriate ways	________	→	________
6. Student repeated observations and used controls *(Check items A & B above to see if a score of 1 is required for question 6.)*	________	→	________
7. Student adequately described observations and recognized important occurrences	________	→	________
8. Student drew reasonable conclusions from the results *(Check items A & B above to see if a score of 1 is required for question 8.)*	________	x **2** =	________
9. Quality of oral presentation & response to inquiries	________	→	________
10. Quality of exhibit	________	→	________
11. Project represents student's own work to the extent appropriate for this age	________	→	________
12. Degree of topic creativity for this age	________	→	________
Total score (maximum = 80)			________

*1 = Needs Improvement, 2 = Fair, 3 = Good, 4 = Excellent, 5 = Outstanding
Make comments to student below. Please be encouraging and specific.

Judge's Comments on Project

student name and grade

The best things about your project are:

....

....

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....

Your project could have been improved by:

....

....

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