STEM Research Project
(Science Technology Engineering and Math)
WHAT KIND OF PROJECT MAY I COMPLETE FOR MY RESEARCH PROJECT AND ENTRY INTO THE DISTRICT STEM FAIR?

For this project you will design and conduct experimental research in order to answer a question based on a topic in any subject area. (You need to do an experiment in which you collect quantitative data.) Before designing your experiment you will complete a short research paper on your topic called a literature review. You will then create a visual display showing the methods and results (analyzed statistically) of the experimental process.

Your project should...

- be the work of one student only. (Projects involving pairs of students are allowed with prior approval but are not recommended.)

- not be an identical repetition of a previous year’s work. However, you can continue work on a previous project if you show significant progress and expansion on the earlier work.

- be a good experience for you - therefore let your teacher know if any special or different types of projects need to be considered.

WE COMPLETE INDIVIDUAL RESEARCH PROJECTS AND PARTICIPATE IN A DISTRICT STEM FAIR BECAUSE THEY ...

- are “real”, hands-on science

- promote interest in science

- help the student recognize the problem solving nature of science

- provide opportunities to learn and use organizational skills

- develop communication skills

- have extrinsic and intrinsic rewards

- build self-confidence

- integrate diverse disciplines
Internet Resources to Get You Started

Where to search for ideas/general info about completing a science project:

2. [www.sciencebuddies.org](http://www.sciencebuddies.org)
4. [http://chemistry.about.com/od/sciencefairprojects/a/sciprohigh.htm](http://chemistry.about.com/od/sciencefairprojects/a/sciprohigh.htm)

Where to search when you are looking for literature review sources:

5. AHS LMC website – LibGuide – Science Project Big6 (step 3 location and access)
   a. [Gale Science in Context](http://gale.cengage.com/)
   b. [Gale Student Resources in Context](http://gale.cengage.com/)
   c. [Gale Expanded Academic ASAP](http://gale.cengage.com/)
   d. [Science Reference Center](http://gale.cengage.com/)

Where to search for overall information and all the forms your teacher will make you fill out for the STEM fair as well as where you will go to register for the district STEM fair:

8. [http://www.societyforscience.org/isef/](http://www.societyforscience.org/isef/) (rules forms and resources link)
9. [http://anokahennepin.schoolwires.net/Page/2685](http://anokahennepin.schoolwires.net/Page/2685)
Projects to Avoid

1. Using prohibited materials - such as alcohol or tobacco

2. Using vertebrate animals - anything “higher up” than insects is not allowed

3. Unscientific “sciences” - astrology, ESP, the occult, graphology (study of handwriting) and dream interpretation may be very interesting but unless you have some way to actually measure results judges (and teachers) consider these pseudoscience

4. Projects that have been done a thousand times already such as: effects of music or talking on plants - effects of cola, coffee, gum.... on teeth - growing molds, crystals or planaria - sleep learning - effect of color on plants, memory, emotions, taste, grades.......

5. Doing taste preference tests - on any kind of foods or drinks.

6. Be wary of consumer science projects - such as finding the “best” glue, soap, laundry detergent, fishing line, golf ball....... To be successful with this type of project you need good use of the scientific method, adequate experimental equipment and statistical analysis of results, and have a specific definition of what “best” means

7. Experiments that require you to guess at the numbers because you have no way of actually measuring the results - such as how fluoride affects teeth, effect of vitamin supplements on a person’s health.....

8. Tests that involve optical illusions or reaction times - since there are MANY variables that could affect the outcome. Male/female comparisons are also difficult to make unbiased or in large enough numbers to counteract the bias

9. Models of the water cycle, solar system, solar collectors are appropriate for elementary projects only

10. Non-operational questions - these are thought provoking questions but rarely offer a chance at actual experimentation: why did the dinosaurs become extinct - why do onions make you cry - how does subliminal advertising affect people’s buying habits.......
Special Circumstance Projects

One of the goals we have for our students with their research projects is to share what they have accomplished at the district STEM fair. Because our district is affiliated with the International Science and Engineering Fair, we have some stringent but necessary guidelines to follow and forms to fill out. The following are some guidelines you need to be aware of before you choose your topic/experiment:

Projects Involving Bacteria:

If your project involves bacteria you MUST have official lab space in which to keep your samples. It is best to purchase specific cultures of bacteria rather than collect samples from the environment. If you do collect bacteria from the environment it is considered pathogenic and safe processes must be used when handling the cultures. A microbiologist (or someone knowledgeable on the safe handling of bacteria samples) MUST be used as a mentor. Any project involving bacteria must get PRIOR approval by the Scientific Review Committee, SRC. You CANNOT start a bacteria experiment until this committee approves your project. These are difficult projects!!

Projects Involving Human Subjects:

If your project involves human subjects - even if you are just going to ask survey questions - you need PRIOR approval from the Institutional Review Board, IRB. In order to get approval from the IRB you will need a mentor who has experience in human behavior such as a psychologist, sociologist... For human projects a minimum number to test is 200 people. (see pages 19-20)

Projects Involving Chemicals:

If your project involves using any chemicals you will need a copy of the “Material Safety Data Sheet” for each chemical used.

Projects Involving Firearms:

If your project involves firearms your mentor needs to be someone who is gun safety certified.

Projects Involving Animals:

Projects involving animals (anything “higher up” than insects) are not allowed by our school district. If your project involves insects you will be required to include steps for disposal of the insects when you are finished with the project. So, think of a sciencey way to say “smoosh the insects”.
Internal Review Board (IRB) and Scientific Review Committee (SRC)

The rules set up by ISEF are the rules that are followed by our school district. ISEF has very strict rules involving experimental research that involves the use of pathogens (disease-causing organisms), controlled substances (drugs or alcohol), humans, animals...... If you are conducting an experiment that involves any of these items you will need PRIOR approval by an Institutional Review Board. The IRB is a school-level committee. Prior approval means the board okays your research plan before you actually begin experimenting.

In order to get approval from the IRB the following needs to be completed:

1. A VERY detailed, thoroughly thought out research plan.
2. Supervision by a qualified scientist must be apparent if required for the project.
3. Complete information and signatures on required certification papers. (Adult sponsor, 1A, 1B, and any others needed for your specific project)
4. Compliance with rules that govern research involving the project you have chosen. (Humans, pathogens...)

Once you have completed the research plan and forms, your teacher will get the necessary signatures from members of the IRB at your school.

The Scientific Review Committee is a district-level committee. At the district STEM fair a member of the SRC will approve projects when needed. In some instances there are projects that need PRIOR approval by the SRC (such as projects involving bacteria). If this is the case your teacher will assist you in meeting any requirements of this committee before you begin experimenting.
Examples of STEM Projects

Your topic can be in any subject area but it is important that the question you choose is an “operational” question. Operational questions are those that can be answered using concrete, hands-on materials while following a logical experimental design.

The following is a list of operational questions:

1. Which natural repellent repels ants the best
2. What wattage (or type) of light bulb attracts more moths
3. Effects of watering plants with “gray” water = water recycled from sinks, laundry bathtub...
4. Differences in water absorption in different types of wood
5. How does type of swimsuit fabric affect drag in water
6. Effect of court surface on tennis ball serves
7. Does smell affect the way taste is perceived
8. Effect of various amounts of light on mushroom growth
9. Effecting of adding Tylenol on time cut carnations last
10. Effect of gibberillic acid on growth of pea plants
11. Effect of type of bicycle gear on uphill distance covered
12. Are new baseballs producing more homeruns
13. Effect of hot tubs on blood pressure
14. Effect of various environments on speed of fruit ripening
15. Synthetic vs. petroleum based oils on bearing failures
16. Amount of potential energy stored in different types of animal waste
17. Which computer upgrade is more efficient for the money spent
18. Effect of electromagnetic fields on meal worms (or other insects)
19. Does temperature affect the efficiency of oil-spill clean-up products
20. Does garlic have anti-insect effects
21. Effect of different binders on strength of adobe bricks
22. Efficiency of solar panels
23. Number of cars running red lights on particular intersections
24. Does Neem affect the life span of crickets
25. Do walnut hulls affect the growth of grasses/weeds
26. Do movable or stationary knocks improve accuracy of arrow

There are many more ideas in the bucket/binder in the classroom...
What Do Judges (and your teacher) Look For In A Research Project?

Overall Project:

- well thought out research
- evidence of library searches for background information - you should be able to have a conversation about your subject/topic
- well thought out planning and experimentation - repetition of trials, lots of data
- significance/rationale of your question - why should we be interested in the answer to your question
- logical thought processes during your research and experimentation
- evidence that you learned something while researching rather than knowing the answer before you began your experiment

Details of the Project:

- how well you followed a logical, scientific method of research
- details and accuracy of notes, data and charts...
- use of the metric system of measurement
- proper use of tools and equipment
- experimenting for a purpose not just because you had the necessary equipment
- originality and significance of the research (possible positive implications...)
THE LITERATURE REVIEW

A literature review is a fancy sounding name for a background information paper. The review should contain information and facts that help the reader (probably your teacher) become familiar with your topic or subject area. It should also contain specific information about experiments that scientists have done which relate to your topic area. It should be 2-5 typed pages. The literature review is ABSOLUTELY NOT a paper about your specific experiment. Focus instead on the broader subject area of your topic. Also, do not expect to find scientists who have completed and published the exact experiment you have in mind.

Take lots and lots of notes as you look through books, periodicals (that’s a fancy name for magazines), journals, dvds... on your area of interest. Putting each note or thought on a separate note card is recommended. That way when you actually start to write the paper you just need to arrange the cards in a logical order.

**Introductory Information:** This is a paragraph or two explaining what your topic is and even stating the question that you hope to answer through your experiment. You may even want to include some implications that your research may have...what could we do with the information you learn in your project?

**Background Information:** This should be the bulk of the paper. This section gives the reader any information needed in order to understand your project and experiment as a whole. For example if your project is on lead contamination in water supplies then you need to explain why we should be concerned about lead contamination, how water supplies are cleaned, how water supplies could become contaminated with lead, what lead is and its uses...

**Related Research:** This section is where you inform the reader of research experiments that are related to your topic. **DO NOT** try to find researchers who have completed your exact experiment. Look for researchers who have experimented in your topic area. **DO NOT** tell the reader what you plan to do in your experiment -- that is what the research plan is for.

**Conclusion:** This section should bring the reader back to ideas written in the introduction and tie together all the parts of the paper. At this time you may include a sentence or two on what your experiment is and the question you hope to answer.

**Bibliography:** This is a complete list of ALL sources you used to write your lit review. A good number to aim for is six to eight varied sources. A more detailed explanation of the bibliography and method of citation are found on another page.
Helpful Hints for Writing a Literature Review

1. Take A LOT of notes while doing research. If you put each note on a separate note card, when writing your paper all you have to do is put the note cards in a logical order.

2. It is ALWAYS obvious to your teacher when you are copying directly out of a published resource. Take the time to paraphrase the info and write it in your own style. See example below:

   **Copying directly without citing source:** Outdoor shooting ranges are thought to use more than 80,000 tons of lead shot and bullets each year. About 4,400 tons of lead fishing sinkers are sold each year in the US. Some states have limited the use of lead shot in heavily hunted areas to minimize the effects of lead in the environment.

   **Using info while citing a source:** Outdoor shooting ranges use more than 80,000 tons of lead shot and bullets each year. Researchers have also found that over four-thousand tons of lead fishing sinkers are sold each year in the United States (Morris, 2009). According to the Minnesota Department of Natural Resources, in order to reduce the effects of lead in the environment, some states have limited the use of lead shot in areas that are popular with hunters (MN Department of Natural Resources n.d.).

   While a research paper/literature review is intended to be very fact-filled, don’t forget to use transition statements to tie together the facts within a paragraph. Transitions also need to be used between paragraphs. See example below:

   **No Transition:** Greywateraction.org says that gray water is recycled from sinks, dishwashers, bathtubs, showers, and washing machines. Gray water is not taken from garbage disposals, toilets, or diaper pails.

   **Transition:** Greywateraction.org states that gray water is clean, recycled water. It can be taken from many areas in a house including sinks, dishwashers, bathtubs, showers, and washing machines. To ensure safety while using gray water though, it is not recycled from garbage disposals, toilets, or diaper pails.

3. Paraphrasing makes concise wording possible and avoids using direct quotes that don’t add quality to the paper. See example below:

   **Direct quote:** According to Goodall “Most exciting of all, on several occasions they picked small leafy twigs and prepared them for use by stripping off all the leaves. This was the first recorded example of a wild animal not merely using and object as a tool, but actually modifying an object and thus showing the crude beginnings of tool making” (Jackson, 2012, p. 214).

   **Paraphrase:** Jane Goodall was excited when she realized that the chimpanzees were using grass stems as tools to get termites from their mounds. This was the first time that the “crude beginnings of tool making” were shown in wild animals (Jackson, 2012).
Internal Citations and Work Cited Page

The literature review is a review of other people’s ideas on your topic. Since you will be referring to other peoples’ work, you will need to cite the sources of this work. You will be using internal citations in the APA format in your literature review.

Internal Citations Example:
In the late nineteenth century Dr. Curtis of North Carolina University discovered that Venus Flytrap plants could be successfully maintained on a diet of beef, but that high-protein cheese resulted in death of the leaf. In his experiment, Dr. Curtis kept 50 Venus flytrap plants in his greenhouse. The plants were divided into five groups and fed a different type of food depending on which group they were in. After fifteen weeks he was able to conclude that the diet of beef produced the healthiest Venus flytrap plants based on their color, turgidity, and speed of leaf closing (Curtis, 1898).

Another researcher also worked on Venus flytrap plants in the late nineteenth century. In 1839 F.J.F. Meyen made the first attempts to explain the mechanism by which the Venus flytrap closes (Gallagher, 2008). Professor Meyen was never able to conclusively determine how the Venus flytrap closes. Jennifer M. MacFarlane later found that two stimuli are required for the closing of the trap. In her experiment she touched one filament on one plant one time, two filaments on one plant one time each, or one filament on one plant two times. Professor MacFarlane concluded that there needs to be two filaments touched in order to trigger the closing of the flytrap. This could be in the form of one filament being touched two times or two filaments being touched one time each (“The Mysterious Venus’ Flytrap”, n.d.).

Reference Page – for Venus flytrap information:

Simply put: If your references entry looks like the following….you are doing it wrong:

It should look like this instead:
Getting Started on the Research Plan

Once you have decided on your topic and figured out a question/problem you would like to look into you should continue your research by using a logical, scientific method of problem solving. The following gives some hints on various parts of the research plan.

State the Problem: This should be written in a researchable way.

Example: Does adding oak wood ashes to ivy plants affect their root length?
Bad Example: How do oak wood ashes affect ivy plants?

Rationale: Along with stating the problem, you should give a reason or two as to why you are interested in doing your experiment.

Example: I am interested in doing this project because I like to grow ivy plants in the sun room in my house. I am always wondering if there are ways to improve their health.
Bad example: I want to prove to farmers how they can grow better plants.

Hypothesis: This should be a cause/effect answer to the problem. It should be an educated guess based on research that you have done for your lit review.

Example: If I grow ivy plants in plain soil and in soil that has had oak wood ashes added then the ivy plants with the oak wood in the soil would have longer roots. I think this because oak wood contains cellulose and cellulose is part of plant cell walls.

Bad examples: Wood ashes help ivy plants.
Oak wood ashes are better than elm wood ashes.

Variables and Controls:

Independent variable: Amount of oak wood ashes. (You change this.)
Dependent variable: Length of roots. (You are measuring this.)
Controls: ALL of the factors that need to be the same for each plant tested.

Procedure: This consists of all the steps to the procedure with ALL the details included – this is explained in more detail on the other page about the research plan.

**This section also includes a materials list and a data table (blank for now)
THE RESEARCH PLAN

In order for new scientific data to be accepted it must be able to be replicated. A detailed research plan allows other people to see what steps you followed and let them complete the same experiment in order to check your data. The research plan is what will tell you, me and a judge exactly what you did in your actual experiment. Details, controls, variables, exact metric measurements, amounts... need to be included.

PROBLEM: You need to state your problem/question in a researchable way. Also include a statement of your rationale for choosing your question. (Why is this an important question to answer?)

HYPOTHESIS: This is where you state a possible answer to your problem before you begin your experiment. The hypothesis should be written in cause/effect format. “If I do this... then this... will occur.”

METHODS AND PROCEDURES: This is where the details come into play. You need to tell me EXACTLY what you plan to do in your experiment. The following should be included at some point in your plan:

- list of materials used - separate from procedure with a heading
- numbered, step-by-step procedure this is where the most points are allotted (Do NOT use paragraphs for the procedure!!!!!!!!!!!!!!!!!!!!)
- diagrams of procedures if necessary for understanding a process
- repetitions of trials is obvious (Three trials is not enough, in order to do statistical analysis later, you need LOTS of data.)
- blank data tables that you will use when recording data (This means you have to think about what type of measurements you will be making.)
- safety precautions noted when necessary
- steps for disposing of all materials when finished
- metric measurements only

CERTIFICATIONS: Because we are following ISEF rules all projects require completion of some forms. Some projects may need additional forms depending on the materials/processes used.

BIBLIOGRAPHY: Part of writing a good procedure is doing some book research before beginning. This starts with the sources you used for your literature review. It also includes researching into how the particular materials you are using should be handled, dealt with, treated, used, disposed of...(To start with use your lit review bibliography – more sources can be added.

Take pictures of your experimental set up and while experimenting. You will need them later for your display board!
Forms and Abstract Instructions

1. **Forms:** Since our district is aligned with the Intel International Science and Engineering Fair, we follow their protocol. Each student will need to fill out three forms. (Your teacher will print one of the forms; you are responsible for printing out the other forms.) These will be turned in with your research plan. In addition there are 8 other forms that are required for various types of projects.

   a. Go to [www.societyforscience.org/isef](http://www.societyforscience.org/isef) to preview and print out the forms required for your project.
   b. Once on the ISEF site click on the link at left of page called “document library”. Then look through the list of forms for the current year.
   c. I will print out the adult sponsor form for each student. You need to print off forms 1A and 1B then look through the other forms listed to see if any are required for your particular project.
   d. There is also a link to these forms on the district STEM website: [http://www.anoka.k12.mn.us/stemfair](http://www.anoka.k12.mn.us/stemfair)

2. **Abstract:** Each student who completes a STEM project must write an abstract to be displayed with the project. An abstract gives the essence of the project very briefly. The abstract should not exceed 250 words. Judges and the public should have a fairly accurate idea of what you did and learned in your project after reading the abstract. The abstract should not include any details. Details are to be found in the literature review and research plan only.

   a. **A general rule of thumb for an abstract is to include the following info:**
      i. Problem/Purpose of experimentation
      ii. General procedure (no details)
      iii. Observations/data/results
      iv. Stats (or averages) and conclusion

   b. If you would like...there is an abstract form on the society for science web site. It is at the bottom of the list of forms in the document library. You can use this form in order to type up your abstract or just type it as a word document.

   c. As always...double space and use 12 point font.
Abstract Examples

1. Optical illusions are part of everyday life. I wanted to know that if color compliments are used in the same picture can they create the same illusion as black and white pictures. I thought that people would not see the illusions as well in the colored pictures as they did in the black and white pictures. I used ten different illusions in the following color pairs: black and white, red and green, yellow and purple and orange and blue. I tested 245 people. My results showed that the number of people who could see the optical illusions in the colored pictures was not statistically different than the number of people who could see the illusions in the black and white pictures. Therefore I rejected my experimental hypothesis and accepted the null hypothesis.

2. My research was conducted to find out if different types of nuts give off different amounts of energy. I tested the energy in six different nuts using a calorimeter. I used pistachios, almonds, peanuts, walnuts, pecans and hazelnuts. The statistical analysis of my data showed that the amount of Calories in each type of nut was statistically significant. The p-value of the Anova test comparing all the types of nuts was 0.02. This means there was a 2% probability the difference in Calorie amounts was due to chance and a 98% probability the difference was due to the different nut types. I rejected the null hypothesis. I concluded that different types of nuts do contain different amount of energy.

3. My family has always grown our own vegetables in a summer garden. Since our growing season is short, I wanted to test a way to get one type of vegetable, carrots, to grow bigger in mass in a shorter amount of time. I grew 100 carrot plants each in their own plastic container with the same amount of soil, light, and water. 50 of the plants were shocked with a transcutaneous electrical nerve stimulation (TENS) device every other day during the testing period. The other 50 plants were not shocked. My data showed that the average mass of the shocked carrots at the end of 45 days of growth was 125.8 grams. The average mass of the un-shocked carrots was 129.3 grams. The difference in these masses was not statistically significant, using the TENS device did not cause the carrots to grow bigger in mass. In the future I hope to test how using different germination methods on carrots affects their mass.

4. My experiment tested if different starting stances for running blocks affected the speed of a runner in a short distance race. I tested 30 different runners by comparing their speeds in a 100 m race with a bunch, medium, and elongated starting stance. I did not compare the speed of the runners to each other but I compared the speed of each runner at the three different starting stances. My hypothesis was that the runners with the starting blocks in the bunch stance would have the fastest race speeds. In conclusion the p-value comparing the bunch stance to the medium stance did not show a statistically significant difference in race speed. But, the p-value comparing the bunch stance to the elongated stance did show a statistically significant difference in race speeds. I think this happened because using the bunch stance at the beginning of a race gives faster, initial acceleration than an elongated stance does. Initial acceleration is important in a short distance race.
DISPLAY PLAN

Each student will practice presenting their project to their class mates (only a few at a time). You will also be taking part in the district STEM Fair. For these presentations you will need to design and make a display that shows off your project.

Students need to make their display on a cardboard or foam display board. (These can be purchased for around $5. If that is an issue, let your teacher know.) Keep in mind that at the STEM fair there are display size requirements. At the district STEM Fair you are not allowed to bring in anything other than your display board and protocol book.

Some thoughts on creating an eye-catching display:

- Have a descriptive title very prominently displayed along with your name and school
- Include photos of your experimental set-up or of yourself conducting the experiment. These add some nice color to the display.
- Be organized!! Display papers, pictures, charts, graphs... in a logical order (left to right and top to bottom).
- Use neat, colorful, large letters for headings such as problem, hypothesis, results... (Pick one type of font, using many different styles is distracting!!)
- BEFORE you glue or tape anything onto the board have another person look at the display and offer suggestions on improving its organization

SCIENCE FAIR/ISEF DISPLAY SIZE REQUIREMENTS:

Side-to-Side width: ≤ 122 cm

Front-to-Back depth: ≤ 76 cm

Top-to-Floor height: ≤ 274 cm
(Tables are 76cm high - that gives you a top-to-bottom height of 198cm.)
Possible Display Board Arrangements

[Diagrams showing different arrangements for displaying project-related information, including purpose, hypothesis, background research, data charts, photos, models, question, prediction, materials, conclusion & discussion, research, model, journal, title, data, results, conclusion, problem, hypothesis, materials, abstract, photographs, research summary, charts, graphs, illustrations, problem, hypothesis, materials, conclusions, safety sheets, endorsements, abstract, photographs, research summary.]
## Science Project Feedback Form

### Project Number

### Presentation

<table>
<thead>
<tr>
<th>Interview</th>
<th>Present</th>
<th>Notable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passion/Interest in project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Answering of questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparedness/Clarity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Poster Content

<table>
<thead>
<tr>
<th>Visual Design Quality</th>
<th>Present</th>
<th>Notable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Readability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall impression/attractiveness</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Process

<table>
<thead>
<tr>
<th>Topic</th>
<th>Present</th>
<th>Notable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thoughtful Question</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knows relevant Background Info</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate/logical hypothesis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Methods                                       |         |         |
| Relevant to question                          |         |         |
| Clear description                             |         |         |
| Repeatability                                |         |         |

| Results                                       |         |         |
| Appropriate tables and graphs                 |         |         |
| Relevant to question                          |         |         |
| Justified by data                             |         |         |

| Discussion                                    |         |         |
| Clear and organized                           |         |         |
| Relates to question/hypothesis                |         |         |

### Overall Comments:

<table>
<thead>
<tr>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
### Science Fair Project Judging Scorecard

**Student's Name:**

**Project Title:**

**Judge's Name:**

<table>
<thead>
<tr>
<th><strong>Scientific Method:</strong></th>
<th>Superior</th>
<th>Above Avg.</th>
<th>Average</th>
<th>Below Avg.</th>
<th>No Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Presented a question that could be answered through experimentation</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2. Developed a hypothesis identifying independent and dependent variables</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3. Developed good procedure for testing the hypothesis, including use of control variables</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4. Clear and thorough process for data observation and collection</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5. Ran sufficient trials (at least 3)</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>6. Accurate experimental technique</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7. Derived conclusions from appropriately organized and summarized data</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>8. Related conclusions back to the hypothesis</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

**Example questions to ask:**

1. Why is this project important?
2. What does your data tell you?
3. How is your project innovative?
4. What problems did you run into while doing your experiment and how did you solve them?
5. What would you change if you were to do the project again?
What are the three most interesting bits of information that you learned when doing this project?