Pineywoods Academy
5th grade STEM Fair: Student/Parent Guide

WHAT IS A STEM FAIR PROJECT?

A STEM fair project is simply your independent research of a science topic using the scientific method. All work and ideas are yours, giving you "ownership" of the research problem and results. By doing a STEM fair project, you will find yourself doing the job of a practicing, professional scientist; giving you a taste of how the body of knowledge we call science is accumulated.

Because STEM fair projects are actually cross-curriculum, projects that train you for real-life problem solving, the science fair project integrates all aspects of your education and helps to prepare you for real-world job assignments. Having completed a STEM fair project, you will have the skills necessary to design future investigations in a variety of different fields.

STEM fair projects are fun and filled with self-discovery. When beginning the process, you may feel overwhelmed, however you will experience tremendous growth and fulfillment as you progress through the steps and are evaluated by peers, teachers, and judges. This experience builds self-confidence and often enables you to present ideas to others in various situations, such as college and job interviews.

Dates to Remember:

- Project Proposal Due- Friday, January 27th, 2017
- Project Set up at PCA - Wednesday, May 17th, 2017 (between 3:30 and 6:00pm- in the old cafeteria)
- STEM Fair Presentation/Judging- Thursday May 18th, 2017

WHAT IS THE PROCESS AND WHAT SHOULD THE END PRODUCT LOOK LIKE?

1. *You select the topic.*
2. *Focus on a question/problem on your topic.*
3. *Use Scientific Method.*
4. *Do your research/investigation/experiment/observations.*
5. *Collect Data*
6. *Present Your Data with a research paper and a presentation board.*

Informational Guide:

1.0 STEPS TO DOING A STEM FAIR PROJECT

1. Select a topic.
2. Narrow the topic to a specific problem with a single variable.
3. Conduct a literature review of the topic and problem and write a draft of the research report.
4. Form a hypothesis or state the purpose of the research.
5. Develop a research plan/experimental design.
6. Apply for approval. Fill out appropriate forms and get signatures of approval.
7. Write the research report.
8. Collect materials and equipment. Make a lab schedule.
9. Conduct the experiment. Record data.
10. Repeat your experiment, as necessary, to thoroughly explore the problem.
11. Form a conclusion.
12. Create the visual display.
13. Review and polish presentation and display for the science fair.

2.0 STEPS TO DOING AN ENGINEERING PROJECTS

Engineering Projects differ from most science research projects. The ENGINEERING PROJECT GOAL is to build a device or design a system to solve a problem. For an engineering project you still need to do a literature search. However, the steps in the project might be as follows.

1. Define a need. (mechanical, structural, electrical, etc)
2. Develop the design.
3. Do a literature search to see what has already been done.
4. Prepare preliminary designs
5. Build a prototype or write program.
6. Test the prototype/program.
7. Retest and redesign, as necessary.

3.0 SELECTING A TOPIC (Follow the KIS principle - Keep it Simple!) There are several factors that need to be considered when selecting a topic. Often, the simplest of projects present the greatest challenges to an imaginative and intelligent student. Consider the following guidelines when selecting the topic of your research project:

Choose a topic that interests you.

- A hobby such as music, gardening, or model rocketry, might give you something to investigate.
- Sometimes your interest in a sport can provide ideas for a science fair project.
- Magazine or newspaper articles on science-related events can spark your interest.
- Find out if there is a sizable amount of information and equipment available pertaining to the selected topic.
- Science-based websites may inspire ideas. (These are just a few, there are literally thousands)

http://school.discoveryeducation.com/sciencefaircentral/Getting-Started.html
http://www.all-science-fair-projects.com/
http://www.sciencebuddies.org/
http://www.education.com/science-fair

Pinterest…..has great ideas!

Determine if the project is “do”-able.

 Can the project be completed within the amount of time allowed? Have you considered the time needed for retrials or repeats of the experiment? For example, in plant projects, you will need a large sample of plants ready to go in two- or three-week intervals.

 Are there environmental concerns? For example, is it the right time of year to make your observations or collect samples?

 Do you have adequate laboratory resources or natural resources, or both, to carry out your investigation?

 What is the cost of completing the project? Is it within your budget? Do you need special equipment beyond what is available? How will you get it? Have you budgeted for retrials?

 Is the design of the experiment adequate? Are the effects measurable in an objective way?

4.0 RESEARCHING THE TOPIC

You have decided upon a topic and are thinking, “Where do I begin?” The best place to begin is the library. The library will have magazines, newspapers, books on the subject, scientific references, and electronic resources, each with information about some aspect of your topic. You may think you should begin with an encyclopedia. Encyclopedias are quick references that will give you basic background information, but not the specific scientific information you may need, especially if you chose a cutting-edge field of science. It is acceptable to begin with an encyclopedia for key terms, but do not use general encyclopedias as the only source of your information, and do not include them in your list of references.

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The Internet is also a valuable tool for students doing research. When conducting research on the Internet, make sure that you use reliable sources. Information you use will need the same citation data as a book or magazine article: author, title, publisher, and copyright. It is best to download copies of everything you use, including the website address. Remember, good literary research and documentation provides a solid foundation for your hypothesis and experiment.

5.0 FORMING A HYPOTHESIS OR STATING THE PURPOSE

Once you have selected and researched your topic, you will need to identify the problem. Phrase your problem as a question and phrase your hypothesis as a statement. Be specific in stating your hypothesis or purpose, but don’t be overly wordy. Most scientists prefer a hypothesis rather than a statement of purpose, although for engineering projects or computer projects a statement of purpose is preferred.

5.1 HYPOTHESIS

A hypothesis is your answer to your question/problem. The data you acquire through experimentation can be used to support or refute the hypothesis. Sometimes your data shows the hypothesis to be incorrect, but this is not a problem as long as your background research justifies the hypothesis. Sometimes your data will neither support nor refute your hypothesis.

6.0 EXPERIMENTAL DESIGN OR RESEARCH PLAN

Enter all your design ideas and modifications in your notebook. Labeled diagrams are a good way to present your ideas. These are essential in an engineering project.

When developing your experimental design you should consider the following questions.

 Will your design test your hypothesis or achieve your purpose?

 What variables affect your experiment? It is important to test only one variable at a time and keep other variables that might affect your results to a minimum.

6.1 CONTROL SET-UP

With a few exceptions, you will need to include a control set-up as well as an experimental set-up in your experimental design. The control and experimental set-ups are exactly the same except that the control set-up does not contain the independent variable (what was changed).
Example: To test the hypothesis that plants grow better in green light than in regular light, the experimental set-up would include plants grown in green light and watered and fertilized in the same way as plants grown in regular light (the control). All other variables, such as type of soil, the amount of humidity, the air temperature, and the light exposure are kept the same for both the experimental set-up and the control set-up.

7.0 CONDUCTING THE EXPERIMENT

Once your experimental design is complete, it is the time to perform the experiment. Plan and organize the experiment. Perform the experiment under controlled conditions. Keep careful records in your notebook. The notebook is for your records and notes. Document everything you do, whether talking to a person about the project, visiting a library for research, or doing the lab work.

7.1 BEFORE YOU START YOUR EXPERIMENT

Organize all material and equipment to be ready for use as you need them. Organizing your work before starting is important.

Outline the procedure and make a timeline. An outline of the proposed timeline to complete each part of the experimentation is helpful.

 Can the entire experiment be completed at one time? Are multiple time slots needed for completion of experimentation? If so, what plans need to be made for securing materials between the experimentation sessions?

 What do you need to measure results? Are the measuring devices in metric units? Do you know how to read them? Do the instruments give accurate measurements?

Keep your scientific notebook handy. Design and set up the tables and graphs you expect to use prior to starting your experimentation. Include units where appropriate.

Keep a camera on location. The camera is a useful tool for documenting your project. Have another person take photos of you performing the experiment, and use the camera to record the progress and the results of experimentation.

7.2 BEGIN EXPERIMENTATION

Make entries in your scientific notebook as you go. Record data; Sometimes what appears to be irrelevant or a failure on one day may become important information at a later date.

Enter measurements in your tables. As you proceed with your project, make certain you include the units and the degree of uncertainty of each measurement based on the exactness of the measuring device.

Make repeated measurements periodically. Some experiments (e.g., plant-growth projects) require repeated measurements over an extended period. Take measurements periodically (e.g., every day at 4:00 PM, every third day at noon) to reduce errors and make entries into your notebook when you make the measurements.

Repeat the experiment, if necessary. After completing the experiment, you may decide you need to repeat the experiment for accuracy of your results. You may need to clarify or even alter the hypothesis, redesign the experiment, and get ready to begin again. You may learn more from the process of revision than you learn when all goes "perfectly." Remember, do not discard or remove any data from your scientific notebook/logbook. These pieces of data are often valuable later. Talk with your teacher or supervisor about improvements and, if necessary, begin the experiment again.

8.0 FORMING A CONCLUSION

Now is the time to look at the results of your experiment and the analysis of your findings.

- Did you collect enough data?
- Do you need to collect more data?
- Were you variables and control properly designated?
- Do your results seem reasonable?
- Are there any trends in your data?
- Do you need to do more experimentation?
- Do your results support your hypothesis? If not, why not? Has your experiment tested your hypothesis?

Ask and answer as many questions about the project as you can. This will help to direct your thoughts and help you to decide whether or not you need to modify, do retrials, or complete the project at this time.

Remember one very important thing - keep an open mind about your findings. ***Never change or alter your results to reflect what*** you think ***is accurate.*** Sometimes the greatest knowledge is discovered through so-called mistakes.

9.0 WRITING THE PAPER

Your report will provide interested readers with an overall look at your topic and research. Your paper should include information collected during the research as well as a complete description of your experiment, data, and conclusion.

A good research paper should be written in the past tense and have the following components:

- Title Page
- Introduction (including Literature Review)
- Hypothesis (or Statement of Purpose)
- Materials and Experimental Methods
- Data and/or Results
- Discussion and Analysis of Data or Results
- Conclusion

10.0 PREPARING YOUR BOARD AND VISUAL DISPLAY

The visual display on the board is meant to attract attention and provide information. Your visual display should challenge onlookers to want to know more about your project. Photographs, graphics, and tables, along with the written text should be included. A well-thought-out and interesting title can also attract attention.

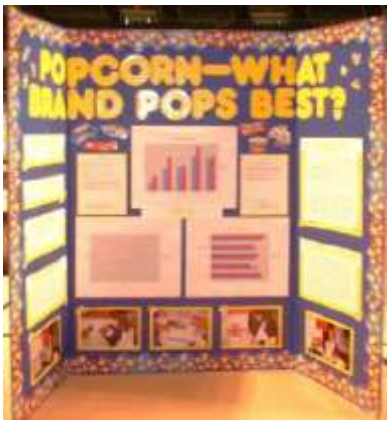
You should take pride in the assembly of the board and it should reflect your work as you want it represented. Neatness, completeness, and clarity are very important. The board and visual display should help you to present your project logically and serve as a prop for you to illustrate what you have done. Pictures can often help you to show what you have used. Be creative. Use color combinations that are pleasing to the eye.

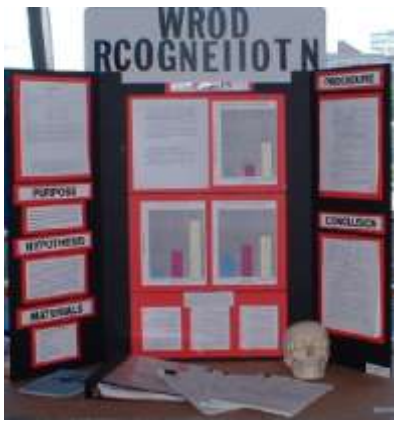
Your project title and section headings on your board should be large enough to be easily read from six feet away. The regular text displayed on your board should be readable from a distance of three feet. Although you may be tempted to make your board larger, remember that your board should not be mostly empty space. Correctly and clearly label graphs, diagrams, and tables. Make certain that the graphs are titled and have both axes labeled clearly and accurately. Use photographs to validate and help explain parts of the project that would be difficult to explain, or that would require time to explain.

Remember, an eye-catching display helps to showcase your project, but your personal presentation is far more important.

** Use your creativity. Envision in your mind how you want your board to look. On a piece of paper sketch a design that is in balance and flows - as illustrated in the above example. Make copies of your sketch. Use crayons or colored pencils to try out different color combinations.

Follow the KIS principle - Keep it Simple!





Pineywoods Academy STEM FAIR Project Proposal Form
Return By Friday, January 27th, 2017

Student Name: _____

Project Information

1. Project Category: (Check one)
☐ Science ☐ Technology ☐ Engineering ☐ Mathematics

2. My Question/Problem: (In a sentence, explain the question or the problem you want to investigate including your independent and dependent variables)

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_____

_____

3. My Hypothesis:

Written in an" If (independent variable) …. then (dependent variable)…. because ….. statement "

_____

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3. Experimental Plan: (How are you planning to test your hypothesis? Explain your experimental design- how are you going to do this?)

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(Use back if necessary)

Date Submitted: _____ Teacher Approval: ☐ Yes

☐ No (see comments)