Fauquier County
6th Grade Science Performance Task
2015-2016

This packet is based on one designed and developed by Frisco Independent School District in Frisco, Texas, and is used by the kind permission of Ms. Kendra Durham, Middle School Science Coordinator for Frisco ISD.
August 2015

Dear Parents/Guardians of Sixth Grade Students in Fauquier County Public Schools:

In light of the recent national emphasis on STEM (science, technology, engineering and math) education and a statewide effort to assess student performance in ways that extend beyond standardized testing, Fauquier County Public Schools has taken an initiative for 2015-2016.

**FCPS sixth-grade science students will be required to devise and complete a science or engineering project as part of their science classes for the 2015-16 school year.** The research and design process will be introduced to students in and through their science classes, with the process culminating in a science/engineering project submitted in early February 2016.

While your students will be guided and graded throughout the project, it is vital that parents/guardians provide assistance and support to the child. The project will progress as:

- 1\(^{st}\) nine-weeks: The student plans and designs his or her project.
- 2\(^{nd}\) nine-weeks: The student completes experimentation or building the project.
- 3\(^{rd}\) nine-weeks: The student presents his or her research.

**Since each project will be unique, parent/guardian support is essential to student success.**

Of these projects, teachers will send a select number to the school science and engineering fair by mid-February, which will be open to 7\(^{th}\) and 8\(^{th}\) graders as well. Top projects from each FCPS middle school will be able to advance to the Fauquier County Regional Science & Engineering Fair (FCRSEF) on March 12, 2016. (Visit [www.FauquierScienceFair.com](http://www.FauquierScienceFair.com)). The FCRSEF is open to students in public, private, and home schools in grades 6-12 in Fauquier County.

As always, FCPS is committed to keeping an open dialogue with parents, students, teachers, and the community. If you have question or concerns, please address them to your child’s science teacher or to me, Pam Pulver, FCPS Supervisor for Science, Health & Physical Education, ppulver@fcps1.org. We anticipate an excellent experience for your child this year.

Sincerely,

Pam Pulver
FCPS Supervisor for Science, Health & PE
Fauquier County 6th Grade Science Performance Task

To Students and Parents:

Each sixth grade student and others interested will design and complete a science fair project for the 2015-2016 school year. The main objective of this assignment is to allow students to explore an area in which they are interested and examine it in depth using the scientific method or engineering design process.

TO THE PARENTS: Parents are asked to assist and supervise their student during the science fair process. You can best support your student by helping them with time management, organization of materials, and proofreading. In some cases, it may be necessary for you to find a mentor for your student as they work through their project.

TO THE STUDENT: You must complete a science fair project within the given timeline in order to participate in the classroom and school science fairs. You will conduct a grade level appropriate project of your own design fulfilling the requirements found in the International Science and Engineering Fair (ISEF) Student Handbook. [https://member.societyforscience.org/document.doc?id=639](https://member.societyforscience.org/document.doc?id=639)

STUDENT/PARENT AGREEMENT

Student’s Printed Name: ________________________________

Science Teacher: ___________________________ Class Period: _______

STUDENT AGREEMENT:
As a science student, I agree that I will follow the 6th Grade Science Performance Task Guidelines to complete and submit my Science Fair Project by [February 12, 2016](#).

Student Signature: ___________________________ Date _______

PARENT AGREEMENT:
I have read the 6th Grade Science Performance Task Guidelines and understand what is required of my student. I agree to provide the necessary support, and I will see that my student is supervised while conducting any experiments. I will support completion of the project by February 12, 2016 and participation in the sixth grade science fair. If the student project is selected for advancement, I will encourage participation in the Fauquier County Regional Science & Engineering Fair on March 12, 2016.

Parent/Guardian Printed Name: ________________________________

Parent/Guardian Signature: ___________________________ Date _______

This agreement is due no later than [Friday, August 28, 2015](#).
## Science Fair Timeline for Parents/Guardians of Sixth Graders

<table>
<thead>
<tr>
<th>DATE</th>
<th>ROLE OF PARENTS / GUARDIANS</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/17-8/27</td>
<td>Brainstorm with student: What research or engineering projects may interest them? Complete and sign the Science Fair Agreement form.</td>
</tr>
<tr>
<td>8/28/15</td>
<td>Science Fair Agreement form due</td>
</tr>
<tr>
<td>8/28-9/17</td>
<td>Help the student to narrow his/her project ideas to two projects and assist them with completing the “Is My Project Feasible?” handout.</td>
</tr>
<tr>
<td>9/18/15</td>
<td>Is My Project Feasible? handout due</td>
</tr>
<tr>
<td>9/18-10/15</td>
<td>Review teacher feedback on feasibility form and narrow to one project. Assist student with completing the proper Intel ISEF forms. If your student plans to work with vertebrate animals, humans, potentially hazardous chemical or biological agents or anything deemed dangerous, additional Intel ISEF forms will be required!</td>
</tr>
<tr>
<td>10/16/15</td>
<td>Intel ISEF Forms due to Scientific Review Committee (SRC)</td>
</tr>
</tbody>
</table>
| 10/16-12/17   | **Research begins!**  
Research begins!  
After SRC approval, assist the student with organizing and completing the project. If the project is NOT approved, communicate with the teacher to help the student make the adjustments necessary for approval. As students conduct their research, they will need to begin writing the information for their display board. Please monitor the writing of their Title, Introduction, Materials & Methods and a 3-Source (at least) Bibliography. |
| 12/18/15      | Title, Introduction, Materials & Methods, and 3-Source Bibliography due                                                                                                                                                     |
| 12/18-1/22    | Students are encouraged to have project completed in early January. Monitor as they write the Results and Discussion & Conclusion information for their display board.                                                        |
| 1/22/16       | Results, Discussion & Conclusion due                                                                                                                                                                                         |
| 1/22/16       | Please ensure that the student has the necessary supplies to complete the trifold display board.                                                                                                                           |
| 2/5/16        | Display Boards Due                                                                                                                                                                                                      |
| TBD           | Classroom Fairs                                                                                                                                                                                                          |
| 2/8-2/15/16   | Middle School Fairs                                                                                                                                                                                                       |
| 2/26/16       | Deadline to Register for Regional Science & Engineering Fair (for selected projects only)                                                                                                                                  |
| 3/11/16       | Setup for Regional Science & Engineering Fair (for registered projects only)                                                                                                                                              |
| 3/12/16       | Fauquier County Regional Science & Engineering Fair                                                                                                                                                                       |

This timeline is provided as an aid to parents and guardians of FCPS sixth grade students. Consult the student’s science teacher for details or specifics.
# SCIENCE FAIR TIMELINE

<table>
<thead>
<tr>
<th>DUE DATE</th>
<th>PORTION OF PROJECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friday, 8/28/15</td>
<td>Science Fair Agreement Page Due</td>
</tr>
<tr>
<td></td>
<td>Receive “Is My Project Feasible?” Handout</td>
</tr>
<tr>
<td>Friday, 9/18/15</td>
<td>“Is My Project Feasible?” Handout Due</td>
</tr>
<tr>
<td>Wednesday, 9/23/15</td>
<td>Teacher feedback on feasibility of project</td>
</tr>
<tr>
<td>Friday, 10/16/15</td>
<td>2016 Intel ISEF Forms Due: Student Checklist (1A), Approval Form (1B) and Abbreviated Research Plan</td>
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<tr>
<td></td>
<td><em>First Marking Period Ends</em></td>
</tr>
<tr>
<td>Friday, 10/23/15</td>
<td>Research Plans and Scientific Review Committee (SRC) Results returned.</td>
</tr>
<tr>
<td>Due Friday, 12/18/15</td>
<td>Research Project Part I- Display board information</td>
</tr>
<tr>
<td></td>
<td>• Title</td>
</tr>
<tr>
<td></td>
<td>• Introduction</td>
</tr>
<tr>
<td></td>
<td>• Materials and Methods</td>
</tr>
<tr>
<td></td>
<td>• Bibliography (at least 3 resources)</td>
</tr>
<tr>
<td>Due Wednesday 1/06/16</td>
<td>Research Project Part II – Gather data and finish research.</td>
</tr>
<tr>
<td>1/06/16 through 1/22/16</td>
<td>Research Project Part III</td>
</tr>
<tr>
<td></td>
<td>• Results- includes data analysis</td>
</tr>
<tr>
<td></td>
<td>• Discussion</td>
</tr>
<tr>
<td></td>
<td>• Conclusions</td>
</tr>
<tr>
<td>1/22/16 through 2/12/16</td>
<td>Science Fair Project Due <strong>COMPLETED</strong></td>
</tr>
<tr>
<td></td>
<td>1. All components completed including Display Board and School Science Fairs.</td>
</tr>
<tr>
<td>Week of 2/08/16 – 2/12/16</td>
<td>Middle School Science Fairs</td>
</tr>
<tr>
<td>Week of 2/15/16 – 2/26/16</td>
<td>Make-up week for fairs due to school cancellations</td>
</tr>
<tr>
<td>2/26/16</td>
<td>Registration deadline for Regional Fair** (selected projects only)</td>
</tr>
<tr>
<td>Friday, March 11, 2016</td>
<td>Regional Science Fair Set-Up – Fauquier High School (registered projects only)</td>
</tr>
<tr>
<td>Saturday, 3/12/2016</td>
<td>Fauquier Regional Science &amp; Engineering Fair – Fauquier High School Cafeteria</td>
</tr>
<tr>
<td>Mid-June</td>
<td>Broadcom MASTERS Online Registration for qualified Regional Fair winners</td>
</tr>
</tbody>
</table>

** Regional Science & Engineering Fair Registration & SRC paperwork deadline - Friday, Feb. 26, 2016

** Important Dates for High School level Science Fairs:**
Virginia State Science and Engineering Fair – April 9, 2016 – Virginia Military Institute, Lexington, VA
Intel International Science and Engineering Fair – Week of May 8-13, 2016 – Phoenix, Arizona
Science Research and the Process of Science

Research is a process by which people discover or create new knowledge about the world in which they live. The Intel ISEF and Affiliated Fairs are research (data) driven. Students design research projects that provide quantitative data through experimentation followed by analysis and application of that data. Projects that are demonstrations, ‘library’ research or informational projects, ‘explanation’ models or kit building are not appropriate for research based science fairs.

Questioning is probably the most important part of a scientific investigation and is often followed by an “if...then” statement. Students are encouraged to design ‘controlled’ experiments, ones that allow them to set up a standard and then change only one variable at a time to see how that variable might affect the original condition tested as the standard. Thus, questioning usually leads to experiments or observations.

Good scientists, both young and old, frequently use a process to study what they see in the world. This process has been referred as the ‘Scientific Method’ or more recently as the ‘Inquiry Cycle’. The following stages listed below will help you produce a good scientific experiment:

1) Be curious, choose a limited subject, ask a question; identify or originate/define a problem. It is important that this question be a ‘testable’ question – one in which data is taken and used to find the answer. A testable question can further be identified as one in which one or more variables can be identified and tested to see the impact of that variable on the original set of conditions. The question should not merely be an ‘information’ question where the answer is obtainable through literature research.

2) Review published materials related to your problem or question. This review should also include reviewing the International Rules and Guidelines (www.societyforscience.org/isef/rulesandguidelines). This is called background research.

3) Evaluate possible solutions and guess why you think it will happen (hypothesis).

4) Experimental design (procedure). In designing the experiment, it is critical that only one variable – a condition that may effect the results of the experiment – is changed at a time. This makes the experiment a ‘controlled’ experiment.

5) Challenge and test your hypothesis through your procedure of experimentation (data collection) and analysis of your data. Use graphs to help see patterns in the data.

6) Draw conclusions based on empirical evidence from the experiment.

7) Prepare your report and exhibit.

8) Review and discuss the findings with peer group/professional scientists.

9) New question(s) may arise from your discussions. This sets the stage for another research project as new questions are raised from others and the process repeats itself. The hypothesis often changes during the course of the experiment. Supporting or not supporting your hypothesis is secondary to what is learned and discovered during the research.

Non Inquiry Based Research

Not all areas of study are best served by scientific method based research. Because engineers, inventors, mathematicians, theoretical physicists, and computer programmers have different objectives than those of other scientists, they follow a different process in their work. The process that they use to answer a question or solve a problem is different depending on their area of study. Each one uses their own criteria to arrive at a solution.

Engineering Projects

“Scientists try to understand how nature works; engineers create things that never were.” An engineering project should state the engineering goals, the development process and the evaluation of improvements. Engineering projects may include the following:

1) Define a need or “How can I make this better?”
2) Develop or establish design criteria (could be more than one)
3) Do background research and search the literature to see what has already been done or what products already exist that fill a similar need. What makes them good and what makes them weak?
4) Prepare preliminary designs and a materials list. Consider costs, manufacturing and user requirements.
5) Build and test a prototype of your best design. Consider reliability, repair and servicing.
6) Retest and redesign as necessary. Product testing.
7) Present results.

Computer Science Projects

These often involve creating and writing new algorithms to solve a problem or improve on an existing algorithm. Simulations, models or ‘virtual reality’ are other areas on which to conduct research.

Mathematics Projects

These involve proofs, solving equations, etc. Math is the language of science and is used to explain existing phenomena or prove new concepts and ideas.

Theoretical Projects

These projects may involve a thought experiment, development of new theories and explanations, concept formation or designing a mathematical model.
Getting Started

1) Pick your topic: This is perhaps the most difficult part. Get an idea of what you want to study or learn about. Ideas should come from things in your areas of interest. A hobby might lead you to a good topic. What is going on in the world that you would like to know more about? Most importantly, pick a question or problem that is not too broad and that can be answered through scientific investigation.

2) Research Your Topic: Go to the library or internet to learn more about your topic. Always ask Why or What if.... Look for unexplained or unexpected results. Also, talk to professionals in the field.

3) Organize: Organize everything you have learned about your topic. At this point, you should narrow your thinking by focusing on a particular idea.

4) Make a Time Table: Choose a topic that not only interests you, but can be done in the amount of time you have. Identify your 'testable question'. Develop a time line to manage your time efficiently. You will need time to fill out the necessary forms and to review the research plan with your sponsor. Certain projects will require more time because they need prior approval from the Scientific Review Committee (SRC) or Institutional Review Board (IRB). Allow plenty of time to experiment and collect data. You will also need time to write a paper and put together a display or 'board'.

5) Plan Your Experiment: Give careful thought to experimental design. Once you have a feasible project idea, write a research plan. This plan should explain how you will do your experiments and exactly what will be involved. Remember you must design your experiment so that it is a 'controlled' experiment. This is one in which only one variable is changed at a time. The results are then compared to the 'standard' data you take originally before you change that one variable. Thus, you have designed an investigation with adequate control and limited variables to investigate a question. Also, in your experimental design, make sure you include sufficient numbers in both control (if applicable) and experimental groups to be statistically valid. The experimental design should also include a list of materials. Once finished with the experimental design (called 'procedure') all students are required to fill out the appropriate forms.

6) Consult with Your Adult Sponsor and Get Approvals: You are required to discuss your research plan with an Adult Sponsor and obtain a signature of approval. In reviewing your research plan, you should determine if additional forms and prior approval are needed.

7) Conduct Your Experiment: During experimentation, keep detailed notes of each and every experiment, measurement and observation in a log book. Do not rely on memory. Besides, judges love notebooks! Use data tables or charts to record your quantitative data.

8) Analyze Your Results: When you complete your experiments, examine and organize your findings. Use appropriate graphs to make 'pictures' of your data. Identify patterns from the graphs. This will help you answer your testable question. Did your experiments give you the expected results? Why or why not? Was your experiment preformed with the exact same steps each time? Are there other explanations that you had not considered or observed? Were there experimental errors in your data taking, experimental design or observations? Remember, that understanding errors is a key skill scientists must develop. In addition, reporting that a suspected variable did not change the results can be valuable information. That is just as much a 'discovery' as if there was some change due to the variable. In addition, statistically analyze your data using the statistics that you can understand and explain their meaning.

9) Draw Conclusions: Did the variable(s) tested cause a change when compared to the standard you are using? What patterns do you see from your graph analysis that exist between your variables? Which variables are important? Did you collect enough data? Do you need to conduct more experimentation? Keep an open mind — never alter results to fit a theory. If your results do not support your hypothesis, that's ok and in some cases good! Try to explain why you obtained different results than your literature research predicted for you. Were there sources of error that may have caused these differences? If so, identify them. Even if the results do differ, you still have accomplished successful scientific research because you have taken a question and attempted to discover the answer through quantitative testing. This is the way knowledge is obtained in the world of science. Think of practical applications that can be made from this research. How could this project be used in the real world? Finally, explain how you would improve the experiment and what you would do differently.

Elements of a Successful Project

1) Project Data Book:
A project data book is your most treasured piece of work. Accurate and detailed notes make a logical and winning project. Good notes show consistency and thoroughness to the judges and will help you when writing your research paper. Data tables are also helpful. They may be a little 'messy' but be sure the quantitative data recorded is accurate and that units are included in the data tables. Make sure you date each entry.

2) Research Paper:
A research paper should be prepared and available along with the project data book and any necessary forms or relevant written materials. A research paper helps organize data as well as thoughts. A good paper includes the following sections.

a) Title Page and Table of Contents: The title page and table of contents allows the reader to follow the organization of the paper quickly.

b) Introduction: The introduction sets the scene for your report. The introduction includes the purpose, your hypothesis, problem or engineering goals, an explanation of what prompted your research, and what you hoped to achieve.

c) Materials and Methods: Describe in detail the methodology you used to collect data, make observations, design apparatus, etc. Your research paper should be detailed enough so that someone would be able to repeat the experiment from the information in your paper. Include detailed photographs or drawings of self-designed equipment. Only include this year’s work.

d) Results: The results include data and analysis. This should include statistics, graphs, pages with your raw collected data, etc.
e) **Discussion:** This is the essence of your paper. Compare your results with theoretical values, published data, commonly held beliefs, and/or expected results. Include a discussion of possible errors. How did the data vary between repeated observations of similar events? How were your results affected by uncontrolled events? What would you do differently if you repeated this project? What other experiments should be conducted?

f) **Conclusions:** Briefly summarize your results. State your findings in relationships of one variable with the other. Support those statements with empirical data (one average compared to the other average, for example). Be specific, do not generalize. Never introduce anything in the conclusion that has not already been discussed. Also mention practical applications.

g) You should always credit those who have assisted you, including individuals, businesses and educational or research institutions. However, acknowledgments listed on a project board are a violation of D & S Display rules and must be removed.

h) **References/Bibliography:** Your reference list should include any documentation that is not your own (i.e. books, journal articles, websites, etc.). See an appropriate reference in your discipline for format or refer to the Instructions to Authors of the appropriate publication.

Three common reference styles are:

- **APA (American Psychological Association) Style:**
  - [http://owl.english.purdue.edu/owl/section/2/10/](http://owl.english.purdue.edu/owl/section/2/10/)

  This resource offers examples for the general format of APA research papers, in-text citations, endnotes/footnotes, and the reference page.

- **MLA (Modern Language Association) Format:**
  - [http://www.mla.org/style](http://www.mla.org/style)
  - [http://owl.english.purdue.edu/owl/section/2/11/](http://owl.english.purdue.edu/owl/section/2/11/)

  This resource offers examples for the general format of MLA research papers, in-text citations, endnotes/footnotes, and the Works Cited page.

- **Chicago Manual of Style**
  - [http://www.chicagomanualofstyle.org/home.html](http://www.chicagomanualofstyle.org/home.html)

  The *Chicago Manual of Style* presents two basic documentation systems. The more concise author-date system has long been used by those in the physical, natural, and social sciences. In this system, sources are briefly cited in the text, usually in parentheses, by author's last name and date of publication. The short citations are amplified in a list of references, where full bibliographic information is provided.

**Patent and Copyright Information**

You may want to consider applying for a patent or copyright if you want to protect your work.

United States Patent and Trade Office
Customer Service: 1-800-786-9199 (toll-free); 571-272-1000 (local); 571-272-9950 (TTY)

http://www.uspto.gov/
http://www.uspto.gov/patents/process/index.jsp

European Patent Office
http://www.epo.org/
http://www.epo.org/applying/basics.html

3) **Abstract:**

After finishing research and experimentation, you need to write an abstract. The abstract needs to be a maximum of 250 words on one page. An abstract should include the a) purpose of the experiment, b) procedures used, c) data, and conclusions. It may also include any possible research applications. Only minimal reference to previous work may be included. The abstract must focus on work done in the current year and should not include a) acknowledgments, or b) work or procedures done by the mentor. See below for an example of an appropriately written abstract. See page 23 of the International Rules for the proper formatting of an Official Intel ISEF Abstract and Certification. **Please Note:** The Official abstract form is only for those participating in ISEF and may not be required for many Affiliated or local fairs.

**Sample Abstract**

**Effects of Marine Engine Exhaust Water on Algae**  
Mary E. Jones  
Hometown High School, Hometown, PA, United States

This project in its present form is the result of bioassay experimentation on the effects of two-cycle marine engine exhaust water on certain green algae. The initial idea was to determine the toxicity of outboard engine lubricant. Some success with lubricants eventually led to the formulation of “synthetic” exhaust water which, in turn, led to the use of actual two-cycle engine exhaust water as the test substance.

Toxicity was determined by means of a standard bottle or "batch" bioassay technique. *Scenedesmus quadricauda* and *Ankistrodesmus* sp. were used as the test organisms. Toxicity was measured in terms of a decrease in the maximum standing crop. The effective concentration - 50% (EC50) for *Scenedesmus quadricauda* was found to be 3.75% exhaust water; for *Ankistrodesmus* sp. 3.1% exhaust water using the bottle technique.

Anomalies in growth curves raised the suspicion that evaporation was affecting the results; therefore, a flow-through system was improvised utilizing the characteristics of a device called a Biomonitor. Use of a Biomonitor lessened the influence of evaporation, and the EC 50 was found to be 1.4% exhaust water using Ankistrodesmus sp. as the test organism. Mixed populations of various algae gave an EC 50 of 1.28% exhaust water.

The contributions of this project are twofold. First, the toxicity of two-cycle marine engine exhaust was found to be considerably greater than reported in the literature (1.4% vs. 4.2%). Secondly, the benefits of a flow-through bioassay technique utilizing the Biomonitor was demonstrated.

**International Rules & Guidelines**

[www.societyforscience.org/isef/rules&guidelines](http://www.societyforscience.org/isef/rules&guidelines)

The rules were developed to facilitate the following:

- protect the rights and welfare of the student researcher and human subjects
- protect the health and well-being of vertebrate animal subjects
- follow federal regulations governing research
- offer guidance to affiliated fairs
- use of safe laboratory practices
- address environmental concerns
4) **Visual Display:**
You want to attract and inform. Make it easy for interested spectators and judges to assess your study and the results you have obtained. You want to ‘catch the eye’ of the judges and convince them that the research is of sufficient quality to deserve closer scrutiny. Most displays or boards have three sections and are free standing. For the most part, the displays are put on a table. Most Intel ISEF judges get a chance to look at the board before the interviews. Make the most of your space using clear and concise displays. You never get a second chance to make a first impression! Please be sure to reference the Display and Safety Rules in the International Rules and Guidelines; this information is also available on the Society for Science & the Public website at [www.societyforscience.org](http://www.societyforscience.org).

**Helpful hints for display:**

a) **Current Year:** Make sure the board reflects the current year’s work only. Prior year’s data books are permitted at your project.

b) **Good Title:** Your title is an extremely important attention-grabber. A good title should simply and accurately present your research and depict the nature of the project. The title should make the casual observer want to know more.

c) **Take Photographs:** Many projects involve elements that may not be safely exhibited at the Fair, but are an important part of the project. You might want to take photographs of important parts/phases of your experiment to use in your display. Photograph or other visual images of human test subjects must have signed consent forms. Credit must be given for all photographs.

**d) Be Organized:** Make sure your display follows a sequence and is logically presented and easy to read. Reach out to the ‘skim-reader’. A glance should permit anyone (particularly the judges) to locate quickly the title, abstract, experiments, results and conclusions. When you arrange your display, imagine that you are seeing it for the first time. Highlight your results using key graphs that show the relationships of the two variables tested. Use the graphs to give a ‘picture’ of the data for your viewers. These graphs will provide an easier method of viewing the data rather than just seeing the recorded quantitative data.

e) **Eye-Catching:** Make your display stand out. Use neat, colorful headings, charts and graphs to present your project. Pay special attention to the labeling or graphs, charts, diagrams, photographs, and tables to ensure that each has a title and appropriate label describing what is being demonstrated. Anyone should be able to understand the visuals without further explanation.

f) **Correctly Presented and Well-Constructed:** Be sure to adhere to the size limitations and safety rules when preparing your display. Display all required forms for your project. Make sure your display is sturdy, as it will need to remain intact for quite a while. You must also consider the weight of the project for shipping. It can be very costly to ship a heavy board. Keep your materials light, but strong.

**Please Note:** The judges are judging your research, not the display. So don’t spend an excessive amount of time or money on the board. You are being judged on the science not the show!

5) **Judging**

Judges evaluate and focus on 1) what the student did in the current year; 2) how well a student followed the scientific, engineering, computer programming or mathematical methodologies; 3) the detail and accuracy of research as documented in the data book; and 4) whether experimental procedures were used in the best possible way. Judges look for well thought-out research. They look at how significant your project is in its field; how thorough you were, and how much of the experiment thought and design is your own work.

Initially, judges get their information from your board, abstract and research paper to learn what the project is about, but it is the Interview that will be the final determination of your work. Judges applaud those students who can speak freely and confidently about their work. They are not interested in memorized speeches or presentations – they simply want to talk with you about your research to see if you have a good grasp of your project from start to finish. It is important to start the interview off right. Greet the judges and introduce yourself. You want to make a good first impression. Appearance, good manners, appropriate attire, and enthusiasm for what you are doing will impress the judges.

Judges often ask questions to test your insight into your projects such as: “How did you come up with this idea? “What was your role?”, “What didn’t you do?”, “What further plans do you have to continue research?” and “What are the practical applications of your project?” Remember that the judges need to see if you understand the basic principles of science behind your project or topic area. They want to determine if you have correctly measured and analyzed the data. They want to know if you can determine possible sources of error in your project and how you might apply your findings to the ‘real’ world. Finally, the judges seek to encourage you in your scientific efforts and your future goals/career in science. Relax, smile and enjoy your time to learn from them and accept their accolades for your fine work.

### Intel ISEF Judging Criteria (points)

<table>
<thead>
<tr>
<th>Category</th>
<th>Points</th>
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<tbody>
<tr>
<td>Creative Ability</td>
<td>30</td>
</tr>
<tr>
<td>Scientific Thought</td>
<td>30</td>
</tr>
<tr>
<td>Engineering Goals</td>
<td></td>
</tr>
<tr>
<td>Thoroughness</td>
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</tr>
<tr>
<td>Skill</td>
<td>15</td>
</tr>
<tr>
<td>Clarity</td>
<td>10</td>
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</table>
Science Fair Project Ideas...“Is My Project Feasible?”

In addition to the “Project Ideas” you list below, ask yourself...

1) Do I have enough time? (Think about the number of weeks you have to collect data.) Data must be collected by January 22, 2016 so plan your time.

2) Make a list of materials and their costs.

3) Is it safe, and will it be approved by my parent/guardian, teacher, and my school SRC (Scientific Review Committee)?

4) Can it be completed where I live? (For example, we cannot study coral reefs in Northern Virginia. We do not live near them.)

Project Idea #1

Topic: ________________________________

I will be investigating: ________________________________

List all data that can be measured: ________________________________

What tools will you use for measurement? ________________________________

List changes that you may observe: ________________________________

Data I will collect and present in graphs/tables: ________________________________

What materials/equipment will I need? ________________________________
**Project Idea #2**

**Topic:** ______________________________________________________________

I will be investigating: ______________________________________________________

________________________________________________________________________

List all data that can be measured: ____________________________________________

________________________________________________________________________

What tools will you use for measurement? ______________________________________

________________________________________________________________________

List changes that you may observe: _____________________________________________

________________________________________________________________________

Data I will collect and present in graphs/tables: _________________________________

________________________________________________________________________

What materials/equipment will I need? ________________________________

________________________________________________________________________
Student Checklist (1A)
This form is required for ALL projects.

1. a. Student/Team Leader: ___________________________ Grade: ___________________________
   Email: ___________________________ Phone: ___________________________
   b. Team Member: ___________________________ c. Team Member: ___________________________

2. Title of Project:

3. School: ___________________________ School Phone: ___________________________
   School Address: ___________________________

4. Adult Sponsor: ___________________________ Phone/Email: ___________________________

5. Does this project need pre-approval?  ○ Yes  ○ No Tentative start date: __________

6. Is this a continuation/progression from a previous year?  ○ Yes  ○ No
   If Yes:
   a. Attach the previous year’s ○ Abstract and ○ Research Plan
   b. Explain how this project is new and different from previous years on ○ Continuation/Research Progression Form (7)

7. This year’s laboratory experiment/data collection:

   Actual Start Date: (mm/dd/yy)  End Date: (mm/dd/yy)

8. Where will you conduct your experimentation? (check all that apply)
   ○ Research Institution  ○ School  ○ Field  ○ Home  ○ Other: ___________________________

9. List name and address of all non-school work site(s):  
   Name: ___________________________
   Address: ___________________________
   Phone: ___________________________

10. Complete a Research Plan/Project Summary following the Research Plan instructions and attach to this form.

11. An abstract is required for all projects after experimentation.
THIS PAGE IS INTENTIONALLY LEFT BLANK
Abbreviated Research Plan – Double-Sided

Name_________________________________________________ Date________________________

Teacher_______________________________________________ Due Date________________________

Attach this sheet to the Intel ISEF Form, Student Checklist (1A).

- For traditional science projects (if you are doing an experiment), complete Section A (below).
- For engineering projects (building a prototype or improving a design), complete Section B (on back).

If you plan to work with vertebrate animals, humans, potentially hazardous chemical or biological agents or anything deemed dangerous, additional Intel ISEF forms will be required!

>> Do not begin research or data collection until you receive approval! <<

Section A - Traditional Science Project

1. What is your research question?

2. What is your hypothesis?

3. Describe your methods.

4. Describe any risk and safety concerns.

5. Bibliography—at least 3 major references

_______ Check here if your research includes human participants, vertebrate animals, and/or hazardous chemical or biological agents or materials, and attach appropriate Intel ISEF forms.
Abbreviated Research Plan – Double-Sided

Name_________________________________________________________ Date________________________

Teacher_______________________________________________________ Due Date________________________

Attach this sheet to the Intel ISEF Form, Student Checklist (1A).

- For traditional science projects (if you are doing an experiment), complete Section A (on front).
- For engineering projects (building a prototype or improving a design), complete Section B (below).

If you plan to work with vertebrate animals, humans, potentially hazardous chemical or biological agents or anything deemed dangerous, additional Intel ISEF forms will be required!

>> Do not begin research or data collection until you receive approval! <<

Section B - Engineering Design Project
1. What is the problem you are addressing?

2. What is your goal or expected outcome?

3. Describe in detail the steps in your process.

4. Describe any risk and safety concerns.

5. Bibliography-at least 3 major references

_______ Check here if your research includes human participants, vertebrate animals, and/or hazardous chemical or biological agents or materials, and attach appropriate Intel ISEF forms.
1. To Be Completed by Student and Parent
   a. Student Acknowledgment:
      - I understand the risks and possible dangers to me of the proposed research plan.
      - I have read the Intel ISEFRules and Guidelines and will adhere to all International Rules when conducting this research.
      - I have read and will abide by the following Ethics statement

   Scientific fraud and misconduct are not condoned at any level of research or competition. Such practices include plagiarism, forgery, use or presentation of other researcher’s work as one’s own, and fabrication of data. Fraudulent projects will fail to qualify for competition in affiliated fairs and the Intel ISEF.

<table>
<thead>
<tr>
<th>Student’s Printed Name</th>
<th>Signature</th>
<th>Date Acknowledged (mm/dd/yy)</th>
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<td>(Must be prior to experimentation)</td>
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</table>

   b. Parent/Guardian Approval: I have read and understand the risks and possible dangers involved in the Research Plan. I consent to my child participating in this research.

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<tr>
<th>Parent/Guardian’s Printed Name</th>
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<td></td>
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<td>(Must be prior to experimentation)</td>
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2. To be completed by the local or affiliated Fair SRC
   (Required for projects requiring prior SRC/IRB APPROVAL. Sign 2a or 2b as appropriate.)

   a. Required for projects that need prior SRC/IRB approval BEFORE experimentation (humans, vertebrates or potentially hazardous biological agents).

   The SRC/IRB has carefully studied this project’s Research Plan and all the required forms are included. My signature indicates approval of the Research Plan before the student begins experimentation.

<table>
<thead>
<tr>
<th>SRC/IRB Chair’s Printed Name</th>
<th>Signature</th>
<th>Date of Approval (mm/dd/yy)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>(Must be prior to experimentation)</td>
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</tbody>
</table>

   OR

   b. Required for research conducted at all Regulated Research Institutions with no prior fair SRC/IRB approval.

   This project was conducted at a regulated research institution (not home or high school, etc.), was reviewed and approved by the proper institutional board before experimentation and complies with the Intel ISEFRules. Attach (1C) and required institutional approvals (e.g. IACUC, IRB).

<table>
<thead>
<tr>
<th>SRC Chair’s Printed Name</th>
<th>Signature</th>
<th>Date of Approval (mm/dd/yy)</th>
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</thead>
</table>

3. Final Intel ISEF Affiliated Fair SRC Approval (Required for ALL Projects)

   SRC Approval after Experimentation and Before Competition at Regional/State/National Fair
   I certify that this project adheres to the approved Research Plan and complies with all Intel ISEF Rules.

<table>
<thead>
<tr>
<th>Regional SRC Chair’s Printed Name</th>
<th>Signature</th>
<th>Date of Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>State/National SRC Chair’s Printed Name (where applicable)</td>
<td>Signature</td>
<td>Date of Approval</td>
</tr>
</tbody>
</table>
STOP! Only certain research projects will need the following questions to be answered. Your teacher will tell you which (if any) of these sections are required.

1. **Human participants research:**
   - **Participants.** Describe who will participate in your study (age range, gender, racial/ethnic composition). Identify any vulnerable populations (minors, pregnant women, prisoners, mentally disabled or economically disadvantaged).
   - **Recruitment.** Where will you find your participants? How will they be invited to participate?
   - **Methods.** What will participants be asked to do? Will you use any surveys, questionnaires or tests? What is the frequency and length of time involved for each subject?
   - **Risk Assessment**
     - **Risks.** What are the risks or potential discomforts (physical, psychological, time involved, social, legal, etc.) to participants? How will you minimize the risks?
     - **Benefits.** List any benefits to society or each participant.
   - **Protection of Privacy.** Will any identifiable information (e.g., names, telephone numbers, birth dates, email addresses) be collected? Will data be confidential or anonymous? If anonymous, describe how the data will be collected anonymously. If not anonymous, what procedures are in place for safeguarding confidentiality? Where will the data be stored? Who will have access to the data? What will you do with the data at the end of the study?
   - **Informed Consent Process.** Describe how you will inform participants about the purpose of the study, what they will be asked to do, that their participation is voluntary and they have the right to stop at any time.

2. **Vertebrate animal research:**
   - Briefly discuss potential ALTERNATIVES to vertebrate animal use and present a detailed justification for use of vertebrate animals.
   - Explain potential impact or contribution this research may have.
   - Detail all procedures to be used.
   - Include methods used to minimize potential discomfort, distress, pain and injury to the animals during the course of experimentation.
   - Detailed chemical concentrations and drug dosages.
   - Detail animal numbers, species, strain, sex, age, source, etc.
   - Include justification of the numbers planned for the research.
   - Describe housing and oversight of daily care.
   - Discuss disposition of the animals at the termination of the study.

3. **Potentially Hazardous Biological Agents:**
   - Describe Biosafety Level Assessment process and resultant BSL determination.
   - Give source of agent, source of specific cell line, etc.
   - Detail safety precautions.
   - Discuss methods of disposal.

4. **Hazardous Chemicals, Activities & Devices:**
   - Describe Risk Assessment process and results.
   - Detail chemical concentrations and drug dosages.
   - Describe safety precautions and procedures to minimize risk.
   - Discuss methods of disposal.
Scientist’s Log Book

You will need to keep a detailed record of the entire science fair project process. This will be your most treasured piece of work that includes your original ideas for your science fair project, the background research you did prior to collecting any data, accurate and detailed notes during experimentation, diagrams, data tables (with SI units) and graphs. Every entry you make must be dated. You should plan to record in your log book every single day. Your notes may be kept in a composition notebook or a binder with loose leaf notebook paper. Be neat and thorough when writing in your log book as this will be viewed by science fair judges. Judges like to see your thinking so if you make a mistake that is okay. They are not judging perfection, but your original work, enthusiasm about your work, and the effort you put into your work. Pen is suggested, but pencil may be used as well. If you make a mistake, do not use white out to correct it, just cross it out once and continue. Here are some samples of students’ log books from the state science fair.
These log book samples are from middle school students. These are only intended to be viewed to give you an idea of what a log book could look like. You may not use their information to help you with your science fair project.
These log book samples are from middle school students. These are only intended to be viewed to give you an idea of what a log book could look like. You may not use their information to help you with your science fair project.
01/20/12
It is around 8:30 in the morning, so the device has been running 8 hours overnight. I measured the water collected in the bowl and it turns out 79ml of water was collected, definitely a drinkable amount. The next step in my project is to build a heat recovery and see how much water that can make.

01/30/12
Using google sketchup, I have designed a heat recovery box:

My made bought bended copper pipes from work today, they look like this:
These log book samples are from middle school students. These are only intended to be viewed to give you an idea of what a log book could look like. You may not use their information to help you with your science fair project.
**Research Paper – OPTIONAL, but helpful**

**Research Paper:** A research paper should be prepared and available along with the project data book and any necessary forms or relevant written materials. A well-developed paper includes the following sections typed out into a composition – not a bulleted list (may be displayed in a binder like the example shown):

1. **Title Page and Table of Contents:** The title page and table of contents allows the reader to follow the organization of the paper quickly.

2. **Introduction:** The introduction sets the scene for your report. The introduction includes the purpose, your hypothesis, problem or engineering goals, an explanation of what prompted your research, and what you hoped to achieve.

3. **Materials and Methods:** Describe in detail the methodology you used to collect data, make observations, design apparatus, etc. Your research paper should be detailed enough so that someone would be able to repeat the experiment from the information in your paper. Include detailed photographs or drawings of self-designed equipment. Only include this year’s work.

4. **Results:** The results include data and analysis. This should include statistics, graphs, pages with your raw collected data etc.

5. **Discussion:** This is the essence of your paper. Compare your results with theoretical values, published data, commonly held beliefs, and/or expected results. Include a discussion of possible errors. How did the data vary between repeated observations of similar events? How were your results affected by uncontrolled events? What would you do differently if you repeated this project? What other experiments should be conducted?

6. **Conclusions:** Briefly summarize your results. State your findings in relationships of one variable with the other. Support those statements with empirical data (one average compared to the other average, for example). Be specific, do not generalize. Never introduce anything in the conclusion that has not already been discussed. Also mention practical applications and the impact your study would have on society.

7. You should always credit those who have assisted you, including individuals, businesses and educational or research institutions. However, acknowledgments listed on a project board are a violation of D & S Display rules and must be removed.

8. **Reference/Bibliography:** Your reference list should include any documentation that is not your own (i.e. books, journal articles, websites, etc.). See an appropriate reference in your discipline for format.
Your display board is an eye catching visual representation of your research. It should be complete and easy to read. In front of your board, you will display your official abstract using a page protector or a plastic 8½x 11 frame. Your completed data log book and research paper (optional) will also be in front of your science fair board. These boards can be purchased at stores such as Wal-Mart or Hobby Lobby. The typical tri-fold board is 36 inches tall by 48 inches wide. Please note the maximum size allowed by ISEF.

**Maximum Size of Project**
Depth (front to back): 30 inches or 76 centimeters
Width (side to side): 48 inches or 122 centimeters
Height (floor to top): 108 inches or 274 centimeters
Properly Credited Images

In each example, the Finalist has identified the source of the image with a credit line prominently displayed beneath the image or images.

Note: Background images on posters must also be credited.
## Science Fair Project Rubric for Students

Title: ____________________________________       TOTAL SCORE _______ / 100

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Low</th>
<th>Mid</th>
<th>High</th>
<th>Max</th>
<th>Scores</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Unclear</td>
<td>Lacks focus</td>
<td>Clear</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contribution to Field</td>
<td>Not identified</td>
<td>Vague</td>
<td>Identified</td>
<td></td>
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<tr>
<td>Scientific Method</td>
<td>Not testable</td>
<td>Partly testable</td>
<td>Testable</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Data Collection</td>
<td>Poorly designed</td>
<td>Some planning</td>
<td>Well-designed</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variables and Controls</td>
<td>Not defined</td>
<td>Incomplete or Inappropriate</td>
<td>Defined and Appropriate</td>
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<tr>
<td>Reproducibility</td>
<td>None Possible</td>
<td>Difficult</td>
<td>Good</td>
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<tr>
<td>Data Collection &amp; Analysis</td>
<td>Arbitrary</td>
<td>Incomplete</td>
<td>Systematic</td>
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<tr>
<td>Math Methods</td>
<td>Erroneous</td>
<td>Some Inappropriate</td>
<td>Appropriate and Correct</td>
<td></td>
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<tr>
<td>Data Collected</td>
<td>None</td>
<td>Insufficient</td>
<td>Sufficient</td>
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<tr>
<td>In Above Criteria</td>
<td>Cookbook, No New Ideas</td>
<td>Teacher Assigned, Some Value Added</td>
<td>Student Initiated, Innovative</td>
<td>20</td>
<td></td>
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</tr>
<tr>
<td>Display Board</td>
<td>Illogical or Unreadable</td>
<td>Lacks supporting docs or some lack of clarity</td>
<td>Logical, readable, and supporting docs present</td>
<td>20</td>
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