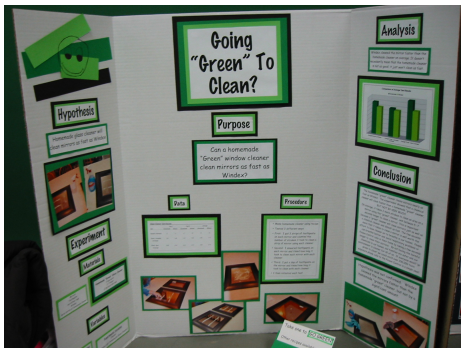
Student Computer Design Packet (S-CDP) For 5th and 6th Grade Students



"How Does a Student Do a Meaningful Science Fair Project Using the Computer Design Process?"

In this packet is information for students showing the steps on how to complete a meaningful science fair project using the Computer Design Process. This packet tells what is recommended and required when students do a science fair project for the school science fair.

If you have any questions about anything ask your teacher or call Paul Nance, the Jordan District Elementary Science Teacher Specialist, at 801-244-6479 or email him at paul.nance@jordan.k12.ut.us.

Three Science Fair Processes To Choose From For A Science Fair Project

One of the major objectives of students doing a science fair project is to acquire more knowledge about the world around them. Students are able to choose from three processes, namely, the scientific method, the engineering design, and the computer design for their projects.

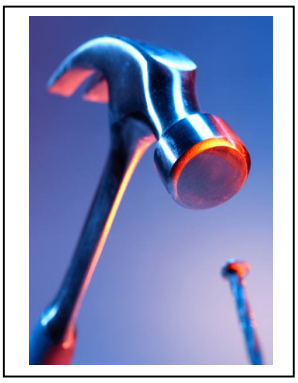
1. **The scientific method:** Using this process you will: write a question; form a hypothesis; plan an experiment; gather the materials needed; perform the experiment; examine the results; write up a conclusion showing what you learned and can apply the knowledge to real world situations.

2. **The engineering design:** Using this process you will: define a need for the product; connect the need to a design goal; establish the requirements needed for product development; write up a procedure with preliminary designs; gather the materials needed; build a prototype (a model of the product) according to the designs; test the prototype; redesign, if necessary, to meet the stated design goal; and connect or apply the value of the prototype to real world situations.

3. **The computer design:** Using this process you will: define a program need; connect the need with a design goal; establish the requirements needed for program development; write up a series of operations for the program code; develop the program with a test plan; conduct several tests according to the test plan for debugging, rewriting, and optimizing the code; and connect or apply the value of the program to real world situations.

How much work that is put into each step of one of these processes will result in a higher score on the judging sheet.

In this packet the Computer Design will be only be presented to you. If you want the information packet on how to do a project using the scientific method or engineering design processes, see your teacher.



Choosing a Topic of Interest for Your Science Fair Project Using the Computer Design Process

Choosing an area of interest is the hardest part of the science fair project. For ideas as where to start, look at this engineering design science fair category and what it entails.

Computer Design

Computer science is the designing and writing a program code for a computer. The program code is written according to the requirements set up by the student. After the program code is written, it needs to be tested to see if it works properly on the computer. If it doesn't work properly, the student needs to go back and make adjustments and retest. Adjustments need to be made until it works properly. The results have to be useful, and it applies the value of the program to real world situations.

Here are some ideas to help you choose a topic for your science fair project using the computer design.

airplane wings
air quality
alarms
animal tricks
blindfolding
bugs
chemical reactions
cleaning
clouds
color
computer
concentration
conservation
coordination
different age skills
dissolving
ecology
electricity
energy
environments
erosion
evaporation
feeling
food nutrition
habits
heat
heredity
inventions
light
listening
magnets
music
memory
noises
optical illusions
pH
puzzles
recycling
rockets
rocks
pollution
smelling
snowboarding
soaps
soil
soil quality
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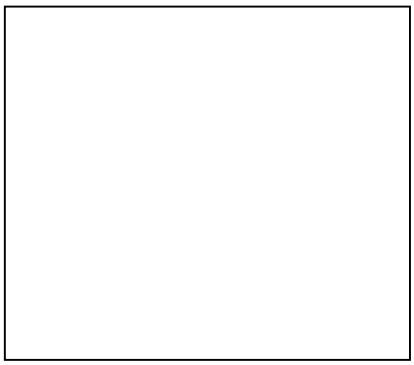
weathering
weight
wind

The Computer Design Process Outline

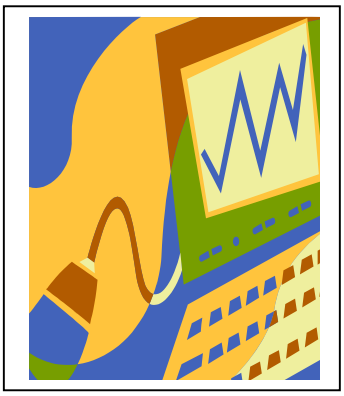


When using the Computer Design while doing a science fair project, all of these steps listed below are required in the order shown. During the process of completing each step, each step needs to be written in your journal and later put on your display board. A judge will also ask about the computer design process in the interview.

- **Define a Need**
- **Research**
- **Design Requirements**
- **Preliminary and Final Designs**
- **Programming and Code Testing**
  - **Programming your computer with the code**
  - **Test the Program**
  - **Record the Data**
  - **Analyze the Data**
  - **If it doesn't work according to the "Design Requirements" then…**
- **Redesign and Retest as Necessary**
- **Conclusion**

In the next section "Computer Design Process " (pages 4a-4b) gives a detailed description of what to do for each step of the computer design process. Please read the next section carefully to know what to do for each step.

The Procedure
For the Computer Design Process



A type of process students can use for a science fair project is the Computer Design Process. The major objective is to understand the process of designing and writing a program code for the computer.

Students who want to design a program code for the computer for the science fair are required to follow The Computer Design Process below. As students follow the Computer Design Process, they must write about each of the following steps in a journal. **Everything that is in the journal can be questioned by the interviewer.**

1. Define a Need:

First you need a purpose for the program you want to code into a computer and to explain its purpose. It could be a problem to solve or a situation that needs improvement. Write it so the need is clearly understood. The goal of this project is to design and write a program code for someone to use to perform a useful function. The designing goal statement for this project might be, "The goal of this project is to write, test, and optimize a computer program code that increases children's ability to learn their math facts."

2. Research:

You need to research your topic using library materials, Internet sites, magazines, textbooks, encyclopedias, experts, and other available and reliable sources. **At least three sources must be used for the research.** A fairly lengthy paragraph should be written about each source telling what you learned. Therefore, there will be three separate paragraphs, one for each source used. Cite each paragraph where the information was found. Copying a page from a book or Internet and placing it in the journal is not research. **The research needs to be hand or type written. All that is written in the journal can be questioned by the interviewer.**

3. Design Requirements:

Next, you need to establish the requirements needed for the development of the program code. You need to decide how the program code will be designed and what the final program will do. The requirements might be how much memory it will take, what it will be able to do, how good its performance will be, and the accuracy of the performance. Another part of the writing requirements is to tell how the program code will be tested to meet the desired expectations.

4. Preliminary and Final Designs:

- **Beginning designs**
  You begin the designing by writings the first program codes. They can be brainstorming ideas showing two or three ideas achieving the same desired results.
- **Final designs**
  As you focus into one type of program code, you write up a series of operations for the program code. You are to show the changes in the development of the program code as the program gets closer to the requirements and expectation of the desired results. The code development needs to show progress from code to code.

5. Programming, Code Testing, and Analysis of the Results

- **Program your computer with the code**
  Program your computer with the code you have designed. Write about the experience of programming your computer.
- **Test and data recording**
  Test the program code to see if it works according to the testing procedure stated in the design requirements. This is the first test of the code. You need to note any bugs, the slow parts, the speedy parts, memory use, and the best parts of the code. You need to write down what is actually happening during the testing. The writing needs to be very descriptive. Testing the product two or three times is important to make sure the test data is accurate.
- **Data is analyzed if redesigning is necessary**
  Analyze the data. See if the results match the design requirements. If not, redesigning is necessary.

6. Redesign and Retest As Necessary

- After the first tests the student may need to make adjustments by redesigning and rewriting the program code. Keep an accurate and detailed record of the adjustments.
- Retesting is always necessary after redesigning has occurred. Keep an accurate and detailed record of the testing results.

(Redesigning and retesting of the code is the most important part of the project. Keeping notes of the changes and the results are very important. You should be able to can see at a glance what changes have been made and what happened when these changes are retested. You need to be able to recall the changes and results if needed.)

- When you feel that the program code has reached its greatest efficiency according to the design requirements, the you then will go on to the conclusion. If you feel that more designing and testing is needed, you need to continue to redesign and retest, writing down the data until the student feels the program code is completed. The program code needs to work and meet the design requirements.

7. Conclusion:

- When writing your conclusion you need to show evidences of what was learned. It summarizes the learning by answering some of these questions: How do the results validate what was expected to happen? What was learned from designing the program code? In what way is this program code important? Is there more that could have been done to improve the program code? How does this program code help people understand the world better? How can this information be applied to real life? What new insights were discovered? What knowledge was gained by designing and programming a computer?
- The conclusion needs to show the value of the project and the program code, and how it can apply to life and/or the real world. Write about the final program code by looking at its merits, originality, and usefulness.

<u>Please note:</u>

Any other project that is done on the computer that does not involve computer program coding should be done using the scientific process.

The Journal For The Computer Design Process

All students entering a computer project in the school science fair must have a journal (log). The journal is the literacy that connects the writing, thinking, research, planning, building, testing, and conclusion to computer project. Everything that is written in the journal can be questioned by the interviewer.

The journal consists of four main parts:

- Title page
- Table of Contents page
- The Computer Design pages
- The Bibliography page

1. Title Page

The title page consists of the project title, student name, school, and date.

2. Table of Contents

The table of contents consists of the following topics (the computer design process) with page numbers so these topics are easily found.

- Define a need
- Research
- Design Code Requirements
- Project Designs
  - Beginning Code Designs
  - Final Code Designs
- Programming, Testing and Recording, and Analyzing the Code
- Redesigning, Retesting and Recording, and Analyzing the Code
- Conclusion

3. The Computer Design

In this section you will write what you did or discovered by following each part of the Computer Design. See the Computer Design pages (4a and 4b) to know what should be written on each page.

- Define a Need page
- Research page
- Design Requirement page
- Project Designs
  - Beginning Designs page
  - Final Designs page
- Programming, Testing and Recoding, Analyzing the Code
  - Programming Code page
  - Testing and Recording page
  - Analysis page
- Redesigning, Retesting and Recording, Analyzing the Code
  - Redesigning page
  - Retesting and Recording page
  - Analysis page
- Conclusion page

4. Bibliography

Write a list of the at least three sources used for research with the type of source, title, and page numbers (if applicable).

The Display Board
For The Computer Design Process

Create a display board so your findings can be shown at the science fair. It is a summary of your project and reflects your journal. This is your showcase. Make it creative and colorful. Below are ideas for a good display board.

- Physically sound and durably constructed, able to stand by itself.
- Title of your project at the top.
- Show all the steps of the computer design process (except the research) with a brief explanation of each: the need, design requirements, preliminary and final designs, program code testing results and the analysis, redesigning and retesting results and the analysis as needed, and the conclusion. The research will be in the journal.
- Well-organized and easy to follow from one idea to the next.
- Neat, edited, and without scribbles and misspelled words.
- Creative, pleasing to look at, colorful, with different font sizes to show emphasis.
- Photos of the developing experiment. (Only the students doing the experiment and family members can be displayed on the board. Others need parent permission if under 18 years of age.)
- Drawn pictures, artwork, and icons that bring out the ideas of the experiment.
- The journal should be in front of the display.

Students like to display items they used when doing their experiments. For reasons of safety the following items cannot be displayed at the school and district fairs. This is also found on the last page of the 2011-2012 Jordan Schools and District Science Fair Registration Form.

- Living organisms
- Plant material (living, dead, or preserved)
- Taxidermy specimens or parts
- Preserved animals including embryos
- Human or animal food including seeds
- Human or animal parts or body fluids
- Soil, sand, or waste samples
- Laboratory/household chemicals including water
- Poisons, drugs, hazardous substances or devices
- Sharp items, scissors, glass, syringes, needles
- Dry ice or other sublimating solids
- Flames or high flammable materials
- Empty tanks that previously contained combustible liquids or gases
- Batteries with open top cells
- Photographs of children under 18 other than yourself or your family without parental written permission
- Photographs or other visual presentations depicting vertebrate animals in surgical techniques, dissection, necropsies, other lab techniques, improper handling methods, improper housing conditions, etc.

Pictures of these items can be place on the board except the last bullet.

Schools and the district have the right to remove these things above and anything else that may be dangerous to the public.

The Interview
For The Computer Design Process

The judge's interview gives you the opportunity to explain your project. The judge wants to know how much you know about your project.

- How you received the idea
- How you personalized it to make it unique
- How you prepared it
- How you set it up
- What information you discovered
- What the information means
- What your conclusion is

The judge also wants to know your background knowledge about the subject you chose. Some of the judges' questions may not be about your project. He/she may ask questions related to your topic. For example, if you coded into your computer a way for students to learn about clouds and the type of weather they show or bring, it would be well to know about what they look like, the type of weather they bring, how the different clouds are formed, and the predictions we can make about the weather by looking at clouds. Even though this information is not entirely what your project is about, it shows you have done research about clouds.

Some questions that might be asked:

- Explain where you got your idea for the project.
- What did you do to personalize it and make it unique?
- Explain the project method you used.
- Why did you choose this subject?
- Explain your results.
- Explain your conclusion.
- How does the result relate to your background knowledge?
- How does the result help you in understanding the world better?
- How does your project have practical applications?
- Specific background knowledge about your subject.
- What problems did you run into?
- How could you have improved your project?
- If you did it again, what would you change?
- What questions do you have now?
- Tell some ideas you learned from your research.
- How did the research help you with your project?
- How much time did you spend on your project?
- How did others help you or give you ideas?
- How did you test your code?

Be excited about your project when you speak. Don't talk too fast. Elaborate on your answers. Help the judge understand your project by speaking clearly in an organized manner so it's not confusing. **You need to show evidences of learning.**

Judges do not want you to redo your experiment for them. Their interest lies in your knowledge of the engineering design process, the display board, the results, and the knowledge you acquired.

5TH AND 6TH GRADES SCHOOL SCIENCE FAIR COMPUTER JUDGING SHEET

Name(s)_____ School _____

Project Title_____

Category	Comments	Excellent	Good	Fair
I. Journal/Log (Computer Design)		**5**	**3-4**	**1-2**
Title Page/Table of Contents: Title, name, school, date, and the table of contents				
Need: A need for the project is defined				
Research: Three different sources cited with well-written notes				
Design Requirements: Clear statement of the requirements for the program code				
Preliminary Designs: o Beginning designs of program codes written showing a variety of ways to meet the design requirements				
o Focus on one set of designs for the program code written showing changes and progress to meet the design requirements				
Programming and Testing of the Code: o Computer coded according to the design requirements				
o Sufficient data gathered during the first testing. Data is analyzed if designing is necessary.				
Redesigning and Retesting: Redesigning and retesting done showing gathered data and analysis.				
Conclusion: Reveals evidence of learning				
II. Display				
o Neat, edited, and physically sound				
o Computer method displayed, easy to follow, and self explanatory				
o Journal and display showed a close relationship				
o Creative Board Design				
III. Interview				
o Student shows a basic knowledge of field studied and able to elaborate				
o Student is able to explain how the computer method was used				
o Student shows interest, enthusiasm, and a passion toward the project and could tell how it was personalized				
IV. Project Design				
o Creative, procedural approach with ingenious use of materials and equipment to solve the problem				
o Project shows in-depth thought and work to solve the problem				
o Results show a well, thought out, reasonable conclusion showing a useful connection to the world				

Score Ex. 5 Gd. 3-4 Fair 1-2

Sub scores				**Total Score**	**/100**

Science Fair Resources

Online Resources for Science Projects Ideas

- http://cusef.byu/edu
- www.sciencebuddies.org
- http://www.stevespanglerscience.com/content/experiment/science-fair-survival
- www.sciencebob.com

Online Resources for Environmental Science Projects

- http://www.isd77.k12.mn.us/resources/cf/SciProjIntro.html
- www.isd77.k12.mn.us/resources/cf/SciProjIntro.html
- www.detroit.lib.mi.us/is/science_fair.htm
- http://faculty.washington.edu/chudler/fair.html

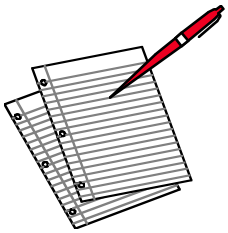
What a Computer Design Science Fair Project Is and Is Not

A Science Fair Project Is Not:

- Just doing something on the computer
- A report about a computer topic
- A simulation or demonstration to show how something works
- A survey of what people think or feel about something
- A design that shows common knowledge that everyone knows
- A design that is copied from of a book or off the Internet
- Gathering statistics from a news source and reporting on the daily changes

A Science Fair Project is:

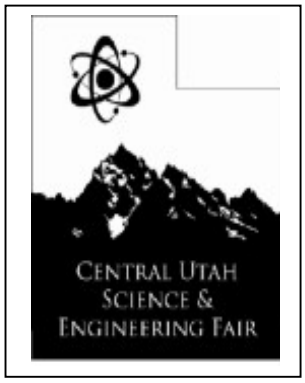
- Thinking of a question or problem to investigate and solving it by means of the computer design process
- Planning by design a design code for a computer program
- Follow through with programming a code for a computer
- Testing the program and analyzing data to gain knowledge
- Using the knowledge learned to make a connection to higher-level ideas and to understand those new ideas to see how to apply them to the real natural world



STUDENT SCIENCE FAIR PROJECT
SUGGESTED TIMELINE
USING THE COMPUTER DESIGN

Week	What is going to be accomplished?	Done
Week 1	Student becomes familiar with the computer design. Student gets science fair journal ready. Student comes up with a topic and purpose for his/her science project design and writes it in the journal.	
Week 2	Student researches the topic by finding at least three sources and reading about them. He/she writes detailed paragraphs in the journal of specific details of what was learned.	
Week 3	Student writes his/her design requirements in the journal. Student begins the preliminary designs and narrows it to the type of design desired.	
Week 4	Student writes up the final step-by-step procedure of the program code in the journal. Student writes in the program code according to the design requirements.	
Weeks 5-6 (or longer if needed)	Student sets up a plan on how to test it. Student tests the program code. He/she gathers data and writes the data in the journal. Student analyzes the data if it worked or not according to the design requirements.	
Week 7	If the program code doesn't work according to the design requirements, then redesigning and retesting is necessary. Data is gathered and analyzed again. A conclusion is written up.	
Week 8	Student makes a creative display board using colors, decorative paper, different font size, pictures, and designs. It displays all parts of the computer design (except the research). Student writes a brief explanation under each design step on the board. Student practices what he/she is going to say about each step for the interview.	

Directions for Filling out the 2012 Central Utah Science & Engineering Fair Registration Form For 5th and 6th Grades



All 5th and 6th grade students entering their respective school science fairs in Jordan District must fill out the 2012 Central Utah Science and Engineering Fair (CUSEF) Registration form for 5th and 6th grades to give to their teachers prior to beginning their science fair projects. There are certain rules that students must follow in doing a science fair project. If these rules are not followed the project can be disqualified at the district and regional levels. Filling out this form correctly and completely will guarantee admittance to all levels of competition.

After you have chosen a topic and prior to beginning your project, the next step is to fill out **completely** the Central Utah Science and Fair (CUSEF) Registration Form for 5th and 6th Grades. Your teacher will give you the CUSEF Registration Form when you receive this student packet. Below are the directions on how to fill out the CUSEF Registration Form. Completion of this form does not guarantee advancement to CUSEF but it will show that you have followed all the science fair rules for all competition levels.

Once you have filled it out, give it to your teacher for approval. If it is not complete he/she will give it back for you to complete. If you change your science fair research plan, then you must submit a new plan to your teacher. **If you are doing this project as a group (maximum of three students per project) you will only need to fill out one form.**

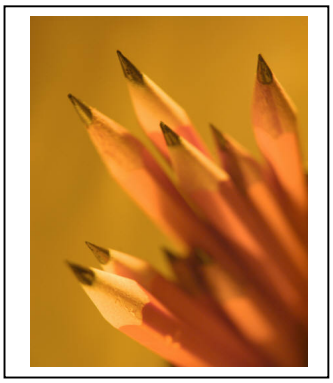
Directions To Filling Out the Four-Page CUSEF Registration Form

Page One—Student and Project Information

1. **Student Information**
   - This is to be filled out by you and anyone else who are doing this project with you. You can have up to three per project.
   - All the information needs to be filled in just in case you need to be contacted either by phone or mail.
2. **Project Information**
   - Fill out all information including teacher's name and his/her email. Your teacher's email will be the first and last name with a period between the first and last names ending with "@jordan.k12.ut.us".
   - Mark the box of which category your project is under. If you have problems knowing, look on pages "1a" and "1b" of the student packet, ask your teachers, or call Paul Nance at 801-244-6479 or email him at paul.nance@jordan.k12.ut.us**.**
   - Mark the boxes on the right if you are going to be experimenting on any of the things listed. If you are, you need to get some signatures before starting your experimentation found on page two of the registration form. If not, mark "none of these".
   - Answer the "yes" or "no" questions at the bottom.

Page Two—Science Fair Project Rules*

(This page is for the those projects that need Special Signatures)



Some projects require special signatures from professionals before you can begin them. These experiments may cause harm to humans and vertebrate animals without being screened. Laws have been set up to protect humans and animals from being hurt, disgraced, or diseased.

The following projects need special signatures from certain professional people listed below with the date they signed it.

- **If you are working with humans as subjects,** you must get **prior approval** from a science teacher, a school administrator, and one of the following: a psychologist (could be from your school), psychiatrist, medical doctor, physician's assistant, or registered nurse. Have each sign on the lines provided on the form. **Also, if any of your subjects are under 18, you need to get written permission from a parent of each child.**

- **If you are working with non-human vertebrate animals as subjects,** you must get **prior approval** from two science teachers and a veterinarian. Have each sign on the lines provided on the form. Proper animal care must be provided daily and there cannot be any pain or discomfort.

- **If you are working with controlled substances,** you must get **prior approval** from two science teachers and a school administrator. Have each sign on the lines provided on the form. All laws in handing the controlled substances must be followed. An adult must be present and supervise the experiment.

- **If you are working with hazardous substance or devices,** you must get **prior approval** from two science teachers and a school administrator. Have each sign on the lines provided on the form. Students must follow the laws in handling these substances or devices. An adult must be present and supervise the experiment.

- **If you are working with potentially hazardous biological agents (bacteria, mold, fungi, viruses, parasites, fresh human or animal tissues),** you must get **prior approval** from two science teachers and a biomedical scientist (usually found at a university or lab office). Have each sign on the lines provided on the form. Growing of unknown microorganisms must be grown in a sealed, unbreakable container such as a Petri dish and stayed sealed during the whole experiment. **The containers must be kept in a lab for observation and not in the home. If this experiment is done at home the project will be disqualified.**

If you have questions about these signatures ask your teacher or call Paul Nance at 801-244-6479 or email him at paul.nance@jordan.k12.ut.us.

***It is important to get these signatures before the experimentation begins. Otherwise, it may cause the project to be disqualified for further competition.**

Page Three—The Science Fair Project Research Plan

After you have chosen a topic, the next step is to write up the research plan for your teacher. There are a couple of reasons a research plan needs to be written.

- **There is pre-work that needs to be done before the actual experimentation. Knowing the steps you need to take to complete a science fair project will help you do a completed project.**
- **Your teacher can look at it and know that your project will be a safe and meaningful project.**

Filling out the Science Fair Project Research Plan includes the following:

1. Coming up with a question that can be answered by science experimentation.
2. Doing research on your topic.
3. Writing a hypothesis using the **"If….then"** phrase using background knowledge acquired during the research.
4. Writing a list of supplies needed for the experimentation.
5. Telling where your experiment will be conducted.
6. The name of your adult supervisor.
7. Writing up the actual procedure, in detail, how you plan to do your experiment.

- **Be sure to be complete when you write up your plan so you, your teacher, parents, supervisor and those who may need to sign it know exactly what you will be doing.**
- **If you change your science fair research plan, then you must submit a new plan to your teacher.**

Page Four—Display and Safety Rules and Student and Parent/Guardian Signatures

1. **Display and Safety Rules**
   - Be sure to read and know all the display and safety rules. They must be followed when displaying your project.
2. **Student and Parent Signatures**
   - All student and parent/guardian signature must be acquired before entering the school, district and CUSEF fairs. Please read the statement above the signature lines so you know what are signing. It is important that you know the rules and what is expected when you enter the different science fairs.
   - There is also a place for parent signatures if child and project information can be appropriately used for publicity purposed.
   - Your teacher also needs to sign and date that your project complies with the rules.
   - You don't need to have the "CUSEF Approval for Completion" at this time.