

Central Jersey College Prep Charter School



Science Fair Handbook 2008-09

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3rd Annual Central Jersey College Prep Charter School Science Fair

Calendar of Events

April 2009

- Entry Forms and Safety Forms given to students (April 15,2009)
- CJCP Science Fair Handbook released.
- Notification letters sent to parents
- **Deadline:** CJCP Science Fair Handbook release and safety forms should be signed by parents (April 17, 2009)
- **Deadline:** Project Idea has to be chosen by student (April 24, 2009)

May 2009

- **Deadline:** Research Plan Attachment should be submitted. (May 8, 2008)
- Judging Information mailed out for Judges (May 15,2008)
- **Deadline:** Power Point Presentations (May 22, 2008)
- **Deadline:** Display Boards (May 29, 2009)
- **3rd Annual CJCP School Wide Science Fair (May 30, 2009)**

LETTER TO PARENTS

Dear Parents,

Your child will participate (mandatory for all middle school) in Central Jersey College Prep Charter School Science Fair, an exciting event that encourages students to think like young scientists. During the next few weeks your child will be designing a science project that uses the scientific method to solve a problem. We hope you agree that the educational benefits are numerous, as students develop skills in writing, oral presentation, creative thinking, and problem solving.

Each student will be given instructions and handouts during class for the various steps of his or her project. Most of the work will be completed at home, and students will receive a weekly calendar noting due dates for each part of the project. For suggestions on helping your child through this process-from choosing a topic to the final report-see various web sites, such as

<http://www.all-science-fair-projects.com>
<http://school.discovery.com/sciencefaircentral/>

Winners will be awarded.

1st place \$100 gift card

2nd place \$75 gift card

3rd place \$50 gift card

We ask that you encourage your child and monitor his or her progress along the way. Your support is the key to a successful project, but please do not allow your involvement to extend any further in order to assure equity and promote student learning! Guide your child whenever and wherever you can, but let the final project reflect your child's individual effort and design. Please read the Science Fair Guidelines with your child (will be given next week) and sign the necessary forms. These forms should be returned by Friday, 4/17/09. Otherwise your child's project will not be approved until forms are submitted. Let us know if you'd like more information on creating a successful science fair project. If you have any questions, do not hesitate to contact us.

All displayed projects will be judged and graded by Science Fair Committee.

Sincerely,

Science Fair Coordinator

Kasim Biyikli

Parent's Signature: _____ Date: _____

Student's Signature: _____ Date: _____

SCIENCE FAIR GOALS

Science teachers have many reasons why we believe the Science Fair is an invaluable experience for our students. Some of the top reasons or goals that we hope our students achieve are:

- to stimulate interest, curiosity, and desire to explore the mysteries of the world.
- to learn, understand, and apply the scientific method.
- to provide real experiences and methods by which all scientific knowledge has been and is still being gathered.
- to help develop skills in communicating both verbally and in writing.
- to help develop skills of interpretation and analysis of data.
- to learn how to complete long range projects.
- to acquire skills of research using a variety of resources such as the Internet, interviews, books, magazines, etc.
- to show a connection between what is learned in the class and what happens in real life.
- to promote unique opportunities for us (teachers) to work individually with you (the student) in an interdisciplinary project.
- to foster independence in the student by providing the opportunity for you to take initiative and responsibility in studying a topic for your own learning.

FOUR MAJOR COMPONENTS

The science fair project can be divided into four major components or parts.

- 1) The Experiment:
 - a. choosing a topic
 - b. performing an experiment
- 2) The Research Paper:
 - a. review literature (research) about your topic and closely related topics
 - b. summarize the experiment and draw conclusions from the experiment
 - c. write a properly formatted and cited research paper
- 3) The Visual Display
 - a. prepare a backboard that illustrates the complete science project
 - b. display equipment and materials needed to explain the project
- 4) The Oral Presentation
 - a. present orally a summary of the project to your teacher, classmates, or judges
 - b. share and explain all phases of the project in an open setting



CJCP SCIENCE FAIR RULES

General Rules and Regulations

1. Students will receive a project grade for their exhibits/projects which will determine the majority of 4th marking period grade in Science class.(40%)
2. However, all students are encouraged to do individual projects, group projects are allowed in all categories. Maximum two students may involve in a group project.
3. All exhibits will be turned in on the due date. See the calendar of events .**No late exhibit is accepted!**
4. For presenting the project at exhibit, student/s will earn 10 extra points for their project. If the student/s will not be at exhibit, the project should be submitted by May 29,2009 but the project will not be judged for awards.
5. All exhibits should be taken after science fair. Exhibits not taken home will be discarded. CJCP Charter school does not take the responsibility for loss or damage to any of the exhibits.
6. Exhibits will have access to electrical power. If your project will need power, request one week in advance to due date.
7. Fair rules will be distributed to the students before school-wide science fair. Failure to follow these rules may result in disqualification from the fair.

SAFETY GUIDELINES

Central Jersey College Prep Charter School follows all rules and requirements specified by most of the national science and engineering fair competition organizations. Students should obtain approval for the projects include biological cultures, chemicals, fire, and radiation. All students should return Science Fair Safety Form.

The exhibits **must not** include any of the following:

1. Microbial cultures or fungi, live or dead (no rotten or moldy stuff either!) Try photographs instead.
2. Displays of live animals.
3. Preserved vertebrate animals, whether whole or their parts (this includes humans).Teeth, hair, nails, and histological sections are permissible if properly acquired and form is filed.
4. Photographs showing vertebrate animals in any non-normal condition.
5. Open or concealed flames, matches, or lighters.
6. Dangerous chemicals, including caustics, acids, and many household chemicals.
7. Highly combustible solids, fluids, or gases. (No rocket engines!)
8. Controlled substances.
9. Radioactive materials.
10. Operating lasers.
11. Anything potentially hazardous to the public.

Special care must be given to the following:

1. High temperature.
2. Batteries. (Open top cells are not permitted.)
3. High voltage equipment must be shielded with a grounded metal box or cage to prevent accidental contact. Wiring, switches, and metal parts must be located out of reach.
4. Electric circuits for 110 volts AC must have an underwriters laboratories approved card equipped with a grounded (3 pronged) plug. Exhibits are limited to 300 watts.
5. All wiring must be properly insulated.
6. Bare wire and exposed knife switches are permissible only in low voltage, low current circuit of 12 volts or less.
7. Electrical connections in 110 volt circuits must be soldered or fixed with approved connectors.
8. Devices emitting ultraviolet light must be equipped with the proper filters for eye protection

DIVISION & CATEGORIES

These are two divisions: 7th Grade and 8th grade. In each division, Experimental exhibits will be divided into three categories:

Life Sciences	Physical Sciences	Engineering/Computer/Math
Plants Behavior/psychology Environmental sciences Biochemistry/Human Body Medicine/Health Microbiology Botany/Zoology	Chemistry Physics	Engineering Electronics/Computer Mathematics

STEPS IN DOING AN EXPERIMENTAL SCIENCE PROJECTS

The steps in the experimental scientific method as usually presented are: Observation, Hypothesis, Controlled Experiment, and Conclusion. To actually do a science experiment, many more steps are needed. The following more accurately reflects the course of an actual experimental investigation.

Initial Observation

You notice something, and wonder why it happens. You see something and wonder what causes it. You want to know how or why something works. You ask questions about what you have observed. You want to investigate. The first step is to clearly write down exactly what you have observed.

Information Gathering

Find out about what you want to investigate. Read books, magazines or ask professionals who might know in order to learn about the effect or area of study. Keep track of where you got your information from.

Title the Project

Choose a title that describes the effect or thing you are investigating. The title should be short and summarize what the investigation will deal with.

State the Purpose of the Project

What do you want to find out? Write a statement that describes what you want to do. Use your observations and questions to write the statement.

Identify Variables

Based on your gathered information, make an educated guess about what types of things affect the system you are working with. Identifying variables is necessary before you can make a hypothesis.

Make Hypothesis

When you think you know what variables may be involved, think about ways to change one at a time. If you change more than one at a time, you will not know what variable is causing your observation. Sometimes variables are linked and work together to cause something. At first, try to choose variables that you think act independently of each other. At this point, you are ready to translate your questions into hypothesis. A hypothesis is a question which has been reworded into a form that can be tested by an experiment.

Make a list of your answers to the questions you have. This can be a list of statements describing how or why you think the observed things work. These questions must be framed in terms of the variables you have identified. There is usually one hypothesis for each question you have. You must do at least one experiment to test each hypothesis. This is a very important step. If possible, ask a teacher to go over your hypothesis with you.

Design Experiments to Test Your Hypothesis

Design an experiment to test each hypothesis. Make a step-by-step list of what you will do to answer each question. This list is called an experimental procedure. For an experiment to give answers you can trust, it must have a "control." A control is an additional experimental trial or run. It is a separate experiment, done exactly like the others. The only difference is that no experimental variables are changed. A control is a neutral "reference point" for comparison that allows you to see what changing a variable does by comparing it to not changing anything. Dependable controls are sometimes very hard to develop. They can be the hardest part of a project. Without a control you cannot be sure that changing the variable causes your observations. A series of experiments that includes a control is called a "controlled experiment."

Experiments are often done many times to guarantee that what you observe is reproducible, or to obtain an average result. Reproducibility is a crucial requirement. Without it you cannot trust your results. Reproducible experiments reduce the chance that you have made an experimental error, or observed a random effect during one particular experimental run.

Some Guidelines for Experimental Procedures

- Select only one thing to change in each experiment. Things that can be changed are called variables.
- Change something that will help you answer your questions.
- The procedure must tell how you will change this one thing.
- The procedure must explain how you will measure the amount of change.
- Each experiment should have a "control" for comparison so that you can see what the change actually did.

Obtain Materials and Equipment

Make a list of the things you need to do the experiment, and prepare them.

Do the Experiments and Record Data

Experiments are often done in series. A series of experiments can be done by changing one variable a different amount each time. A series of experiments is made up of separate experimental "runs." During each run you make a measurement of how much the variable affected the system under study. For each run, a different amount of change in the variable is used. This produces a different amount of response in the system. You measure this response, or record data, in a table for this purpose. This is considered "raw data" since it has not been processed or interpreted yet. When raw data gets processed mathematically, for example, it becomes results.

As you do experiments, record all numerical measurements made. Data can be amounts of chemicals used, how long something is, the time something took, etc. If you are not making any measurements, you probably are not doing an experimental science project.

Record Your Observations

Observations can be written descriptions of what you noticed during an experiment, or problems encountered. Keep careful notes of everything you do, and everything that happens. Observations are valuable when drawing conclusions, and useful for locating experimental errors.

Perform Calculations

Do any calculations needed from your raw data to obtain the numbers you need to draw your conclusions. For example, you weighed a container. This weight is recorded in your raw data table as "wt. of container." You then added some soil to the container and weighed it again. This would be entered as "wt. of container + soil." In the calculation section, do the calculation to find out how much soil was used in this experimental run:

$$(\text{wt. of container} + \text{soil}) - (\text{wt. of container}) = \text{wt. of soil used}$$

Each calculated answer is entered into a table in a Results section.

Not all experiments need a calculation section. However, if you do not have any calculations you may not be using the experimental scientific method. If you have calculations to make, you probably are using the experimental scientific method.

Summarize Results

Summarize what happened. This can be in the form of a table of processed numerical data, or graphs. It could also be a written statement of what occurred during experiments.

It is from calculations using recorded data that tables and graphs are made. Studying tables and graphs, we can see trends that tell us how different variables cause our observations. Based on these trends, we can draw conclusions about the system under study. These conclusions help us confirm or deny our original hypothesis. Often, mathematical equations can be made from graphs. These equations allow us to predict how a change will affect the system without the need to do additional experiments. Advanced levels of experimental science rely heavily on graphical and mathematical analysis of data. At this level, science becomes even more interesting and powerful.

Draw Conclusions

Using the trends in your experimental data and your experimental observations, try to answer your original questions. Is your hypothesis correct? Now is the time to pull together what happened, and assess the experiments you did.

Other Things You Can Mention in the Conclusion

- If your hypothesis is not correct, what could be the answer to your question?
- Summarize any difficulties or problems you had doing the experiment.
- Do you need to change the procedure and repeat your experiment?
- What would you do different next time?
- List other things you learned.

A SAMPLE PROJECT

The Effect of Salt on the Boiling Temperature of Water

INITIAL OBSERVATION

Cooking instructions tell you to add salt to water before boiling it.

PROJECT TITLE

The Effect of Salt on the Boiling Temperature of Water

PURPOSE OF THE PROJECT

To find out how table salt affects the boiling temperature of water.

HYPOTHESIS

Adding table salt to boiling water will cause the water to boil at a higher temperature.

MATERIALS AND EQUIPMENT

- Table Salt
- Distilled Water
- 2 Quart Cooking Pot
- Pint measuring cup
- Teaspoon and tablespoon measuring spoons
- Thermometer
- Stirring spoon

EXPERIMENTAL PROCEDURE

- 1 Boil one quart of distilled water on a stove.
- 2 Measure the temperature of the boiling water. Record the highest temperature reading. This is the **control** to compare with.
- 3 Measure out table salt using a kitchen measuring spoon. Level the spoonful.
- 4 Add the measured salt to the boiling water and stir.
- 5 Measure the temperature of the boiling water with the salt in it. Record the highest temperature reading.
- 6 Repeat for other amounts of salt.

DATA

Data Obtained: 2/25/95, Mankato, MN	
Amount of boiling water	2 Cups
Temperature of boiling water (Control)	212.9° F
Amount of table salt added to boiling water: Run #1	1 Tbl.
Temperature of boiling water after adding salt: Run #1	215.6° F
Additional amount of table salt added to boiling water: Run #2	1 Tbl.
Temperature of boiling water after adding salt: Run #2	218.3° F

EXPERIMENTAL OBSERVATIONS

when the salt was added to boiling water it bubbled up more, and then stopped boiling. Shortly afterwards, it boiled again.

If the thermometer extends beyond the outside of the pot it reads a higher temperature. Heat from the stove burner makes the thermometer read higher. Keep the thermometer over the pot when making temperature measurements.

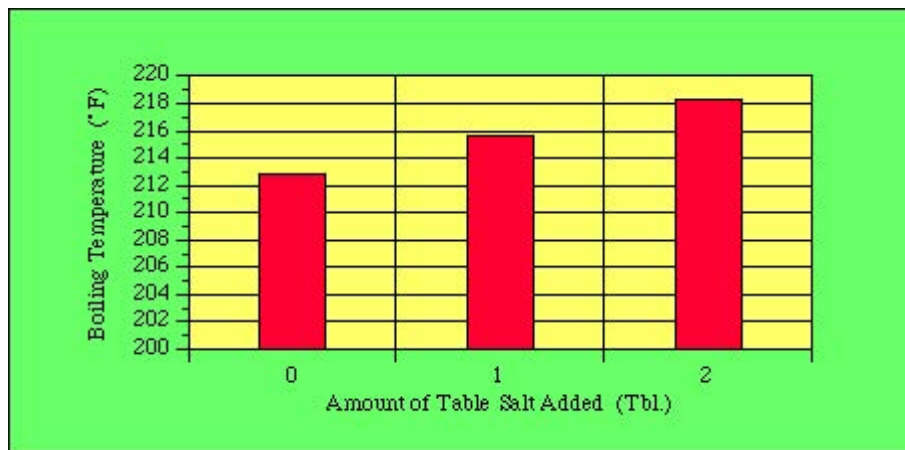
CALCULATIONS

- Total amount of table salt added for Run #1: $0 + 1 = 1$ Tbl.
- Total amount of table salt added for Run #2: $1 + 1 = 2$ Tbl.

Temperature of boiling water (Control)	212.9° F
Amount of table salt added to boiling water: Run #1	1 Tbl.
Temperature of boiling water after adding salt: Run #1	215.6° F
Total amount of table salt added to boiling water: Run #2	2 Tbl.
Temperature of boiling water after adding salt: Run #2	218.3° F

RESULT

Amount of Table Salt Added Versus Water Boiling Temperature



CONCLUSIONS

- Is the hypothesis correct? Yes. Adding table salt to water causes the water to boil at a higher temperature.
- Problems with doing the experiments. The temperature readings were hard to make. Gloves had to be worn to keep my hands from getting too hot. Had to be careful that the stove heat was not hitting the thermometer.
- Other things learned. Be careful when adding salt to boiling water. It makes the water boil vigorously for a second or two.

RELATED QUESTIONS

- Why do you think cooking instructions tell you to add salt when boiling water? When the water is hotter, you can cook food faster. Salt also makes the food taste better.

PARTS OF A RESEARCH PAPER & POWERPOINT PRESENTATIONS

Each student is required to submit a research paper for their research project. After their project is approved, students will prepare a PowerPoint presentation in science/computer classes and they will decorate their poster boards.

The following parts should be covered by your project

- 1 INTRODUCTION (Explain your topic. What is it about?)
- 2 PURPOSE (The purpose of a statement of what you intend to do. What is your goal? What idea are you trying to test?)
- 3 PROBLEM (What is the scientific question you are trying to answer?)
- 4 HYPOTHESIS (Explain how you think your project demonstrate your purpose. Make a prediction regarding the outcome of your experiment. State the results you are predicting in measurable terms.)
- 5 VARIABLES (Independent, dependent, constants, and control group. Be clear about the variables (elements of the experiment that change to test your hypothesis) versus your controls (elements of the experiment that do not change).
- 6 MATERIALS (List all materials and equipment that were used. Your list of materials should include all of the ingredients of the procedure recipe.)
- 7 PROCEDURE (In steps not in paragraphs), if possible, with pictures. Give a detailed explanation of how you will conduct the experiment to test your hypothesis. Be very specific about how you will measure results to prove or disprove your hypothesis. You should include a regular timetable for measuring results or observing the projects (for example, every hour, every day, and every week). Your procedure should be like a recipe – Another person should be able to perform your experiment following your procedure. Test this with a friend or parent to be sure you have not forgotten anything.)
- 8 PICTURES
- 9 DATA TABLES (All of your data in tables)
- 10 GRAPHS!
- 11 ANALYSIS (Explain your observations, data and results. This is a summary of what your data has shown you. List the main points that you have learned. Why did the results occur? What did your experiment prove? Was your hypothesis correct? Did your experiment prove or disprove your hypothesis? This should be explained thoroughly.)
- 12 CONCLUSION (Answer your problem/purpose statement. What does it all add up to? What is the value of your project?)
- 13 APPLICATIONS & FURTHER RESEARCH (What is the application of your project in daily life/economy? What further study do you recommend given the results of your experiment? What would be the next question to ask? If you repeated this project, what would you change?)
- 14 BIBLIOGRAPHY List the books, magazines, or other communications you used to research your topic.

DISPLAY BOARD

Your science fair display represents all the work that you have done. It should consist of a backboard, the project report, and anything that represents your project, such as models made, items studied, photographs, surveys, and the like. It must tell the story of the project in such a way that it attracts and holds the interest of the viewer. It has to be thorough, but not too crowded, so keep it simple. The allowable size and shape of the display backboard can vary, so you will have to check the rules for your science fair. Most exhibits are allowed to be 48 inches (122 cm) wide, 30 inches (76 cm) deep, and 108 inches (274 cm) high (including the table it stands on). These are maximum measurements, so your display may be smaller than this. A three-sided backboard is usually the best way to display your work. Sturdy cardboard or other heavy material is easier to work with and is less likely to be damaged during transportation to the fair. Some office supply stores sell inexpensive premade backboards such as Hobby Lobby, Office Depot. Purchased backboards generally come in three colors, black, blue, and white. You may use one of these colors. The title and other headings should be neat and large enough to be read at a distance of about 3 feet (1 m). A short title is often eye-catching. Self-sticking letters, of various sizes and colors, for the title and headings can be purchased at office supply stores and stuck to the backboard. You can cut your own letters out of construction paper or stencil the letters for all the titles directly onto the backboard. You can also use a word processor to print the title and other headings.

The following headings are examples: Problem, Hypothesis, Experiment (materials and procedure), Data, Results, Conclusion. The project title should go at the top of the center panel, and the remaining material needs to be placed neatly in some order.

You want a display that the judges will remember positively. So before you glue everything down, lay the board on a flat surface and arrange the materials a few different ways. This will help you decide on the most suitable and attractive presentation. The figure below shows what a good display might look like.



THE PRESENTATION

1. The presentation along with the backboard is very important within the scientific community. Using the backboard as your prop, you will present your project in an objective and scientific perspective. The following topics should be addressed while presenting.
2. **INTRODUCTION:** Give the project title, your name, grade, school, and science teacher. Explain the topic to be discussed and why you became interested in this topic.
3. **ACKNOWLEDGMENTS:** Thank the people who helped you and those whom you contacted for interviews or research information.
4. **PURPOSE AND HYPOTHESIS:** State clearly the purpose and hypothesis. A short explanation of the reasoning behind the hypothesis is appropriate.
5. **BACKGROUND INFORMATION:** The background section is like a short review of literature. Give some of the information from the review but just enough to familiarize the audience.
6. **PROCEDURE:** A detailed and complete explanation of how you completed the experiment. Use the step by step method just as you wrote for the paper. Start with the first step and proceed including explanations of designs and techniques used while experimenting.
7. **RESULTS:** Use the charts and graphs on the backboard to explain the results and numbers that were produced from the experiment.
8. **CONCLUSION:** State clearly the conclusion, whether the hypothesis was accepted or rejected. Admit any deficiencies or errors that may have occurred during the experiment and may affect the conclusion. All scientists respect the fact that all experiments have some deficiencies.
- a. **FUTURE PLANS:** Discuss any possible future investigations that can be done to continue with your project.
9. **QUESTIONS:** At the end, ask if anyone has questions for you. Take your time and think about the answer, then answer slowly. If you do not know the answer, admit it! Offer to look for the answer and then ask for more questions. It is better to admit to not knowing, than to be wrong! If questions are not related to your topic, try to clarify the question. If the question is still unrelated, then redirect the conversation back to your topic.
10. **THANK THE AUDIENCE AND JUDGES FOR LISTENING!**

HELPFUL HINTS:

- Use note cards and the backboard to make sure that you hit all points.
- Do NOT read the backboard or note cards.
- Speak slowly and face the audience.
- Be dynamic and enthusiastic.
- Practice! Practice! Practice in front of parents, friends, teachers, mirrors, etc.

JUDGING CRITERIA

CRITERIA	INDV	TEAM	EXPLANATION
Creativity	30	25	Originality of the problem, uniqueness of approach and the handling and interpretation of data should be commensurate with the grade level of the student. Ingenious use of equipment and materials is considered regardless of the expense of the items involved.
Scientific Thought or Engineering Goals	30	25	SCIENTIFIC THOUGHT The project shows evidence of depth of study and effort in employing scientific procedures in the solution of a clearly defined problem including study of background, sampling, orderly recording and analysis of data, and the formulation of logical conclusions or engineering goals. The project has a clear objective relevant to the needs of the potential user. The product or process has been tested and is workable and feasible economically and ecologically.
Thoroughness	15	12	The study is complete within the scope of the problem. Scientific literature has been searched, experiments have been repeated and careful records have been kept.
Skill	15	12	Credit is given for special skills needed for the construction or use of equipment and for mathematical, computational, and observational and design skills.
Clarity	10	10	The purpose, procedures and conclusions are clearly explained orally and through the display. The project notebook is well organized, and neat and accurate. Sources of ideas, data and assistance are clearly identified.

**3rd ANNUAL CJCP SCIENCE FAIR
HANDBOOK RELEASE FORM**

(This form is necessary for all students)

My signature below indicates that I have read and understand CJCP Science Fair Handbook Guidelines and have been given a copy of my own to keep.

Student Name and Signature

Date

Email Address

SCIENCE PROJECT SAFETY FORM

(This form is necessary for all students)

Student's Name : _____
Grade : _____
Parent/Guardian Name : _____
Phone Number : _____

- If a science project involves vertebrate animals, human subjects (including surveys), controlled substances and pathogens, recombinant DNA, tissues including blood, cell cultures, microorganisms, environmental sampling, or potentially dangerous chemicals or equipment; you need approval from the Science Fair Committee.
- All bacteria, fungi, etc. should be considered potentially pathogenic.
- Air, water, mud and soil samples may contain pathogens or hazardous materials.
- Learn about animal safety measures if working with animals. Pet store animals may not be used for any type of research.
- Surveys should not involve violation of privacy act or potential risk.
- Consumable alcohol and tobacco products and drugs must be obtained by and used by adult project supervisor.
- If using equipment that has voltage greater than 220 volts, firearms, radioactive substances and radiation, you need to review the proper safety standards before experimentation.
- The starting date of project is when approved. No student can begin until they receive approval from their parents and teacher.

Student Acknowledgement:

I understand the risks and possible dangers to me of the project I will be working on. I will adhere to all CJCP Science Fair rules when conducting my research and project.

(Student's Printed Name) (Signature) (Date)

Parent/Guardian Approval:

I have read and understand the risks and possible dangers involved in a science fair project. I consent to my child participating in a research project.

(Parent/Guardian's Printed Name) (Signature) (Date)

Research Plan Attachment

A. Problem/Purpose/Question Being Addressed

The students should present the ideas behind the research. Why is the research to be done? There should be a reason for wanting to do the research. Some explanation should be given regarding what the research is expected to show and what is to be learned.

The last statements of this section should include a specific purpose of the research and an applicable hypothesis. The purpose should reflect a very close relationship with the title. Use additional sheets if needed.

B. Hypothesis/Engineering Goals

A specific statement of the Hypothesis(es) or Engineering Goals must be included. Explain how you think your project can demonstrate your purpose. Make a prediction regarding the outcome of your experiment. State the results you are predicting in measurable terms.

C. Methods or Procedures

Give a detailed explanation of how you will conduct the experiment to test your hypothesis.

Be clear about the variables (elements of the experiment that change to test your hypothesis) versus your controls (elements of the experiment that do not change).

Be very specific about how you will measure results to prove or disprove your hypothesis. You should include a regular timetable for measuring results or observing the projects (for example, every hour, every day, and every week).

Your procedure should be like a recipe - Another person should be able to perform your experiment following your procedure. Test this with a friend or parent to be sure you have not forgotten anything.

For projects involving human research, include survey or questionnaire if used, and critically evaluate the risks.

For vertebrate animal research, you must briefly discuss potential alternatives and present reasons why alternatives are not suitable.

MAJOR DEVIATIONS FROM THE APPROVED PLAN MAY ONLY BE IMPLEMENTED WITH THE WRITTEN APPROVAL OF THE QUALIFIED SCIENTIST OR THE TEACHER-SUPERVISOR.

D. Bibliography

List the books, articles and papers that were read in preparation of the Research Plan.

Each reference should contain the author, title of the book or paper, publisher, date of publication, and pages used. Research involving animals must have appropriate references on animal care.

RESEARCH PLAN ATTACHMENT 2008-2009

TITLE:

BY:

A. Problem/Purpose/Question Being Addressed*

B. Hypothesis I Engineering Goals*

RESEARCH PLAN ATTACHMENT 2008-2009

TITLE:

BY:

C. Methods or Procedures*

D. Bibliography*

*Use more sheets if needed