

**Individual Science Research Packet**

**for Teachers**

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Date

Dear Parents:

As part of our science curriculum at **(insert school)**, students will participate in conducting a science fair project and the paper will be due in **(insert date)**. The board will be due **(insert date)**. Your student has been given a packet of information regarding the fair, and all of the rules and guidelines concerning the project. Please review this information with them so that there will be no confusion regarding due dates, rules, etc. The project will be completed and presented in class in early January. Please keep in mind that these dates are for final, not rough drafts. Therefore, your help in proofreading all of their assignments before they are turned in for a grade is very important.

Please sign this form and have your child return it to their teacher as soon as possible. Thank you for your help and cooperation.

Respectfully,

(Insert name)

(Insert title)

Science Department

Student Signature (print): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Parent: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Regional Science Fair Date: (Insert date), held at the (Insert location)

Student projects will be evaluated (insert date) at our Annual Science Showcase Day and if selected, will receive an invitation from (insert school) to represent our school at the Regional Fair. ALL students will present their project on (insert date), but NOT all students will defend their project at the Regional Level.

Annual Science Showcase will be open to all parents, family members, student body and faculty/staff at (insert school). It will be held during 7th and 8th periods in the gym.

# INDIVIDUAL SCIENCE RESEARCH PROJECT GUIDELINES

This project will enhance critical thinking, speaking, and writing skills, develop the use of the scientific method to solve problems, and establish contacts with researchers in the community. **For rules, guidelines, and other helpful information, visit the** [**Regeneron International Science and Engineering Fair**](https://www.societyforscience.org/isef/)

**Below are the items that must be turned in before the science fair:**

Topic selection and Literature Review must be turned in even if they were accepted and graded by your last year’s science teacher, or you may choose to submit a new topic. They will be re-evaluated and re-graded by your current science teacher. Please note that due dates and grading criteria are subject to change, and may be slightly different from teacher to teacher. **Grading will also reflect originality of the project and effort put into its completion. Item 7 must be submitted to turnitin.com by midnight of the due date. All forms can be downloaded from the above website, using the Regeneron ISEF** [**Rules Wizard**](https://ruleswizard.societyforscience.org/)

**LOGBOOK – work on throughout project, turn in with final paper**

# TOPIC SELECTION (including null/alternate hypothesis

# and question) DUE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. RESEARCH PLAN (refer to sample research plan) **DUE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
2. REVISED RESEARCH PLAN **DUE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
3. SRC/FORMS REVIEW **DUE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
4. LITERATURE REVIEW **DRAFT** **DUE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
5. RESULTS/DISCUSSION/ABSTRACT DRAFT **DUE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

# FINAL PAPER with all corrections (test grade) DUE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(must include original/graded drafts)

# DISPLAY BOARD (test grade) DUE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. ORAL PRESENTATION (gym/science fair) **DUE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

# Remember the following guidelines throughout your project

* Everything must be in Times New Roman, 12 font and APA format
* 1” margins with double spacing and only one space after a period.
* **Do not use first person.**
* Try to use past tense or passive voice.
* This should **NOT** be written like a creative writing assignment.
* **All measurements must be in metric.**
* All papers returned to you from your teacher must be kept in a folder, to be turned back in at the end of the project with your final paper.
* Any special supplies needed that require your teacher to order must be written down and submitted for approval.
* Refer to the sample papers/abstracts/logbook available in class.

**I. TOPIC SELECTION:**

**A. After choosing a topic that is interesting to you, apply the following requirements:**

1. It must be an experiment, not a survey or demonstration.
2. It must involve a problem that is solved by applying the scientific method.
3. There must be only one variable (or condition) being tested and a control group is established.
4. A hypothesis must be formed.
5. The experiment must result in a collection of quantitative data that can be analyzed to solve the problem, and must be repeated a minimum of three times for validity.
6. Choose a category below from the Intel ISEF Categories and Subcategories below:

\* Projects in these categories are guaranteed to require Preapproval from the SRC/IRB committee

**0100 Behavioral and Social Sciences**  
**0200 Biochemistry**  
**0300 Inorganic Chemistry**  
**0400 Organic Chemistry**  
**0500 Earth and Environmental Science**  
**0600 Animal Sciences**  
**0700 Biomedicine and Health**  
**0800 Microbiology**  
**0900 Physics and Astronomy**  
**1000 Engineering Mechanics**)**1100 Mathematics and System Software**  
**1200 Robotics and Intelligent Machines**)

**1300 Plant Sciences**

Full description of courses: <https://www.sciencefair.msstate.edu/categories/>

**B. Turn in the Science Project Proposal Form from your teacher. (First item due)**

**Science Fair Project: Proposal Outline** (original document on [Region V Science Fair website](https://www.sciencefair.msstate.edu/))

Answer the following questions as best you can. It will give me an idea of what you’re trying to accomplish.

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| --- |
| Once you find a general topic that interests you, write down the question that you want to answer. A scientific question usually starts with: How, What, When, Who, Which, Why, or Where. For example, “How much current does a robot’s arm use to lift a weight?”  **What is your project question?** |
| **Purpose:** Write 1 – 2 full sentences stating the problem. |
| **Summary**: Briefly describe the project in 2 – 4 sentences. |
| **Why** do you want to conduct the experiment? (Rationale) |
| **What** do you hope to learn about? (Research Problem) |
| What you do **hypothesis** will happen? (null and alternate, if possible) If you’re unsure how to write a null/alternate hypothesis, write the hypothesis the best you can. |
| A ‘good objective test’ requires that you change only one factor (variable) and keep all other conditions the same. If you cannot design a ‘good objective test, then you should change your question.  **Can you design a fair test to answer your question? YES NO** |

|  |
| --- |
| Your science fair project should involve factors or traits that you can easily measure using a number. Or, factors or traits that are easily identified (like colors)  What will you measure? |
| The experiment should measure change to the important factors (variables) using a number that represents a quantity such as a count, percentage, length, width, weight, voltage, etc. Or, just as good might be an experiment that measures a factor (variable) that is simply present or not present. For example, light ON in one trial, then light OFF in another trial, or USE fertilizer in one trial, the DO NOT USE fertilizer in another trial.  What will you change? (independent variable or manipulated variable) |
| You must be able to control other factors that might influence your experiment. A ‘fair test’ occurs when you change only one factor (variable) and keep all other conditions the same.  What will you **NOT** change, only measure and observe? (dependent variable or responding variable) |
| Is your experiment **safe** to perform? **YES NO Unsure**  If unsure, go to: <https://student.societyforscience.org/international-rules-pre-college-science-research> and review the rules for all projects. Explain why you’re unsure if the experiment is not safe. |
| Do you have all the materials and equipment you need for your science fair project, or will you need assistance with the supplies? Please be as thorough as possible. |
| Will you perform your project on campus, home, or at another facility? If another facility, please include the name of the company and possible mentor. |
| Are currently working on a research project not associated with the research course here at MSMS? If so, please state where, how long, mentor, and if it is a continuation project. |
| When are you available to work on your project? For example, during school when your schedule is open, directly after school, during tutorials? |
| Do you have enough time to do your experiment before the deadline of your region’s science fair? Some regions in Mississippi have fairs as early as January**. YES NO Unsure**  Visit: <https://msefair.wixsite.com/msef> |

Once your topic has been approved, you may begin your experiment. If your project is a continuation project, you must submit an explanation of how the first-year project was performed, as well as how the second-year project will proceed. A logical progression of the project must be evident in order for a second-year project to be approved.

# II. RECORD KEEPING:

1. Purchase a composition or spiral notebook to be used specifically for this project.
2. This logbook **should begin on day one** of your topic selection, and must include anything you do in regards to your project. (all brainstorming, rough sketches of your design, background research, method, data tables, graphs, all results, discussion, abstract, etc.)
3. Set up your logbook as follows. Always use page numbers and dates/times of entry.
   1. First page: Title page
   2. Second page: Table of contents
   3. Third page and on: any work performed on your project (data tables and graphs may be glued in). Be sure and include possible errors that may have occurred, or things that may have affected the outcome of your experiment.

# III. LITERATURE REVIEW AND REFERENCES: This is a summary of what the scientific literature says about your specific topic or question.

# Sources can be from the following: magazines, science journals, newspaper articles, popular literature, and scientists in the field of interest. Sources must be dated 2008 to date unless you have received teacher approval. You must use a minimum of (6) six resources. One additional resource must be a MSDS reference (if needed for the experiment).

1. Your paper must be written in APA format. Therefore, when citing sources within the body of your paper, put the author/authors name, a comma, and the year of publication, all in parenthesis at the end of the sentence, followed by a period. Example (White, 1999). No footnotes are needed.
2. The Literature Review **must contain a minimum of \_\_\_\_ words, and include the following:** 
   1. An introduction that states the topic and why it is important.
   2. The question/hypothesis or problem to be to be explored.
   3. Literature review of past research on the topic.
   4. Extensive referencing to establish support for the discussion.
   5. An explanation of how your study will add to the past research on the topic.
   6. Establishing your initial hypothesis.
   7. Word count at the end of the paper (only on the rough draft).

**Questions to keep in mind:**

* Did you define the problem?
* Was an adequate literature search conducted? Was recent scientific literature cited as well as popular literature?
* Was there a logical progression to your background research?
* Did you discuss experimental methods being conducted in your field of interest?
* Were future plans and possible directions of research clearly expressed?
* Were your written explanations clear and concise?
* If tables, graphs and/or illustrations were used, did you explain and cite them correctly?
* Was your research from a published and recognized institution?

1. The Literature Review must also contain a **“Works Cited”** page to list all books and periodicals used in your literature review. Some of the specific rules for writing a “Works Cited” page are:

* It must be on a separate page.
* Sources should be properly punctuated with periods, colons, and commas.
* Use APA format for the reference page.
* Alphabetical order by author’s last name.
* Double-space between all lines on the References page.
* Do not number your sources.
* Be sure to include a MSDS reference (if applicable)

**IV. METHODOLOGY/ PROCEDURE:** This section describes the method by which the experiment was conducted. It can be in paragraph, bullet, or numbered format but laid out step-by-step, using time transitions such as “then” and “next”. Subheadings should be used such as “Participants”, “Materials”, and “Procedure”. (See the sample paper in your classroom for help.) Detail is a must when writing the methods portion of the paper.

**V. RESULTS AND DATA:** These sections should restate your hypothesis and summarize your findings, including any problems encountered, followed by an interpretation of the results. Data tables and graphs should be included in this part of your paper.

1. Data tables showing your results should have a title, columns must be labeled, and units of measuring must be metric.
2. Graphs are used to analyze your data, and may be in the form of line graphs, bar graphs, scatter graphs, pie charts, relational graphics, or before and after illustrations. They must be completed on Microsoft Excel (or some other type of graphing program). They must have a title, and both axes must be labeled. If there is more than one line, include a legend identifying each line. When doing calculations, show the equation(s) you are using and how to solve it.

**VI. DISCUSSION (CONCLUSION):** This section is a summary of what you have done and an explanation of what you have deduced from your experimental results. It should also contain a short concluding paragraph at the end. The following should be included in this section:

1. State your problem once again.
2. State your hypothesis and explain why you formed that particular hypothesis.
3. Summarize your experiment and state the general results.
4. Explain the meaning of the results (the analysis).
5. If your hypothesis was correct, explain why it was correct. If your hypothesis was incorrect, then explain why. State your revised hypothesis.
6. Explain your errors, or why your results may have been skewed.
7. Explain what you would do to investigate your topic further.

**VII. ABSTRACT:** This section summarizes the problem or question, participants, hypotheses, methods used, results, and conclusions. **It is usually the first item that a judge will read, and therefore is extremely important.** It is written last, but then placed at the beginning of the report. **It must be a minimum of 125 words, or a maximum of 250 words.**

**VIII. VISUAL PRESENTATION:** Your visual presentation is the first impression someone will have of your project. Purchase a ready-made presentation board that is free standing for a table display. Be sure to review maximum limits for boards online at <http://www.societyforscience.org> and refer to rules and guidelines. **MAKE TYPE LARGE ENOUGH TO BE READ AT LEAST 4 FEET AWAY**.

**The following are required on the display board:**

* Project Title
* Question (Problem) and Hypothesis
* Abstract (framed/pinned to front of table but not on the board)
* Method/Procedures
* Data tables and graphs
* Results and Discussion
* You may have photos of you conducting the experiment. Other types of photos MUST be cited.

**The following cannot be on the display board:**

* Photographs from books, magazines, Internet, etc. **without** acknowledging the source.
* NO Acknowledgments for companies, mentors, etc. who have assisted you with your project.

Example: All graphs, diagrams, math calculations, and figures are designed by student research unless otherwise noted.

**If your projects is selected to compete at the Regional Fair:**

**The following is required on the table with your display board for the day of the fair in February:**

* Copy of the final written report in a folder.
* Logbook
* Any equipment, models, etc. from your experiment, but no live cultures, animals, DNA samples, plants, etc.
* At least 10 copied abstracts for judges to take and read (only if your project proceeds to the regional fair)

**IX. ORAL PRESENTATION:** When the judges come to see your project, they will ask you to explain what you did, or they may simply observe for a few minutes and ask particular questions. It is important to understand the research that you discussed in you Literature Review, so be prepared. Be ready to present your project in a four to five-minute time frame. Remember that (insert type of dress clothes) is required on the day of the science fair.

**When you explain your project to the judges, include the following areas:**

1. Your problem/question.
2. Your hypothesis and why you chose it.
3. How you performed the experiment and collected the data.
4. An analysis of your data.
5. A conclusion, including how you might continue the project.

**Ideas for a good oral presentation:**

* Make eye contact.
* Enunciate your words and be confident.
* Show that you are excited and interested in your project.
* Avoid using “umm”, “ahh”, and “like”.
* Do not chew gum.
* Practice your presentation with a video camera or for someone else for an evaluation of your project.
* Point to your display board as you explain each part.
* Remember that you are trying to convince someone that you know a great deal about your project. A judge will remember more about how you presented your project (approximately 60% of your presentation) than what your actual project is about.
* Be polite, using words such as “yes sir”, “no sir”, etc.
* Shake the judge’s hand and thank them for their time.



<http://www.easyclassical.com/images/figure7_1_1_.gif>

**X. FINAL PAPER LAYOUT: APA FORMAT (refer to sample paper).**

**1. First Page – Title page (double spaced)**

* Centered on the paper from left to right and top to bottom
* Title of your project
* Your name
* Place a page header one-half inch from the top right, and put five spaces between the page header and the number. (APA format)

**2. Second Page – Abstract**

* “Abstract” centered at the top of the page. Only the Abstract should be on this page.

**3. Third Page – Begin Literature Review (Similar to Introduction, just longer)**

* “Title of Paper” centered one inch from the top of the page.

**4. The Materials/Equipment and Method section should be placed directly under the Literature Review section, NOT on a separate page.**

* “Materials/Equipment” and “Methodology” centered or left justified on the page.

**5. The Results section should be placed directly under the Method section, NOT on a separate page.**

* “Results” centered or left justified on the page.

**6. The Data Analysis section should be placed directly under the Results section, NOT on a separate page.**

* “Data Analysis” centered or left justified on the page.

**7. The Discussion (or Conclusion) section should be placed directly under the Results section, NOT on a separate page.**

* “Discussion” centered or left justified on the page.

**8. The “Errors/Improvements” section should be placed directly under the Discussion section, NOT on a separate page.**

* “Errors/Improvements” centered or left justified on the page.

**7. The Works Cited page should be on a separate page**.

* **“**Works Cited” centered at the top of the page.

**APA STYLE REFERENCING RULES AND EXAMPLES:**

**A.** APA style prefers a reference to the print form of a source, even if it is available on the Net. If you have read **only** the electronic form of an article’s print version, add “Electronic version” in brackets after the title of the article. If an on-line article has been changed from the print version or has additional information, follow the same general format for the author, date, and title elements of print sources, but follow it with a “retrieved” statement, citing the date of retrieval and the electronic address. Refer to the following website for guidance on the proper format of the paper: <http://owl.english.purdue.edu/owl/resource/560/01/>

**RESEARCH WEBSITES FOR SCIENCE FAIR IDEAS**

Keep in mind that selecting a science fair project already performed is plagiarism. These sites are to assist you designing your project, not copying a project. Some sites may no longer be active. If you find a search engine that you’d like to share with the class, let me know.

<http://www.nature.com>; <http://www.sciencenews.org>; <http://www.eurekalert.org>

**Projects Supply Companies:**

Carolina Biological Supplies: <http://www.carolina.com/> ; Flinn Scientific: <http://www.flinnsci.com/>

**Items needed to compete in the Region V Regional Fair: (example from my former fair)**

* Release and consent form (permission slip) for Seminole County Public Schools, Florida
* Parental Information Form
* Individual or team entrant form MUST be submitted
* All participants need the following forms: Checklist for Adult sponsor, Student Checklist 1A, Research plan (details are very important), Approval form 1B
* If IRB or SRC approval is needed, you MUST have preapproval by the fair committee. SRC and IRB committees within your school cannot replace the fair committee approval
* Electronic signatures are not allowed for the Qualified Scientist
* MSDS reference MUST be included in the works cited page and research plan
* If conducting a lab at a BSL-1, a BSL checklist MUST be included
* A SSEF abstract MUST be submitted
* Private schools must retrieve the Awards ceremony invitations. They will not be delivered to your school
* The Awards ceremony will NOT be held on the same day as the fair
* A chaperone MUST be present the day of the fair (due to location) and a form must be submitted to the fair committee

**Research Plan Template (original document on** [**Region V Science Fair website**](https://www.sciencefair.msstate.edu/)**)**

**Example**

|  |
| --- |
| **Student Name:** Minnie Mouse |
| **School Name:** Nursery School |
| **Category:** Earth & Environmental Sciences |
| **Science Teacher’s Name:** Tina Gibson |

**Question or Problem being addressed – Title**

|  |
| --- |
| Creating a Fungicide from Extracts of the Bromeliad Spanish Moss in Central Florida |

**Hypothesis/Engineering Goals**

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| A fungicide consisting of extracts of Spanish Moss (gathered from sites near highways with heavy traffic and residential urban sites in central Florida) can be created through the process of looking into the chemical composition of Spanish Moss, and analyzing and experimenting on the extracts of the bromeliad. |

**Rationale**Brief synopsis of the background research that supports your research problem and explains why this research is important scientifically.

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| There are many existing chemical and physical uses of extracts from the bromeliad Spanish Moss, such as making bedding, emergency clothes, lids for cooking pots, serving as sponges, floral decorations; “brewed into a tea to treat fevers, chills, rheumatism and contraction pains of childbirth”,” treatment of infant epilepsy, estrogen substitute, and antibacterial uses”, “strengthen and protects skin capillaries and slows skin cells decline” (Deane, 2016, para.4). However, more uses need to be discovered to fully exploit the bromeliad. This experiment will be conducted to test if extractions from the bromeliad Spanish Moss can be used as an organic low-cost fungicide. |

**Material List**Bulleted list of all items used in research. Make sure to include concentration of all chemicals, source, amount of all living organisms, and all equipment used.

|  |
| --- |
| 1. Gloves 2. Goggles 3. Gauze masks 4. Aprons 5. 350g of Spanish moss gathered from sites near highways with heavy traffic and residential urban sites in central Florida 6. A sample of Lingzhi fungi 7. 1 Blender 8. 1 Filter 9. 1 Knife 10. 1 Stopwatch 11. 1 Zip lock bag 12. 2 Plastic wrap 13. 2 Small plastic cups 14. 1 Pipette 15. 1 Test tube rack 16. 5 Test tubes (13 × 100 mm) 17. 400 mL beaker for rinsing stirring rods 18. 250 mL beaker for hot water bath 19. Several stirring rods 20. pH paper 21. Hot water bath 22. Centrifuge 23. 150 mL of hot water 24. Distilled water 25. Chemicals (at most 10 drops): 6 M NaOH, 6 M HCl, 6 M H2SO4, 3% H2O2, 0.1 M K4[Fe(CN)6], 6 M HNO3, NaBiO3; NaHCO3(s), vinegar (5% acetic acid solution) |

**Procedure**Describe in detail the method or procedure required to complete your project, including risk and safety, proper disposal of materials if needed.

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| --- |
| 1. Identify one type of fungi to conduct the experiment on: a fungus called Lingzhi mushroom that grows on maple or oak tree. 2. Collect a sample of fungi and a sample of Spanish Moss. 3. Extract the Spanish Moss: 4. Cut the Spanish Moss into small pieces (approximately 350g of Spanish Moss were used). 5. Blend the pieces of Spanish Moss with 150ml of hot water until smooth. 6. Filter out the solids of the suspension. 7. The liquid solution is the extract of Floridian Spanish Moss. 8. Prepare 5 test tubes, and add three drops of pure extract into each test tube (about 2mL of solution) 9. Test for the presence of lead, manganese, and zinc ions in the extract  * Analyze the solution for the presence of Pb2+  1. Add 8 drops of 6 M HCl solution to Test Tube 1 and stir the mixture. If a white precipitate forms, then one or more of the following ions are present: Ag+, Pb2+, and/or Hg22+. Centrifuge the test tube and add one more drop of 6 M HCl. No additional precipitate should form. If more precipitate does form, continue adding HCl one drop at a time until the supernatant remains clear. 2. Centrifuge the mixture and transfer the supernatant liquid to Test Tube 2. 3. Add 1 mL of distilled water to Test Tube 1, containing the precipitate. Stir the mixture, centrifuge the test tube, and decant the wash water down the sink. 4. Test the precipitate for Pb2+ ions by first adding 1 mL of distilled water to Test Tube 1. Place Test Tube 1 in the hot water bath, which should be at or very near boiling, for about 3 minutes. Stir the test tube every thirty seconds or so. Centrifuge the hot liquid and quickly decant the supernatant into Test Tube 3. 5. Add 5 drops of 6 M H2SO4 to Test Tube 3. If there are lead (II) ions present, a white precipitate will form in the test tube. If you find Pb2+ ions, repeat Steps d and e with Test Tube 1 to remove all of the lead (II) ions from the precipitate. Continue until the addition of sulfuric acid does not form a white precipitate. Dispose of the lead (II) sulfate precipitate, from Test Tube 3, as directed.  * Analyze the solution for the presence of Mn2+  1. Add 10 drops of 3% hydrogen peroxide solution to Test Tube 2. Add three drops of 6 M NaOH solution, mix, and check the pH of the liquid. If it is not basic, add more NaOH dropwise until the liquid is basic. Once the liquid becomes basic, add 3 additional drops of 6 M NaOH. 2. Stir the mixture in the test tube and place it in a hot water bath for three minutes. A precipitate will form; the darker the precipitate, the more different ions are present. 3. Wash the precipitate in Test Tube 2 with 10 drops of 6 M NaOH and 10 drops of distilled water. Centrifuge the test tube and discard the wash water. 4. Add 5 drops of water to Test Tube 2 and mix. Add 6 M H2SO4 dropwise until the solution is acidic. Wash the precipitate in Test Tube 2 with 10 drops of distilled water, centrifuge it, and discard the supernatant. 5. Add 1 mL of water and 1 mL of 6 M H2SO4 solution to Test Tube 2. Add 1 mL of 3% H2O2 solution and place the test tube in a hot water bath, brought to gentle boiling. Stir Test Tube 2 occasionally and keep it in the hot water bath until all of the precipitate dissolves. When the precipitate dissolves, transfer half of the solution to Test Tube 4. 6. To test for Mn2+, add 1 mL of 6 M HNO3 to Test Tube 4. Mix, and add a very small scoop of solid sodium bismuthate, NaBiO3. There should be an excess of sodium bismuthate in the test tube; add more if necessary to create an excess. Stir the contents of the test tube and centrifuge it. If the supernatant liquid is a purple color, then Mn2+ ions are present. Dispose of the contents of Test Tube 4 as directed and clean the test tube.  * Analyze the solution for the presence of Zn2+:  1. To test for Zn2+, and complete the qual scheme for cations, add 6 M HCl solution dropwise to Test Tube 5 until the liquid is acidic. Add 3 drops of 0.1 M K4[Fe(CN)6] and stir the mixture. Centrifuge the test tube. If there is a precipitate (its color could be white or light green or blue green) in the test tube, then there are Zn2+ ions present. Dispose of the contents of Test Tubes 5 as directed. 2. After testing for the presence of Pb2+, Mn2+, Zn2+, fill up a pipette with the pure extract. 3. Cut out two small samples of the fungi Lingzhi (each has a Length of 1.8cm, Width of 0.6cm, and Thickness of 0.6cm) and place one of the samples inside a plastic cup, one inside a zip lock bag and seal. 4. Add 15 drops of the Floridian Spanish Moss extract onto the Lingzhi sample in the plastic cup so that the whole sample is covered, then quickly wrap the cup with plastic wrap so that no matter escape nor enter the system. 5. Record quantitative changes in length, width, and thickness of the sample covered in Spanish Moss extract every one hour for 12 hours. 6. Variables. Independent: Time; Dependent: Length, Width, Thickness. 7. The Lingzhi sample in the zip lock bag is the control group. 8. Observe qualitative changes in the sample covered with Spanish Moss extract every one hour for 12 hours. 9. Compare the experimental group with the control group. 10. Clean up everything after the experiment is finished. |

**Data Analysis**Describe the procedure you will use to analyze the data that will answer the research question, hypothesis, or engineering goal?

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| Examine the experimental group and compare to the control group (the sample unaffected by the pure central Floridian Spanish Moss extract); see the fungi sample in which cup is most affected, or killed, if any. After examining the cups, draw a conclusion of whether a fungicide can be created using the extracts of Spanish Moss gathered from sites near highways with heavy traffic and residential urban sites in central Florida or not. |

**Bibliography**

**List of possible references/resources are included in the ISEF Rules and guidelines, pages 23 – 25.**

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| ASHTA Chemicals Inc. (2016, April 15). Material Safety Data Sheet Hydrochloric Acid, 31 –  36%. Retrieved October 22, 2016, from  [http://www.ashtachemicals.com/Products/SDS/SDS\_HydrochloricAcid\_Jan05- 15.010.pdf](http://www.ashtachemicals.com/Products/SDS/SDS_HydrochloricAcid_Jan05-%0915.010.pdf)  Bael, V. M. (1986, September). Cadmium compounds Chemical Fact Sheet 9/86. Retrieved November 07, 2016, from <http://pmep.cce.cornell.edu/profiles/fung-nemat/aceticacid-> etridiazole/cadmium/fung-prof-cadmium.html  Clemson University. (n.d.). Other Problems - Spanish Moss. Retrieved December 18, 2016, from <http://www.clemson.edu/extension/horticulture/landscape_ornamentals/crapemyrtle/culture/other_problems_spanish_moss.html>  Common and Trade Fungicide. (n.d.). Retrieved November 7, 2016, from [https://www.apsnet.org/edcenter/intropp/topics/Documents/CommonAndTradeFun gicides.pdf](https://www.apsnet.org/edcenter/intropp/topics/Documents/CommonAndTradeFun%20%20%20gicides.pdf)  Daoubi, M., Hernández-Galán, R., Benharref, A., & Collado, I. (2005). Screening study of lead compounds for natural product-based fungicides: antifungal activity and biotransformation of  6alpha,7alpha-dihydroxy-beta-himachalene by Botrytis cinerea. Retrieved December 18, 2016,  from <https://www.ncbi.nlm.nih.gov/pubmed/16104783> |

**Blank Document (original document on** [**Region V Science Fair website**](https://www.sciencefair.msstate.edu/)**)**

|  |
| --- |
| **Student Name:** |
| **Category:** |
| **Science Teacher’s Name:** |
| **County:** |

**Question or Problem being addressed – Title**

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**Hypothesis/Engineering Goals**

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**Rationale**Brief synopsis of the background research that supports your research problem and explains why this research is important scientifically.

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**Material List**Bulleted list of all items used in research. Make sure to include concentration of all chemicals, source, amount of all living organisms, and all equipment used.

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**Subject Specific Items**Items 1–4 below are subject-specific guidelines for additional information to be included in your research plan/project ONLY if you are doing any of the following types of projects.Write your answer below the question delete the items you do not use. **See the subject specific rules in the ISEF rule book BEFORE beginning this section.**

1. **Human participants research:**   
   **a. Participants:** Describe the composition of participants.   
   **b. Recruitment:** Where will you find your participants? How will they be invited to participate?   
   **c. 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?   
   **d. Risk Assessment:** What are the risks or potential discomforts (physical, psychological, time involved, social, legal, etc.) to participants? How will you minimize risks? List any benefits to society or participants.   
   **e. Protection of Privacy:** Will identifiable information (e.g., names, telephone numbers, birth dates, email addresses) be collected? Will data be confidential/anonymous? If anonymous, describe how the data will be collected. If not anonymous, what procedures are in place for safeguarding confidentiality? Where will data be stored? Who will have access to the data? What will you do with the data after the study?   
   **f. 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:**   
   a. Discuss potential ALTERNATIVES to vertebrate animal use and present justification for use of vertebrates.   
   b. Explain potential impact or contribution of this research.   
   c. Detail all procedures to be used, including methods used to minimize potential discomfort, distress, pain and injury to the animals and detailed chemical concentrations and drug dosages.  
   d. Detail animal numbers, species, strain, sex, age, source, etc., include justification of the numbers planned.   
   e. Describe housing and oversight of daily care   
   f. Discuss disposition of the animals at the termination of the study.

**3. Potentially hazardous biological agents research:**   
a. Give source of the organism and describe BSL assessment process and BSL determination.   
b. Detail safety precautions and discuss methods of disposal.

**4. Hazardous chemicals, activities & devices:**   
a. Describe Risk Assessment process, supervision, safety precautions and methods of disposal.

**Procedure**Describe in detail the method or procedure required to complete your project, including risk and safety, proper disposal of materials if needed.

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**Data Analysis**Describe the procedure you will use to analyze the data that will answer the research question, hypothesis, or engineering goal?

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**Bibliography**

List at least five major references (e.g. science journal articles, book, credible internet sites) from your literature review. **See pages 23 - 25 of the rule book to see references for subject specific projects.**

* If you plan to use **vertebrate animals**, one of these references must be an animal care reference.
* If you plan on using **human subjects**, one of these references must be from the list of human subjects
* If you plan on using **potentially hazardous biological agents,** one of the references must include aseptic technique.
* If you plan on using **chemicals,** each chemical should include a reference for a MSDS/SDS. (Chemicals does not include water or any household product)

List of possible references/resources are included in the ISEF Rules and guidelines, pages 23 – 25.

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Rubrics for grading the Science Fair Display board and Journal, Science Fair Research Paper, and Addendum for elementary/middle school projects. Some aspects of this portion of the packet were adapted from online resources)

**Science Fair Packet Addendum Elementary/Middle School**

**Science Fair Project Steps:**

1.Choose a topic that interests you. Do not pick one because you think it will be easy. Talk it over with your parents and when you have decided, inform your teacher.

2. State your purpose as a question. What is it that you want to find out by doing this project?

3. Research your problem. Look at any books/websites that might help you, make observations by simply looking at things, talk to people, and find out as much as possible about your topic. Write down any ideas you have and where you got them. Also, keep note of all information needed for citing your resources.

4. Form a hypothesis. What do you think is going to happen? Based on what you know or found out from step #3, what do you think the results of your experiments will be? After doing the experiments, it may turn out that your guess was wrong. It is okay if this happens.

5. Plan your project. How will you test your hypothesis? What experiments will you do? How will you measure the results? Where will you keep your information? Be sure to keep notes and write down everything you do and what happens.

6. Collect all your materials. Find a place to keep things where others will not bother them. Let other family members know what you are doing so they do not throw your materials away by mistake.

7. Conduct your experiments. Remember, the more times you do an experiment the more reliable and accurate the results will be. Do each experiment at least three times and get an average of the results for your graph. Use something to measure your experiments: a ruler or yardstick if you are measuring distance, a clock to measure time, etc. Check the measurements to be sure you are correct.

8. Record your data. As you do your experiments, you will want to write down what you saw or found out. Organize this information in an orderly manner. Put the date, time, and any other useful information. Write your measurements clearly.

9. Draw conclusions. What did you learn from your experiments? Have you proved or disproved your hypothesis? You made a guess about what you thought would happen. Now tell what really did happen. You do not lose points if your guess turned out to be wrong.

10. Prepare your titles, charts, graphs, drawings, and diagrams. Make them large enough to see, neat, and colorful.

11. Construct your science fair display. Get your cardboard display board from your teacher so you can show all your work and have your hands free to point to sections when you give your presentation.

12. Prepare and practice your presentation. Be able to tell about what you used what you did in your experiments, and what you found out. Know it well enough that you do not have to read it from the display.

13. Plan a timeline so you do not leave everything until the last minute. If you need help, tell your parents and your teacher, the earlier the better.

**Rules Conducting a Science Fair Project**

1. Number one rule. . . think safety first before you start. Make sure you have recruited your adults to help you.

2. Never eat or drink during an experiment and always keep your work area clean.

3. Wear protective goggles when doing any experiment that could lead to eye injury.

4. Do not touch, taste, or inhale chemicals or chemical solutions.

5. Respect all life forms. Animals are not allowed to be used in experiments. Do not perform an experiment that will harm a person.

6. All experiments should be supervised by an adult.

7. Always wash your hands after doing the experiment, especially if you have been handling chemicals.

8. Dispose waste properly.

9. Any project that involves animals, drugs, firearms, or explosives are NOT permitted.

10. Any project that breaks district policy, and/or local, state, or federal laws are NOT permitted.

11. Use safety on the Internet! NEVER write to anyone without an adult knowing about it. Be sure to let an adult know about what websites you will be visiting or have them help you search.

12.If there are dangerous aspects of your experiment, like using a sharp tool or experimenting with electricity, please have an adult help you or have them do the dangerous parts. That’s what adults are for so use them correctly. (Besides, it makes them feel important!)

**Name**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **PROJECT SUMMARY WORKSHEET**

**Due Date**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Topic**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Question: Statement of Purpose (Written as a Question)**

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**Hypothesis or Prediction:**

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**Materials I will need:**

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| --- |
|  |

**Procedures: (Detailed Steps)**

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| --- |
|  |

**Resources (You must have \_\_ Resources): (example)**

Type of Resource: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Website: <http://________________________________________________>

Author: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Publishing Company: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Location of the Publishing Company: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date of Publication: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Information found in your own words: (Must be at least one paragraph summary.)** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**1st Quarter Student Checklist**

|  |  |  |
| --- | --- | --- |
| Due Date | Component | Completed |
| Sept 17th | Permission/Participation Slip – Signed and Returned |  |
| Sept 17th | **Topic:** Choose a topic. Be sure it interests you. Do not pick one because you think it will be easy. Talk it over with your parents and when you have decided. Do not change your topic later. (Included in Participation Slip) |  |
|  | **Purpose:** State your purpose as a question or a statement. What is it you that you want to find out by doing this project? (Included in Project Summary Outline) |  |
|  | **Hypothesis:** Form a hypothesis. What do you think is going to happen? Based on what you know or found out, what do you think the results of your experiment will be? After doing the experiment, it may turn out that your guess was wrong. It’s okay if this happens. (Included in Project Summary Outline) |  |
|  | **Materials:** List all materials that will be used in your experiment. Include exact quantities for each item used. (Included in Project Summary Outline) |  |
|  | **Procedures:** List and describe steps taken to complete the project. Presented in chronological order or numbered order. (Included in Project Summary Outline) |  |
|  | **Research:** Look at any books that might help you, make observations by simply looking at things, talk to people, and find out as much as possible about your topic. Write down any ideas you have and where you got them. (Included in Resource Form – You must have \_\_\_!) |  |
|  | **Deadlines:** All deadlines to turn in components were met. |  |

Note: The Project Summary Worksheet can be accepted for the 1st Quarter. It does not need to be typewritten. If more space is needed on the Project Summary Worksheet, please use and staple extra paper to the original sheet.

**2nd Quarter Student Checklist** **Written Report**

|  |  |  |
| --- | --- | --- |
| Due Date | Component | Completed |
|  | **Title Page:** The first page in the report should include the title of the project as well as the name and grade of the student. |  |
|  | **Acknowledgement Page:** The second page in the report should thank all individuals who assisted in the project. |  |
|  | **Table of Contents:** This page provides the reader with a list of the different parts of the project and the page number on which each section can be found. |  |
|  | **The Purpose:** State your purpose as a question or a statement. What is it you that you want to find out by doing this project? |  |
|  | **Hypothesis:** State your hypothesis. What do you think is going to happen? Based on what you know or found out, what do you think the results of your experiment will be? After doing the experiment, it may turn out that your guess was wrong. It’s okay if this happens. |  |
|  | **Research:** This is part of the report that contains all the background information the student collected about the chosen topic. All gathered information should be summarized and presented in this section. It should be written in the student’s own words and not copied from the source. |  |
|  | **Materials:** List all materials that were used in your experiment. Include exact quantities for each item used. |  |
|  | **Procedures of Investigation:** List and describe steps taken to complete the project. Presented in chronological order or numbered order. |  |
|  | **Results:** Tell what happened when you did the experiment. Show what happened by making a chart, graph, or table. Include the date, the time, and any other useful information. Write all measurements clearly. |  |
|  | **Conclusion:** This is a brief statement explaining why a project turned out the way it did. Students should explain why the events they observed occurred. The conclusion should tell whether the hypothesis was proven or not proven. It should offer an answer to the student’s original purpose. |  |
|  | **Reference Page:** In alphabetical order, list all the resources that you used to research your project. Correct format was used. Conventions: Proper use of spelling, grammar, punctuation, and capitalization. MUST be typed. |  |

**3rd Quarter Display Board**

|  |  |  |
| --- | --- | --- |
| Due Date | Component | Completed |
|  | **Title:** Does the title catch people’s attention and is it large enough to be read from across the room? |  |
|  | **Purpose** |  |
|  | **Hypothesis** |  |
|  | **Procedures of Investigation** |  |
|  | **Materials** |  |
|  | **Results/ Graphs/ Charts:** Did the student use pictures and diagrams to effectively convey information about the project? |  |
|  | **Conclusion** |  |
|  | **Conventions:** Proper use of spelling, grammar, punctuation, and capitalization on all elements on the display board. |  |
|  | **Neatness** |  |
|  | **Organization:** Are the sections on the display board organized like a newspaper so they are easy to follow? |  |

**3rd Quarter Oral Presentation**

|  |  |  |
| --- | --- | --- |
| Due Date | Component | Completed |
|  | **Introduction:** Student introduces him/herself and gives the title of the project. |  |
|  | **Statement of Purpose/ Hypothesis** |  |
|  | **Explanation of Procedure** |  |
|  | **Explanation of Results/Charts and Graphs** |  |
|  | **Conclusion** |  |
|  | **Good Posture and Eye Contact** |  |
|  | **Speaks Clearly** |  |



**The Question:**

What is the effect of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_?

For Example: What is the effect of **sunlight** on **the growth of plants**?

What is the effect of **eye color** on **pupil dilation**?

What is the effect of **brands of soda** on **a piece of meat**?

**The Affect question:**

How does the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ affect \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_?

For Example: How does the **color of light** affect **the growth of plants**?

How does **humidity** affect **the growth of fungi**?

How does **color of a material** affect **its absorption of heat**?

**The Which, What and Verb Question:**

Which/What \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (verb) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_?

For Example: Which **paper towel** is **most absorbent**?

Which **foods** do **meal worms prefer**?

Which **detergent** makes **the most bubbles**?

## What is a Hypothesis?

A hypothesis is a tentative, testable answer to a scientific question. Once a scientist has a scientific question she is interested in, the scientist reads up to find out what is already known on the topic. Then she uses that information to form a tentative answer to her scientific question. Sometimes people refer to the tentative answer as "an educated guess." Keep in mind, though, that the hypothesis also has to be testable since the next step is to do an experiment to determine whether or not the hypothesis is right!

A hypothesis leads to one or more predictions that can be tested by experimenting.

Predictions *often* take the shape of "If \_\_\_\_then \_\_\_\_" statements, but do not have to. Predictions should include both an independent variable (the factor you change in an experiment) and a dependent variable (the factor you observe or measure in an experiment). A single hypothesis can lead to multiple predictions, but generally, one or two predictions is enough to tackle for a science fair project.

<https://www.sciencebuddies.org/>

## Examples of Hypotheses and Predictions

| Question | Hypothesis | Prediction |
| --- | --- | --- |
| How does the size of a dog affect how much food it eats? | Larger animals of the same species expend more energy than smaller animals of the same type. To get the energy their bodies need, the larger animals eat more food. | If I let a 70-pound dog and a 30-pound dog eat as much food as they want, then the 70-pound dog will eat more than the 30-pound dog. |
| Does fertilizer make a plant grow bigger? | Plants need many types of nutrients to grow. Fertilizer adds those nutrients to the soil, thus allowing plants to grow more. | If I add fertilizer to the soil of some tomato seedlings, but not others, then the seedlings that got fertilizer will grow taller and have more leaves than the non-fertilized ones. |
| Does an electric motor turn faster if you increase the current? | Electric motors work because they have electromagnets inside them, which push/pull on permanent magnets and make the motor spin. As more current flows through the motor's electromagnet, the strength of the magnetic field increases, thus turning the motor faster. | If I increase the current supplied to an electric motor, then the RPMs (revolutions per minute) of the motor will increase. |
| Is a classroom noisier when the teacher leaves the room? | Teachers have rules about when to talk in the classroom. If they leave the classroom, the students feel free to break the rules and talk more, making the room nosier. | If I measure the noise level in a classroom when a teacher is in it and when she leaves the room, then I will see that the noise level is higher when my teacher is not in my classroom. |

**Science Fair Judging Rubric (to be used by students as practice)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Objectives | Outstanding Work | Acceptable Work | Needs Some Work | Needs a lot of work |
| Shows knowledge of the Science Method | **4** – Can explain all major parts of an experimental science projects; and justify conclusion. | **3** – Can explain at least 5 parts of an experimental science project with understanding. | **2** – Can explain most parts of an experimental science project with the help of the display board. | **1** – Tries to answer questions (posed by judge) and/or has some steps missing. |
| Show enthusiasm and interest in the project | **4** – Student eager to tell all about the project. | **3** – Student is pleasant and willing to share information. | **2** – Student tells about the project only when asked a question. | **1** – Student answers some of the questions about the project. |
| Speaks knowledgeably about the project | **4** – Student able to share many details about the project through the scientific process. | **3** – Student shows an understanding of the project. | **2** – Student knows about the project and offers minimal explanation. | **1** – Student can answer some questions when asked. |
| Written document clearly demonstrates use of research, experimentation and analysis skills | 4 – Booklet has cover, table of contents, research data, experimental data, bibliography | 3 – Booklet has cover, table of contents, research data and some of the experimental data. | 2 – Booklet has cover, some research, some data. | 1 – Booklet is minimal or does not exist. |
| Presents data on a board that is well organized and visually appealing | **4** – Board shows data in an organized, neat manner, complete with charts, tables and pictures that are labeled. | **3** – Board is neat and attractive and has limited charts, tables and pictures. | **2** – Board list major headings of the scientific process and some data. | **1** – Board list major headings of the scientific process and limited data. |
| Total Score: |  |  |  |  |
| Positive Comments: |  |  |  |  |



