

Snake Lake Science Fair

Saturday, March 9, 2013

Tacoma Nature Center

Student Handbook



Applications Due by March 1, 2013

To ask questions or to volunteer, please email:

michele@tacomaparks.com

or call (253) 591-6439

A major portion of this handbook is credited to the staff and volunteers of the Sumner School District Science Fair and to the authors of *Not Just Another Science Fair*, Laura Vazquez, David M. France and Kim M. Perkins.

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GENERAL INFORMATION

Dear Parent:

The Science Fair Student Handbook contains information about rules, project guidelines, registration forms and other helpful items to assist in the science fair experience. A registration form is included near the end of the handbook. Additional forms and handbooks are available at the Tacoma Nature Center, or may be downloaded off the Nature Center website (www.TacomaNatureCenter.org).

Your cooperation in helping your child adhere to deadlines will help us do a better job of coordinating the fair. If you anticipate a problem with the dates and times specified in this handbook, please contact us to explore alternatives. Tacoma Nature Center (253) 591-6439

Sincerely,
Snake Lake Science Fair Steering Committee
See you at the fair!

Science Fair Goals

- To promote science education at all grades by hands-on exploration of scientific principles through the preparation and presentation of science projects.
- To promote understanding of, and creativity in, a scientific method of investigation.
- To promote the self-discipline necessary to accomplish the experiment, prepare a display, and write a summary within the given time frame.
- To give the students a sense of pride and accomplishment derived from participation in the science fair.
- To stimulate and nourish a fond interest in science.
- To promote educational links among parents, community, and school.
- To foster a lifelong appreciation of scientific processes in preparation for life in an increasingly technological society.

Science Fair Dates to Remember

March 1, 2013	Project registration forms are due at the Tacoma Nature Center by 4:00pm
March 6, 2013	Project summary/report is due at the Tacoma Nature Center by 4:00pm
March 8, 2013	Project check-in and set up: 4:00pm – 6:00pm, Tacoma Nature Center <i>ABSOLUTELY NO CHECK-IN WILL BE ALLOWED AFTER 6:00PM</i>
March 9, 2013	Science Fair Judging: 9:00 am – noon, Tacoma Nature Center Public viewing 1:30 pm – 2:30pm <i>Students are requested to stand next to their exhibit during public viewing to answer questions.</i> Awards Ceremony 2:30pm – 2:50pm

ALL AWARDS WILL BE DISTRIBUTED AT THE AWARDS CEREMONY AT 2:30 P.M.

SELECTING A PROJECT

Sometimes one of the hardest things about a science fair project is selecting a topic! Here are a few things to keep in mind when you are selecting your topic:

- Pick something you are interested in
- Ask family members what they think you should do
- Think of something that you already know a little about
- Think about what types of materials you already have at your home

If you still can't think of something to do, check out some of the web sites listed below or the books listed on the next page. Students are allowed to choose any topic that they would like as long as it follows these rules:

- All projects must follow the scientific method and test a hypothesis. No displays or demonstration projects; for example, no volcanoes.
- Students may either work by themselves, or with one other student. Students from two different grades will be judged at the level of the oldest student.
- Grades K-2 can do a class project.
- A student's project should reflect his/her age and ability level.
- All experiments must be supervised by an adult.
- Glass, flames, live animals, and hazardous chemicals will not be allowed as part of a student's display.
- For a complete summary of the rules, see pages 17 – 18 of the handbook.
- For more information on selecting a topic, see pages 21 - 22 and 27 – 31 of the handbook.

Once you have selected a topic for your project, please complete the application form with your family, and return it to the Tacoma Nature Center with the appropriate fee. Then you may begin working on your project. Applications are accepted beginning in November 2012 and are all due by March 1, 2013.

RESOURCES – WEBSITES

Science Buddies

<http://www.sciencebuddies.org/mentoring/science-fairs.shtml>

Science Fair Topics

www.accessexcellence.org/RC/scifair.html

School Discovery

http://www.school.discovery.com/science_fair_central/

All Science Fair Projects

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

The Ultimate Science Fair Resource

<http://www.scifair.org>

RESOURCES – BOOKS

Below is a list of books that can help you select a topic and frame your project. Some books are subject specific and others are more grade specific. Most elementary school and public libraries in the area have at least one science fair book. If you are unable to find any books at all to help you, contact the Tacoma Nature Center to use their lending library. All of these books can be found at local bookstores as well.

700 Science Experiments for Everyone, Doubleday, 1958,*
ISBN 0-385-05275-8

Great Science Fair Projects, Scientific America, Marc Rosner, 2000,
ISBN 0-471-35625-5

Science Fair Projects for Dummies, Maxine Levaren, Wiley Publishers, 2003,
ISBN 0-7645-5460-3

Sure to Win Science Fair Projects, Joe Rhatigan, Lark Books Publisher, 2002,
ISBN 1-57990-238-3

Hands-On Science, King Fisher Publisher, 2001,
ISBN 0-7534-5440-8

The Science of Life, Projects and Principles for Beginning Biologist,
Frank G. Bottone Jr., 2001, Chicago Review Press,
ISBN 1-55652-382-3

The Complete handbook of Science Fair Projects, Revised edition,
Julianne Blair Bochinski, 1996, Wiley and Sons Publishers,
ISBN 0-471-12378-1

Electron Herding 101, 50 Hands-on Science Experiments That Explore Electricity,
B.K. Hixson, 2002, Loose in the Lab, Inc. Publisher

Science in Seconds for Kids, Over 100 science experiments you can do in ten minutes,
Jean Potter, Wiley and sons publisher, 1995,
ISBN 0-471-04456-3

Mad Professor – Concoct Extremely Weird Science Projects,
Mark Frauenfelder, Chronicle Books, 2002, ISBN 0-8118-3554-5

Strategies for Winning Science Fair Projects, Joyce Henderson and
Heather Tomasello, Wiley and Sons, 2002,
ISBN 0-471-41957-5

** This is a 1950's golden oldie. It demonstrates building science equipment using regular household items.*

SCIENCE FAIR PROJECT ‘HOW TO’ GUIDE

All projects must follow each step of the grade level appropriate scientific method. See “What goes in each section of my science fair project” for 6-12, 3-5, K-2 for details. The grades 6-12 section has a step-by-step description of the scientific method and what students need to do for each part.

All projects will need to be displayed on a presentation board (suggested size 48”x 36”). These boards can be purchased at an office supply store, or large pieces of cardboard also work well. Each grade 6-12 student’s presentation board should have seven sections and follow the format below. Younger students have different requirements. See the following proper sections for details.

	(Project Title)		
Section #1 Question / Problem Statement	Section #2 Prediction / Hypothesis	Section #3 Resources	Section #4 Variables
Section #5 Materials / Procedures	Section #6 Data / Analysis		Section #7 Conclusion / Summary
(Side #1)	(Middle Section)		(Side #2)

- The project must have a title, and each section must also have a title.
- The spacing demonstrated here is only a suggestion. The size of each section may vary; however, their order and location must be as shown above.
- Your name and contact information should be located ON THE BACK of your board. If associated with a formal school or homeschool group, the school or group name should be on the back as well.
- See the ‘Visual Display’ section on page 23 for more details.

'HOW TO' GUIDE: 6th – 12th GRADES

What goes in each section of my science fair project?

Section 1: Question / Problem Statement

What is the Question / Problem Statement?

The first section of the scientific method is the Question / Problem Statement. It is the question that you are trying to answer with your project, the reason for doing the experiment.

For example: “Which type of bread will grow mold the fastest?”

What must be included in this section?

This section only needs to be one sentence long, but it must be in the form of a question.

Tips: Make sure that your Problem Statement is only going to be testing one thing. For example, you would not want to be testing which type of bread will grow mold the fastest and which type will grow mold the slowest. That would be doing two experiments in one and could confuse your results.

Don't forget to title this section “Question / Problem Statement”.

Section 2: Prediction/Hypothesis

What is the Prediction/Hypothesis?

The second section of the scientific method is the Prediction/Hypothesis. It is a guess of what you think will happen when you do your experiment, and it should be written as a cause and effect statement. You can include your labeled variables in your prediction. You need to include why you think what you do.

For example: “If a plant gets more light (manipulated variable), then it will grow taller (responding variable) because plants need light to grow.

What must be included in this section?

This section only needs to be one sentence long, but it must be a cause and effect statement.

Tips: Make sure that your hypothesis only predicts one outcome. Then, you will clearly know whether your hypothesis is right or not. Your hypotheses can be two sentences. The first is If...(manipulated variable), then...(responding variable) and the second sentence is why you think what you do.

For example: If you are testing different types of bread and your hypothesis says that sourdough bread will grow mold the fastest and wheat bread will grow mold the slowest, you will have a problem if one part comes true and the other doesn't. When you get to the last section of the scientific method, you will not know whether to accept or reject your hypothesis.

Don't forget to title this section “Prediction / Hypothesis”.

Section 3: Resources

What is this section?

The third section of the scientific method is the Resources. This is where you gather background information on your topic and the materials that you are going to use. You will then use this background information to gain a better understanding of the science behind your project.

What must be included in this section?

This section must have a list of resources from which you obtained the background information on your project. It will look like a bibliography.

Tips: For example, if your project uses plants, you would want to do some reading on photosynthesis and possibly the exchange of gases. Make sure to list all resources that you used for background knowledge. If you gained information from a person, you must list that as an interview, citing the date and time of the conversation, as well as the person's expertise on your topic. For example, an exterminator would be a credible person to interview regarding the behavior of insects.

Don't forget to title this section "Resources".

Section 4: Variables

What are Variables?

The fourth section of the scientific method is the Variables. This is where you list the things that will remain the same and the things that will be different during the experiment.

What must be included in this section?

This section must have three types of variables listed: 1) You must list the Controlled Variables. This is what you will make sure to keep the same. For example, if you are testing the effect of music on plant growth, your controlled variables would be the amount of sunlight, water, and temperature of the plants. You will want to keep all of these things the same so that the only difference between the plants is what you are testing for. 2) You must also list the Manipulated Variable. This is what you are changing to do the experiment. When testing the effect of music on plant growth, the manipulated variable would be the type of music played to each plant. 3) You must also list the Responding Variable. This is what you are measuring. It is the response to the manipulated variable. In the plant experiment, the responding variable would be the amount growth for each plant.

Tips: This section should look something like this:

Controlled Variables - sunlight, water, temperature, location of plants, length of time exposed to music

Manipulated Variable - type of music played to plants

Responding Variable - amount that each plant has grown

Don't forget to title this section "Variables".

Section 5: Materials / Procedure

What is the Materials / Procedure?

The fifth section of the scientific method is the Materials / Procedure. This is where you outline exactly what you are going to be doing to see if your hypothesis is correct.

What must be included in this section?

This section must include two parts: (1) a list of all materials needed to conduct your experiment and (2) a step-by-step procedure that you will follow to conduct your experiment. A list of all safety concerns surrounding this experiment should be recorded in your journal.

Tips: Make sure that your step-by-step procedure is detailed enough so that anyone could gather the materials from your list, follow your procedure, and get the same results that you did. Also, there are always safety concerns when conducting experiments. Make sure not to leave these out!

Don't forget to title this section "Materials / Procedure".

Now that you have completed sections 1-5, it is time to do your experiment. Make sure that you have your family's permission before conducting any type of science experiment!

Section 6: Data / Analysis

What is the Data / Analysis?

The sixth section of the scientific method is the Data / Analysis. This is the record of what actually happened during the experiment. It is the results of the experiment.

What must be included in this section?

This section must include three parts: (1) a graph or chart that displays your data, (2) pictures or drawings of your experiment as it happened, and (3) a few paragraphs that explain what happened during your experiment.

Tips: Make sure that your chart or graph is colorful and can easily be understood. It should paint a clear picture of exactly what happened. Also make sure that your paragraphs have been proofread and do not contain any spelling or grammar errors.

Don't forget to title this section "Data / Analysis".

Section 7: Conclusion / Summary

What is the Conclusion / Summary?

This is the last section of the scientific method. The Conclusion is where you decide if you will accept or reject your hypothesis, and explain what you have learned.

What must be included in this section?

This section must include two parts: (1) a complete sentence claiming whether you accept or reject your hypothesis and (2) a few paragraphs that explain what you have learned, how other people can learn from your experiment, and how others can put your results to work in real situations.

Tips: To decide whether you should accept or reject your hypothesis, you will need to compare it to your Data / Analysis section. If what you thought was going to happen really did happen, you should write: “I accept my hypothesis”, however, if what you thought would happen did not really happen, you should write: “I reject my hypothesis”.

***Note:** Many more scientists end up rejecting their hypothesis than accepting it; so don't feel bad if you end up rejecting yours. Whether you accept or reject your hypothesis will have absolutely no effect on the judging.

Don't forget to title this section “Conclusion / Summary”.

Individual students are scored in four categories:

A sample scoring rubric for this category is on page x.

- The scientific process: Is the project grade level appropriate. Does the project promote analytical thinking? Does it demonstrate scientific thinking? Is the student's growth and learning evident?
- The board: Does it contain all the grade level appropriate sections? Is the hand written material neat and legible? Is there a title?
- The oral presentation: Can students communicate their findings?
- The Journal: A hand written journal that includes all of the original data.

'HOW TO' GUIDE: 3rd – 5th GRADES

What goes in each section of my science fair project?

- Section 1: Question/Problem Statement** – A question that asks what you want to find out.
- Section 2: Prediction/Hypothesis** – What do you think will happen? Use an “ If...(manipulated variable), then...(responding variable)” type statement or some type of cause and effect statement.
- Section 3: Materials and Procedures** - A list of what you're going to use. Use multiple trials (usually a minimum of five). Make a list of the steps that are going to be used to complete your science fair project. Are there any safety concerns with this project?
- Section 4: Variables** - What is measured and how often? Include the variables below.
 1 variable kept the same (controlled)
 1 variable changed (manipulated)
 1 variable measured (responding)
- Section 5: Data** - Record what happened in your science journal to the measured variable. Make charts or graphs to help you summarize your data.
- Section 6: Conclusion** - A conclusion tells you if your hypothesis or prediction was accepted or rejected. Explain the reasons why you accept or reject your hypothesis and explain why your experiment would be useful. Predict what might happen if your investigation lasted longer.

Helpful Hints:

- Use a science notebook or journal to collect your data.
- Rather than use the standard seven-section science board as shown in 6-12 example, 3rd–5th students would only have the six sections above. Include a title. Include safety concerns in your journal.
- The whole project can be handwritten. Good science does not require a computer. We encourage all graphs and charts to be drawn by the students. If students are going to use a computer, students in the third grade and above should do all their own computer processing.

Individual students are scored in four categories:

- The scientific process: Is the project grade level appropriate. Does the project promote analytical thinking? Does it demonstrate scientific thinking? Is the student's growth and learning evident?
- The board: Does it contain all the grade level appropriate sections? Is the hand written material neat and legible? Is there a title?
- The oral presentation: Can students communicate their findings?
- The Journal: A hand written journal that includes all of the original data.

'HOW TO' GUIDE: K – 2nd GRADES

What goes in each section of my science fair project?

Section 1: **Question** – Ask a question

Section 2: **Prediction** – Make a prediction

Section 3: **Experiment** to test the prediction – Write the steps of your experiment. Include a list of materials.

Section 4: **Observe** and take notes - Collect data. Write your notes and data in your science journal. In your science journal, include your notes and data, drawings of your experiment, charts and/or graphs and pictures.

Section 5: **Conclusion** - Decide if the prediction is true or false and tell why. What did you learn from the experiment?

Helpful Hints:

- Use a science notebook or journal to collect your data. This journal will be part of your project presentation.
- Rather than use the standard seven section science board as shown in the 6-12 example, K-2 students would only complete the five sections above.
- Encourage your student to write in his or her own handwriting. We encourage all graphs and charts to be drawn by the students. No excel charts or graphs should be used. Word processing is OK if done by the student. We encourage the entire project to be hand written by the student. Common words are spelled correctly, challenging words spelled phonetically.
- A category called “Class Projects” for grades K-2 is an option as well.

Individual students are scored in four categories:

- The scientific process: Is the project grade level appropriate. Does the project promote analytical thinking? Does it demonstrate scientific thinking? Is the student’s growth and learning evident?
- The board: Does it contain all the grade level appropriate sections?
- The oral presentation: Can students communicate their findings?
- The Journal: Is it a handwritten journal that includes all of the student’s original data?

Class Project

Class projects: K-2 class projects will be scored in the same four categories above except that 2-4 student’s can present. The class must follow the scientific process, create a science board, include a class journal, and be present for the oral presentation. The oral score will be a combination score of the presenters. Class project awards are separate from individual awards. Student’s presenting for a class should not be competing in the individual category.

JUDGING CRITERIA

The judging panel, using the attached appropriate grade level “Science Fair Project Scoring Rubric”, will review all projects. ***To be considered for a prize, projects must receive a score of 3 in each section.*** The judging panel will then revisit all projects that meet these criteria and make their award decisions based on the following:

- The Scientific Process: Does the project promote analytical thinking (grade level appropriate)? Does it demonstrate scientific creativity?
- The Presentation Board
- The Oral Process: Can the student verbally explain all aspects of their project? Is the student’s growth and learning evident?
- The Journal: Handwritten (Work that has been typed can be taped into your journal.)

Certain aspects of science fair judging can be subjective. In an attempt to remove conflicts of interest, parents and teachers will not be allowed to function as judges for any category in which their child or one of their students is competing.

Prizes & Awards

Prizes will be awarded by grade level. There will be first, second, and third place prizes awarded for each grade level. There also will potentially be honorable mention ribbons awarded at each grade level. All participants receive a Certificate of Participation.

Any student earning either a prize or an honorable mention ribbon will be encouraged to compete at the South Sound Regional Science Fair at Pacific Lutheran University. The official deadline for registration in the regional fair is usually right around the date of the Snake Lake Science Fair. However, they usually take late registrations. Registration forms will be available at the Tacoma Nature Center during the Fair.

In addition to the above awards, up to three Snake Lake Science Fair ‘Outstanding Winners’ will be designated based on the judges scores from all categories. Announcement of these winners will be made during the Awards Ceremony.

Parental Assistance

All projects must be the work of the student. However, parents may assist students with certain aspects of the project. Parental assistance may include the following:

- Parents may help establish the idea of the project.
- Parents may help gather materials.
- Parents may help by answering questions and guiding students through the scientific method.
- **Parents may assist with computer-generated work for students in grades K-2 only. All graphs, charts, and word-processing must be student generated for grades 3-12.**

Student: _____

**Science Fair Project (6-12)
Scoring Rubric**

Project Title: _____

Process	<ul style="list-style-type: none"> - Applies the skills and processes of scientific inquiry - Uses scientific concepts and principles to understand systems 		
<p>4 - Exceeds Standards Exceeded standards by expanding, extending or showing creativity and originality through:</p>	<p>3 - Meets Standards Includes the following components: Problem investigated, hypothesis with reason, test using measurement performed, a list of materials and procedure, observations and measurements were recorded, variables are clearly stated with multiple trials, data was accurately collected and analyzed using graphs and/or charts, a conclusion was drawn based on observation and data, hypothesis was clearly accepted or rejected and why.</p>	<p>2 - Does not meet standard One or two components are missing or incomplete and/or data was not analyzed or the conclusion is incorrect.</p>	<p>1 - Does not meet standard Three or more components are missing and/or the conclusion is not proven by the investigation.</p>
Display Board	<ul style="list-style-type: none"> - Writes clearly and effectively - Writes in a variety of forms for different audiences and purposes 		
<p>4 - Exceeds Standards Exceeded standards by expanding, extending or showing creativity and originality through:</p>	<p>3 - Meets Standards Display board is sturdy and neat, with an attractive and colorful layout. It has a title, states the problem being investigated, the hypothesis with reason, lists procedures and materials, variables are properly labeled with multiple trials, includes a clearly labeled data table or graph, has a conclusion and a clearly stated summary that accepts or rejects the hypothesis. Spelling and grammar are accurate.</p>	<p>2 - Does not meet standard One component is missing or incomplete and/or is difficult to read because of errors and careless work.</p>	<p>1 - Does not meet standard Two or more components are missing and/or placement of components and careless work make it difficult to read.</p>
Oral Presentation	<ul style="list-style-type: none"> - Communicates clearly and effectively 		
<p>4 - Exceeds Standards Exceeded standards by expanding, extending or showing creativity and originality through:</p>	<p>3 - Meets Standards Uses appropriate speed, volume, and expression and maintain eye contact. Thoroughly explains the process, results, and significance of the project.</p>	<p>2 - Does not meet standard One component is not fully demonstrated.</p>	<p>1 - Does not meet standard Two or more components are not fully demonstrated.</p>
Journal	<ul style="list-style-type: none"> - Writes clearly and effectively - Writes in a variety of forms for different audiences/purpose 		
<p>4 - Exceeds Standards Exceeded standards by expanding, extending or showing creativity and originality through:</p>	<p>3 - Meets Standards Scientific notebook or journal includes backgrounds research and information, explains the hypothesis, procedures, and materials used, and contains complete records of tests. It is explained clearly, using proper spelling and grammar. Include safety concerns.</p>	<p>2 - Does not meet standard One component is not fully explained, and/or some explanations are unclear. Numerous errors in spelling, grammar, and punctuation.</p>	<p>1 - Does not meet standard Two or more components are missing and/or explanations are unclear. Errors in spelling, grammar, and punctuation make reading difficult.</p>

Student: _____

**Science Fair Project (3-5)
Scoring Rubric**

Project Title: _____

Process	<ul style="list-style-type: none"> - Applies the skills and processes of scientific inquiry - Uses scientific concepts and principles to understand systems 		
<p>4 - Exceeds Standards Exceeded standards by expanding, extending or showing creativity and originality through:</p>	<p>3 - Meets Standards Includes the following components: Question or problem investigated, prediction or hypothesis formed, test using measurement performed, a list of materials, observations and measurements were recorded, variables are clearly stated with multiple trials, data was accurately collected and analyzed using graphs and or charts, multiple trials were run, a conclusion was drawn, and your hypothesis was clearly accepted or rejected and why.</p>	<p>2 - Does not meet standard One or two components are missing or incomplete and/or data was not analyzed or the conclusion is incorrect.</p>	<p>1 - Does not meet standard Three or more components are missing and/or the conclusion is not proven by the investigation.</p>
Display Board	<ul style="list-style-type: none"> - Writes clearly and effectively - Writes in a variety of forms for different audiences and purposes 		
<p>4 - Exceeds Standards Exceeded standards by expanding, extending or showing creativity and originality through:</p>	<p>3 - Meets Standards Display board is sturdy and neat, with an attractive and colorful layout. It has a title, states the question or problem being investigated, the prediction or hypothesis, lists procedures and materials, the variables are properly labeled with multiple trials, includes a clearly labeled data table or graph, has a conclusion and a clearly stated summary that accepts or rejects the hypothesis. Spelling and grammar are accurate.</p>	<p>2 - Does not meet standard One component is missing or incomplete and/or is difficult to read because of errors and careless work.</p>	<p>1 - Does not meet standard Two or more components are missing and/or placement of components and careless work make it difficult to read.</p>
Oral Presentation	<ul style="list-style-type: none"> - Communicates clearly and effectively 		
<p>4 - Exceeds Standards Exceeded standards by expanding, extending or showing creativity and originality through:</p>	<p>3 - Meets Standards Uses appropriate speed, volume, and expression and maintain eye contact. Thoroughly explains the process, results, and significance of the project.</p>	<p>2 - Does not meet standard One component is not fully demonstrated.</p>	<p>1 - Does not meet standard Two or more components are not fully demonstrated.</p>
Journal	<ul style="list-style-type: none"> - Writes clearly and effectively - Writes in a variety of forms for different audiences/purpose 		
<p>4 - Exceeds Standards Exceeded standards by expanding, extending or showing creativity and originality through:</p>	<p>3 - Meets Standards Scientific notebook or journal includes backgrounds research and information, explains the hypothesis, procedures, and materials used, and contains complete records of tests. It is explained clearly, using proper spelling and grammar. Includes safety concerns.</p>	<p>2 - Does not meet standard One component is not fully explained, and/or some explanations are unclear. Numerous errors in spelling, grammar, and punctuation.</p>	<p>1 - Does not meet standard Two or more components are missing and/or explanations are unclear. Errors in spelling, grammar, and punctuation make reading difficult.</p>

Student: _____

**Science Fair Project (K-2)
Scoring Rubric**

Project Title: _____

Process	<ul style="list-style-type: none"> - Applies the skills and processes of scientific inquiry - Uses scientific concepts and principles to understand systems 		
4 - Exceeds Standards Exceeded standards by expanding, extending or showing creativity and originality through:	3 - Meets Standards Includes the following components: Question or problem investigated, prediction formed, test the prediction using measurement. Observations and measurements were recorded with notes, Decide if the prediction is true or false and tell why. What did you learn from the experiment?	2 - Does not meet standard One or two components are missing or incomplete.	1 - Does not meet standard Three or more components are missing.
Display Board	<ul style="list-style-type: none"> - Writes clearly and effectively - Writes in a variety of forms for different audiences and purposes 		
4 - Exceeds Standards Exceeded standards by expanding, extending or showing creativity and originality through:	3 - Meets Standards Display board is sturdy and neat, with an attractive and colorful layout. It has a title, it states the question, the prediction, and has a clearly stated summary. Common words spelled correctly, challenging words spelled phonetically.	2 - Does not meet standard One component is missing or incomplete..	1 - Does not meet standard Two or more components are missing.
Oral Presentation	<ul style="list-style-type: none"> - Communicates clearly and effectively 		
4 - Exceeds Standards Exceeded standards by expanding, extending or showing creativity and originality through:	3 - Meets Standards Uses appropriate speed, volume, and expression and maintain eye contact. Thoroughly explains the process, results, and significance of the project.	2 - Does not meet standard One component is not fully demonstrated.	1 - Does not meet standard Two or more components are not fully demonstrated.
Journal	<ul style="list-style-type: none"> - Writes clearly and effectively - Writes in a variety of forms for different audiences/purpose 		
4 - Exceeds Standards Exceeded standards by expanding, extending or showing creativity and originality through:	3 - Meets Standards Scientific notebook or journal includes dates, explains the hypothesis, procedures, and materials used, and contains complete records of tests. It is explained clearly with common words spelled correctly and challenging words spelled phonetically.	2 - Does not meet standard One component is not fully explained, and/or some explanations are unclear.	1 - Does not meet standard Two or more components are missing and/or explanations are unclear.

RULES

1. Students wishing to enter a project in the Snake Lake Science Fair should fill out the enclosed registration form and return it to the Tacoma Nature Center by March 1, 2013.
2. Students must do their own projects. Each child will be judged on his or her knowledge of the subject. **Parent Participation:** Although one of the judging criteria is independent work, parents are encouraged to discuss the project with the student and provide assistance with research or preparation of the exhibit. Students should be encouraged to do as much as possible on their own. Students should do the manipulations and measurements in the experiments and should make their own drawings and charts. For younger students, dictation of the project summary is appropriate. Parents should advise their children about potential safety hazards.
3. Two students may work together as a team to complete a single project. However, if they are in different grades, they will be judged at the level of the older student. Each student in the team must fill out a registration form.
4. **Animal Experiments:** All science fair experiments involving animals must be in keeping with criteria established by the Animal Welfare Institute. If experiments are to be conducted on living subjects for science fair projects, then only lower orders of life may be used. *Lower orders:* such as bacteria, fungi, protozoa, and insects can reveal much basic biological information.
5. Vertebrate animals are not to be used in experiments for the science fair with the following exceptions:
 - a. Observations of normal living patterns of wild animals in the free living state or in zoological parks, gardens, or aquaria.
 - b. Observations of normal living patterns of pets, fish, and domestic animals. No living vertebrate animal shall be displayed in exhibits.
 - c. Only observational type studies may be used in science fair projects involving chicken embryos. If normal egg embryos are to be hatched, satisfactory humane considerations must be made for disposal of chicks. If such arrangements cannot be made, then the chicken embryos must be destroyed on the nineteenth day of incubation. No eggs capable of hatching may be exhibited.

Experiments involving humans or any other animals shall conform with these regulations. Normal physiological and behavioral studies may be carried out. Projects must be carefully selected so that neither physiological nor psychological harm can result from the study.
Source: Animal Welfare Institute, P.O. Box 3650, Washington, DC 20007.
6. Experiments with bodily fluids are prohibited.
7. All projects(K-12) must include:
 - a. Project display
 - b. Oral presentation
 - c. Project summary/report-Typed or neatly written.

NOTE: *There are different guidelines for grades K-2, 3-5 & 6-12.*
8. The exhibit showing the results of the experiment may consist of the project itself, the equipment used, and/or pictures, drawings, charts, and diagrams. All exhibits must be durable and safe. Movable parts must be firmly attached. The actual display must be no larger than 30" deep (front to back) by 36" wide (side to side) and no higher than 5'.
9. No flames or dangerous materials will be allowed at the fair.
10. Electricity will not be available at the fair.

11. All exhibits must be removed by 4:00pm on the day of the fair. Exhibits not removed will become the property of the Tacoma Nature Center to be used for display purposes or to be discarded.
12. An identification number will be assigned to each project when it is checked in the night before the fair.
13. Absolutely NO parents (even helpers) will be allowed in the project display area after 10:00am the day of the fair.
14. Ribbon facsimiles will be placed on projects for the public viewing from 1:30pm – 2:30pm. Actual ribbons and prizes will be presented at the Awards Ceremony at 2:30pm. Photographs of ‘Outstanding Winners’ will be taken immediately following the Awards Ceremony.
15. The decision of the judges is final. The criteria given on the Science Fair Judging Sheet are used for all projects, and a computer program normalizes results before awards are assigned.

SCIENTIFIC METHOD

How to do a Science Experiment

A scientific method is simply an orderly method for investigating a problem or observing a process. A scientific method is an important part of the process of scientific investigation. While the results of an investigation are important, it is impossible to tell if the results are accurate without knowing how the investigation was done. Were the correct items tested? Were there controls? Was the experiment repeated with the same results? All of these questions need to be answered to establish the correctness of the measurements and the results.

All experiments must have two key parts:

1. **Variables** There are three different types of variables.
 - **Manipulated Variable:** This is the one thing you will change in your experiment. For example, if you wanted to know how temperature affects the life of batteries, the temperature of the batteries being tested is the only variable you would change.
 - **Responding Variable:** This is the thing that changes as the result of the changes in the manipulated variable. If you were testing batteries in a flashlight, the responding variable would be the length of time the flashlight would work with batteries that had been kept at different temperatures.
 - **Controlled Variables:** Sometimes called controls, these are all the things you will keep the same in your experiment. Controls in the battery for example would be the brand and size of battery, the date on the package indicating shelf life, the kind of flashlight used, the length of time each battery had been kept at each temperature, and anything else that might affect the results.
2. **Measurements** By taking measurements of the responding variable, you know how much change has occurred. In conducting an experiment, it is better to measure changes that involve differences in time, distance, height, and so on - things you can measure in numbers. Sometimes, you may want to “measure” things by just looking at them and observing change. However, measurements in numbers are more satisfactory.

Summary of the Steps of a Scientific Method:

1. **SELECT A QUESTION** you can answer by conducting an experiment. Use the library or internet for ideas and information. You will find commonly done experiments, but you may also get some ideas about new topics and how to set-up your own experiment. Your question should be asked in such a way that it cannot be answered with a simple yes or no. For example, “How does salt affect the freezing point of water?” is a better question than “Does salt affect the freezing point of water?” **Be Careful!** Many library books suggest science fair questions that are really demonstrations. Make sure that you cannot answer the question with a simple yes or no. Also be sure that you will change something (have a manipulated variable) and measure something when answering the question. If you cannot figure out what you will be changing in doing the experiment, you probably have a demonstration question and not an experiment question.

2. **FORM A HYPOTHESIS**, a prediction about what will happen as a result of your experiment. Forming a hypothesis will help you design your procedure, and the experiment will prove or disprove your hypothesis. This step can be easier if you have visited the library and found other experiments that are similar to the one you want to do.
3. **PERFORM THE EXPERIMENT:**
 - a. Plan the details of your experiment.
 - b. Select the manipulated and responding variables.
 - c. Decide what things you must keep the same - these are your controls.
 - d. Determine what you will be measuring and what instrument you will use.
 - e. Select the materials to form the test equipment.
 - f. Plan how the test will be done: Which test will you do first? How many tests will you do? What will be recorded? How many times will each test be repeated?
 - g. Assemble the equipment to be used in the experiment.
 - h. Prepare data sheets for recording measurements and for your comments. (A log book may also be used for comments.) As you perform the tests, enter all measurements on your prepared data sheets. Take careful notice of what happens at all times and write down what you observe. It is important that you repeat each test several times. That way you can be sure of your results.
4. **PREPARE THE RESULTS:** Group and organize the measurements you have made. Make charts, graphs, and tables to show what happened. Wherever possible, use numbers to show your results. You may find that you will have to do more tests or perhaps make different measurements if you notice something happening that you cannot explain in one of your measurements. If one measurement is very different from all the others, check your comments in your logbook to be sure that nothing unusual happened to that test. For example, if you were testing the effect of temperature change on batteries and you dropped the flashlight, your results from that test might not be accurate. Try to understand the problem so that you can explain unusual results.
5. **EXPLAIN THE RESULTS:** It is a good idea to spend some time thinking about your results and talking to other people about them. Think about what charts, tables, and your comments mean. Note patterns and amounts. Try to explain how or what the results came out as they did. What is the cause? Do the results agree with your hypothesis?
6. **DRAW CONCLUSIONS:** What can you say about your experiment in general? What can you count on happening again if someone else does a similar experiment? Again note patterns and amounts in your conclusions. If possible, try to describe how your results might apply to everyday experiences. For example, in the battery experiment, you might decide that it is better to store extra batteries in the refrigerator or freezer. Or think about what might have happened to the results if you had made a really big change in the manipulated variable.

Using all of these steps will make for an orderly experiment with reliable measurements and results. Follow this scientific method, and, like any good detective, you can trust your findings.

SAMPLE SCIENCE PROJECT IDEAS

Popular Topics

- How does a certain type of fertilizer affect plant growth?
- How does the amount of water affect plant growth?
- How does the amount of water affect seed germination?
- How does the amount of light affect plant growth?
- How does the color of light affect plant growth?
- Which paper towel is the strongest?
- Which paper towel absorbs the most water?
- Which pop corn pops the most kernels?
- How is bread mold growth affected by light?
- How is bread mold growth affected by temperature?
- How is battery life affected by temperature?
- How is magnet strength affected by temperature?

Topics That Are A Little Different

Familiar experiments can be done with a new twist. Here is an example:

- Rather than manipulating the variable of light by amount or color as in the 4th and 5th topic above, manipulate its direction. What effect does side lighting have on plant growth?
- Instead of measuring the effects of temperature on a battery, measure the effect the rate of use has on total battery energy (if a battery will power a 2-watt bulb for 2 hours, will it power a 4-watt bulb for 1 hour?)
- Experiments with flight are not often chosen. A parachute project that does not have an obvious answer is: What effect does the size of the hole in a parachute have on its falling speed?
- How does motion affect plant growth?
- What is the effect of cigarette smoke on plants?
- How is plant growth affected by watering slowly or all at once?
- How much weight can be lifted by a string when the weight is lifted slowly? Briskly? (Is a fish more likely to break your line when it is under water or when it jumps?)
- How is water flow affected by length of garden hose?

Demonstrations

While demonstrations and models can help you learn many important concepts, this science fair requires students to do an experiment following a scientific method. Here are some examples of questions that do not require an experiment. They can be answered by reading a book or making a model. These are not appropriate choices for the Snake Lake Science Fair.

- Can I grow bread mold? This event can be shown by a simple demonstration.
- Do plants need light to grow? This question can be answered by a simple “yes” or “no” and a demonstration.
- How does a battery work? This question can be answered by a model or demonstration.

Do not pick these kinds of questions! In the following section, we will turn these demonstrations into experiments. Remember, the judges will be asked to classify the projects as demonstrations or experiments.

EXPERIMENT EXAMPLES

The following examples are questions that can be answered by doing an experiment.

Popular Experiments

- What is the effect of different temperatures on growing bread mold?
 - *Manipulated Variable:* Temperature
 - *Controls:* Light, moisture, kind of bread, location of sample
 - *Measurement of Responding Variable:* Amount of mold

- Under what kind of light do plants grow best?
 - *Manipulated Variable:* Light Source (sunlight, grow lights, fluorescent light)
 - *Controls:* kind of plant, moisture, substrate
 - *Measurement of Responding Variable:* Amount of growth of plant

- How does temperature affect the life of a battery?
 - *Manipulated Variable:* Kind of light
 - *Controls:* Kind and size of battery, type of flashlight, length of time battery will be kept at a certain temperature
 - *Measurement of Responding Variable:* Length of time battery will operate the same flashlight bulb

Experiments that are a Little Different

- **Effect of light direction on plant growth**
 - *Question:* What effect does side lighting have a plant growth?
 - *Hypothesis:* Plants may grow to different heights if light comes from the top, sides, or both. Top lighting should be better than lighting from the sides, but the effect of both remains to be measured.
 - *Manipulated Variable:* Direction of light
 - *Responding Variables:* Height plant grows in a certain length of time
 - *Controls:* Type of plant, length of time in light, amount of light, size of pot, type of soil, amount of water

- **Effect of use rate of battery life**
 - *Question:* What effect does the rate of use have on total battery energy?
 - *Hypothesis:* Batteries tend to provide more energy when used slowly. The differences remain to be measured.
 - *Manipulated Variables:* Size (watts) of flashlight bulb
 - *Responding Variables:* Time for parachute to fall
 - *Controls:* Hole area, size of parachute, length of fall, shape of the parachute

REMINDER: The judges will be asked to classify the projects as demonstrations or experiments. An experiment must have something that is changed (manipulated variable) and a measurement.

VISUAL DISPLAY

Every student must have a visual display to accompany his or her project. Begin by making a small sketch of what you want your display to look like. Things to remember about your display:

- Your display board should be a self supporting two or three-sided display.
- The actual display must be no larger than 30” deep (front to back) by 36” wide (side to side) and no higher than 5’.
- It may be constructed of posterboard, tagboard, corrugated cardboard, plywood, paneling, or pegboard, reinforced to stand securely on its own.
- Lettering should be clear and legible (neat printing, stencils, precut letters, or large computer lettering)
- The display should include the title of your project.
- Graphs, charts, photos, and drawings add to the attractiveness of a display.
- Use attractive attention-getting colors.
- Be neat and orderly, following the steps of the scientific method in your display.
- Do not clutter your display with unnecessary information. Start with the question, followed by the hypothesis, equipment and procedure used, and end with the results and conclusions.
- See the ‘How To’ Section beginning on page 6 for a sample layout of the display.

ORAL PRESENTATION

Every student must give a short oral presentation to the judges. The talk should be a few minutes long (five minutes maximum). When you give your presentation, include the following information:

- What is the title of your experiment?
- What is the question you wanted to answer? (Purpose)
- Before you did the experiment, what did you think would happen? (Hypothesis)
- Mention any books or articles you may have read.
- What materials and equipment did you use?
- What did you do to answer your question? (Procedure)
- Be sure to tell the judges what thing you changed (manipulated variable), and what thing changed as a result (responding variable). Also mention those things you kept the same throughout the experiment (controls).
- What happened, and what is the answer to your question? (Results and Conclusion)

Be prepared to answer questions from the judges. Here is a list of questions the judges may ask you:

- Please describe your project.
- Did you get the results you expected?
- What caused the results you found?
- Would you expect me to get the same results if I built this experiment and performed it at my house?
- Why did you build the equipment this way?
- Did anything change besides the manipulated variable?
- What might happen if you changed.....?
- If you did this project over, what would you do differently?
- Did you do the project yourself? If someone helped you, what did he or she do?

PROJECT SUMMARY

NOTE: This summary must be turned in to the Tacoma Nature Center by March 6, 2013.

As you develop your science fair project, think about the following questions. As you prepare your project for the science fair, write the answers to these questions so that others can know what you did. At the top of your project summary, place your name and leave a space for the number of your exhibit.

Questions to answer in the Project Summary:

1. What is the question I wanted to answer?
2. What materials did I use?
3. What did I do to answer my question?
 - a. What did I change?
 - b. What changed as a result of what I did?
 - c. What things did I keep the same?
4. What is the answer to my question? (Include any ideas that may have influenced the outcome.)
5. What books or other information did I use to help me?

Your summary will be read by the judges. Please make it neat and readable. It can be as long or short as you like (about one page is fine). You may use pictures, drawings, or graphs. These questions are another way of describing the scientific method for doing an experiment. They are meant to guide you so that your summary explains all of the parts of your experiment.

If you are interested in competing in the Snake Lake Science Fair, please complete this form and turn it in at the Tacoma Nature Center by Friday, March 1, 2013 at 4:00pm.
A \$10/project fee should be submitted with this application, or no later than March 1, 2013.
Scholarships available.

Snake Lake Science Fair Application

Name: _____ Grade Level: _____ Age: _____

Email: _____ Phone: _____

Project Title: _____
If applicable...

School: _____ Classroom Teacher: _____

Please write your Problem Statement in the form of a question.

(Child's Name) _____ has reviewed the information in this packet and would like to participate in the Snake Lake Science Fair. We are aware that a science fair project is a big commitment that takes time to plan and conduct. We understand the rules and are willing to assist our child as needed. We are also aware that the competition will be held on Saturday, March 9, 2013 at the Tacoma Nature Center, and that child and project transportation is up to individual families. **I give my consent to have my child photographed and/or recorded for video and/or audio reproduction to be used in television, Internet and print programs and promotions, associated with the Tacoma Nature Center. This authorization releases Metro Parks Tacoma and the Tacoma Nature Center of all or any liabilities that may result from participation. Any revocation of this consent should be given in writing.**

 (Parent / Guardian Signature)

 (Date)

 (Classroom Teacher Signature *if applicable*)

 (Date)

MORE PROJECT IDEAS

The following is a listing of science fair project ideas on a wide range of topics. In most cases, a project idea includes a suggestion for the responding variable as well as possible manipulated variables, any one of which could be used for a science fair experiment. The procedure, equipment, controls, and so on, are left to choice. Students can choose project ideas directly from this list and plan and execute an experiment, or use them as a starting point for others. Students should be encouraged to talk with their teachers, their parents, and staff at the Tacoma Nature Center to ensure that the projects they have chosen are appropriate for their age group, and can be done independently and safely.

The following five science fair projects all pertain to the corrosion of metal. The responding variable is given in the question; it is the growth or amount of corrosion. Suggested manipulated variables are wax, paint, varnish, silicone, or epoxy. Any one of these (but only one) can be used effectively in a science fair experiment. The details are not given, and that is up to you. For example, you might experiment with a type of paint, or the number of coats of paint. You can also substitute your own manipulated or responding variable for those listed. The method of testing is up to you, too.

- *How well is metal protected from corrosion by:*
 - wax?
 - types of paint?
 - varnish or shellac?
 - silicone?
 - epoxy?

Some of the project ideas that follow include a list of manipulated variables from which to choose, as in the example above. Others are single idea projects.

- *How is plant growth affected by type of water?*
 - tap water
 - distilled water
 - lake water
- *How is seed germination affected by:*
 - amount of water?
 - salt content of water?
 - temperature?
 - acid rain?
 - different fertilizers?
 - different soils?
 - vibration?
 - rotation?
 - electricity?
 - amount of mulch?
 - type of mulch?

- *How is the growth of plants affected by:*
 - humidity?
 - type / amount / periods of light?
 - type / amount / periods of water?
 - turning?
 - temperature?
 - sound / music?
 - type of soil?
 - acidity of soil?
 - soil mixtures?
 - soil stratification?
 - type of fertilizer?
 - very large amounts of fertilizer?
 - electricity?
 - cigarette smoke?
 - salt content of water?
 - vibration?
 - rotation?
 - orientation after germination?
 - magnetic fields?
 - different gases?
 - caffeine?
 - thickness of mulch?
 - type of mulch? (plastic or organic)?
 - type of light? (sun or lamp)?
 - color of light?
 - amount of light?
 - direction of light? (top, bottom, or side)?
 - soap or detergent?
 - amount of various gases in the air?

- *How is seed germination affected by a pre-planting condition of:*
 - freezing?
 - boiling?
 - microwave heating?
 - soaking in different liquids?
 - electric shock?
 - dental X-rays?

- *On which type of bread does mold grow more quickly?*

- *How is the growth of mold affected by:*
 - humidity?
 - light?
 - temperature?

- *How is metal corrosion affected by:*
 - amount of table salt in water?
 - amount of other chemicals in water? (such as Epsom salts or sugar)
 - liquids?
 - temperature?
 - humidity in the air?
 - acids like vinegar?
 - bases like baking soda?
 - type of metal?
 - surface condition?

- *How is electrical conductivity affected by:*
 - type of material?
 - type of liquid?
 - chemicals in liquids?
 - temperature?

- *How is heat conducted through solid materials affected by:*
 - type of material?
 - moving or still air at surface?
 - moving or still liquid at surface?
 - temperature of material?

- *How is heat absorbed from the sun or a lamp affected by:*
 - color of solid material?
 - color of liquid?

- *How does temperature affect the frequency that a cricket chirps?*

- *How is composting efficiency affected by:*
 - amount of the lime or other chemicals used?
 - type of organic materials (food, leaves, and so on) used?
 - amount of water?
 - temperature?
 - amount of air?
 - light?

- *How is algae growth affected by:*
 - soaps?
 - temperature?
 - sunlight?
 - amount of chlorine?

- *How is root growth affected by:*
 - soil type?
 - vitamins?
 - type of fertilizer?

- *How is fermentation affected by:*
 - amount of yeast?
 - amount of sugar?
 - temperature?
 - light?

- *How is battery life affected by:*
 - temperature?
 - slow or fast use?

- *How much is friction changed by:*
 - lubricants?
 - temperature?
 - surface roughness?
 - bearing type?

- *How is the holding strength of glue, adhesives, or fasteners such as nails, screws, or rivets affected by:*
 - type of glue?
 - type or size of nail or screw?
 - material of rivet?
 - type of materials being bonded?

- *How is the strength of fasteners affected by the way force is applied: pulling, pushing, twisting, sliding, or bending?*

- *How is bending a nail until it breaks (fatigue) affected by:*
 - speed of bending?
 - diameter of nail?
 - material of nail?
 - movement of each bend?
 - temperature?

- *How long does food last when stored in different containers or encased by different food wrappings?*

- *Which brand of popcorn pops the most kernels?*

- *Which brand of paper towel or diaper:*
 - is the strongest?
 - absorbs the most liquid?

- *Which brand of soap or detergent cleans best?*
- *Which brand of stain remover works best?*
- *Which type of packing material is best for protection against shock or breakage?*
- *How long do various amounts of aspirin extend the life of cut flowers?*
- *How is the speed of a model car or boat affected by:*
 - shape?
 - weight?
 - area?
 - model car wheel bearings?
 - water temperature for boats?
- *How is the dissolving speed of powders (like salt) or solids (like candy) affected by:*
 - stirring?
 - heating?
 - type of liquid?
 - amount of liquid?
- *How is magnetic recording tape affected by temperature?*
- *How is magnetic erasure of recording tape affected by:*
 - strength of magnet?
 - distance from a magnet to tape?
 - temperature?
- *How is the height of a bouncing ball affected by:*
 - size of ball?
 - height from which ball is dropped?
 - temperature of ball?
 - temperature of surface?
 - material of ball or surface?
- *How is shoe traction affected by:*
 - pattern in the sole?
 - sole material?
 - weight of the wearer?