2012 Vermont State Science & Math Fair

Dear Prospective Participant,

Welcome to the 2012 Vermont State Science & Math Fair; an inquiry based poster-presentation competition open to all middle and high school level students in the state of Vermont.

The VSSMF is an exciting opportunity for aspiring scientists in grades 5-12 to showcase the results of their independent research. Each year 250 student projects, (selected from over 2000 projects statewide) which address all possible areas of science, technology, engineering and math, are reviewed by at least three judges. Our approximately 150 judges include scientists, secondary education faculty, medical and industrial practitioners, military personnel and retirees, and other science related professionals from across Vermont.

Participants compete for more than $4000 in cash and $12,000 in trip prizes donated by Vermont organizations, and $1 million in scholarships to Vermont colleges. The fair is also affiliated with the International Science and Engineering Fair and Broadcom MASTERS, I-SWEEEP and e3 Challenge, and the Stockholm Junior Water Prize, which award additional prizes.

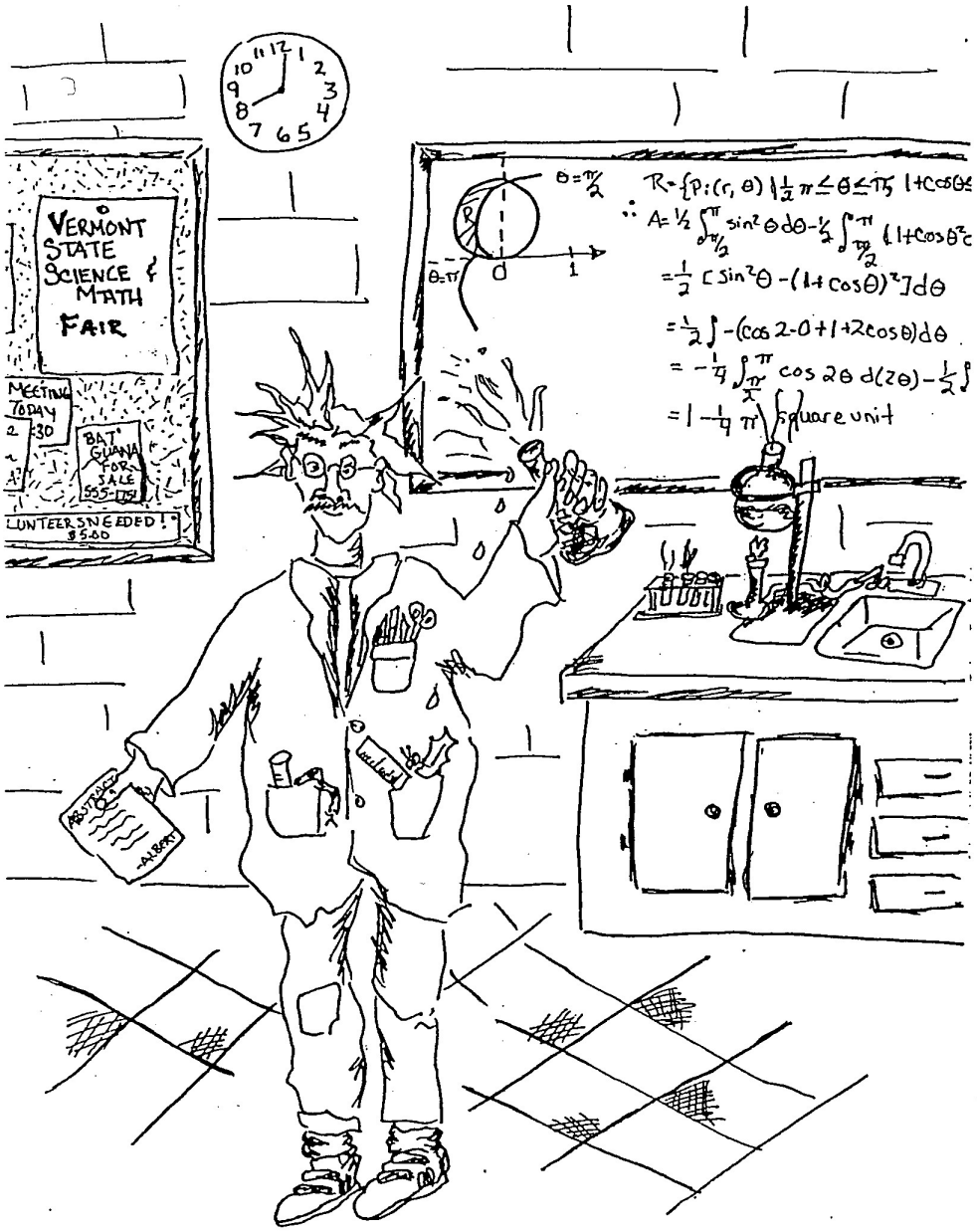
The competition embodies the VSSMF mission; to inspire and reward Vermont middle and high school students for high quality inquiry by providing free access to competitions for independent student research and services to Vermont teachers to improve inquiry education; and to facilitate the formation of connections and experiences with students that reveal Vermont's vibrant STEM community.

The 2012 Participant Handbook has rubrics, worksheets and advice intended to help you produce high quality work and have a meaningful experience. While using these materials is not required to participate, projects that follow these recommendations and rubrics score well with judges at the VSSMF. The requirements for competing in the VSSMF are detailed in the Rules and Special Rules section of this handbook.

Thank you for participating in the Vermont State Science & Math Fair!

Tricia Finkle
Carl Pinkham
Co-Directors VSSMF

Vermont State Science & Math Fair
2012 Participant Handbook



Name_____

Teacher_____

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The Vermont State Science & Math Fair At a Glance

Who?

- All 5-12th grade students in Vermont are eligible to participate.
- Currently 250 students from 21 schools and several home school students present 200 projects to 140 Science Professional Judges.

What?

- The VSSMF is a state level poster-presentation competition for independent student research in science, technology, engineering and math.
- A Science Fair project is an EXPERIMENTAL or INVESTIGATIVE project (seeks to answer a question or address a problem), use of the SCIENTIFIC METHOD or the ENGINEERING PROCESS in answering a question or addressing a problem *is expected.*
- The ultimate product of the project will be an exhibit that illustrates your project, which you will present and be expected to answer questions concerning your project at the fair.

Where?

- Students present their projects in the Science Complex at Norwich University in Northfield, Vermont.

When?

- The 2012 VSSMF is Saturday, March 31.
- Projects are presented to judges between 9-11:30am followed by lunch.aqqa
- The Awards Ceremony begins at 1:30 and ends by 3:00pm Saturday afternoon.
- Final abstracts are due by March 9, 2012.
- Registration is due by February 17, 2012.

Why?

- Science is about asking questions, then finding the answers, skills everyone should have no matter what their career choice may be. Specific benefits of doing a Science Fair project include independently studying, gaining experience in time management, research and public speaking skill building, networking with supportive adults (mentors), applying reading, writing, and math skills to a real problem, and doing science using the scientific method.

How?

- Use this booklet to guide you through a successful science fair experience.

Introduction to Science Fair

Undertaking independent research can be exciting and rewarding, and lead to interests and connections that last a lifetime. We want to inspire you to perform high quality research and produce a competitive science fair project.

This booklet provides advice, rubrics and activities that lead you through the steps of the scientific method, and produce written pieces for your final presentation. It is a work in progress and we welcome feedback and additional content that would be useful.

The step sheets currently have to be downloaded separately, but ultimately will be integrated in the final handbook. Thank you for using our Alpha Release materials.

Suggested Science Fair Time Table

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SEPTEMBER

Topic Selection	Start exploring topics. Read the first three sections [Key Info, Finding an Idea for Your Science Fair Project, and Your Science Fair Project Question] at http://sciencebuddies.org/science-fair-projects/project_question.shtml. Use the Topic Selection Wizard to help narrow down project ideas to specific categories. Look at old abstract books for examples of questions in your topic area at http://vssmf.pbworks.com/Final-Abstracts at the bottom.

OCTOBER

Question	Read What kinds of questions make for good science fair projects? in this packet**.** Make a list of possible questions. Use the Science Fair Project Checklist at the bottom of http://sciencebuddies.org/science-fair-projects/project_question.shtml to test the questions on your list. Define the specific question or engineering goal you will be investigating on top of Step Sheet 1.
Research and Bibliography	Read the whole page at http://sciencebuddies.org/science-fair-projects/project_background_research_plan.shtml and http://sciencebuddies.org/science-fair-projects/project_finding_information.shtml. At least five sources must be identified that will help you understand the topic better. At least three sources must be non-web site sources. Journals accessed over the internet are not considered web sites if the content is the same as the printed version. Complete Step Sheet 2. See page XX for format guidance.
Variables and Hypothesis	Determine which factors will be changed while conducting the experiment and create a hypothesis on the resulting impact of the change. Complete Step Sheet 1.
Background (Draft)	Based on your research, use note cards to outline the introduction to your project. This section includes: The Theory behind the topic, including key concepts, terms and equations (if applicable), The Method (the best techniques for investigating the topic), a history of others who have investigated the topic and what they found, and the significance of your study.

NOVEMBER

Materials and Procedure	List everything you anticipate needing for your project, plus what you are going to do with those materials in a step by step format. Complete Step Sheet 3.
ISEF forms to be eligible for ISEF	Research Plan, Research Plan Attachment, Checklist for Adult Sponsor, Approval Plan, and other forms as needed. (See page XX)

Introduction Draft #2	Compile your note cards into paragraph form, with information about both independent and dependent variables, and a hypothesis. Score your draft using the rubric on page XX and the checklist on page XX

DECEMBER

Data, round one	By this time you should have run through your experiment once and recorded data. This is an excellent time to modify experimental design to eliminate problems. Work on Step Sheet 4
Introduction, final draft	Make the necessary changes to your draft for a perfect score on the rubric on page XX and the check list on page XX. Print a polished copy of your introduction paper

JANUARY

All data	Complete Step Sheet 4
Data Analysis and Graphs	Analyze the data and summarize the findings of the experiment in graph form. See pages XX and XX. Begin Step Sheet 5.

FEBRUARY

Draft Results section	Give an explanation of the data and trends in data. See page XX. Complete Step Sheet 5.
Draft Conclusion section	An explanation of the results of the experiment, the conclusion considers the applications of the new information, possible sources of error in the experimental design, and proposes follow-up projects. See page XX.
Abstract	Summarize the whole process and the findings. See pages XX, XX & XX. Complete Step Sheet 6
Research Paper	Collect all of the above written assignments in one place, plus an abstract of the project. See the rubric on pages XX and XX.
Oral Presentation	Prepare a 5-7 minute oral presentation on your project and practice it with your classmates. See page XX.
Revise papers	Make the necessary changes to your report and abstract for a perfect score on the rubrics on pages XX and XX. Your paper and abstract are displayed with your project at the Science Fair.
Display Board	Produce the final project board that will be displayed at the Science Fair. See page XX. Complete Step Sheet 7

MARCH OR APRIL

VSSMF	**Judging of projects in the Science Complex at Norwich University in Northfield, VT 9am-3pm**

MAY

I-SWEEP	**MAY 5-9**	**ISWEEEP in Houston, Texas**
ISEF	**MAY 8-13**	**ISEF in Los Angeles, California**

What kinds of questions make for good science fair projects?

- **Most importantly...it must be about something of interest.** The questions must be about something that the student cares about; enough to work on for 2 months or more. It should be of interest to other people as well. Questions are particularly juicy if their answer affects people or policy, or have other important consequences. Ask, "What are the interest points of the question?"

- **The question is open to research.** This means a reasonable search should produce enough information related to the question to create a solid hypothesis. For some questions, it may be difficult to find enough information, and the question will have to be adapted to make it more open to research. Questions that only have one possible answer, or the answer is considered fact, are not open to research.

- **The question must be testable.** The answer must be determined by the performance of an experiment using the scientific method or production and testing of a product or process using the engineering design method. Questions that rely on library research alone are not acceptable. Library research is used to establish a solid hypothesis; this hypothesis is then tested with an experiment.

- **The answer must be available. It is not enough for a question to be testable, though only testable questions are suitable for science fair projects**. There are many fabulous testable questions that are not available to the student because of time and resource limits, or safety reasons**.** Not to say a really good question shouldn't be pursued at least to the extent that it is fairly determined to be truly unavailable to the student.

- **The answer cannot be a simple fact or yes/no.** Good science fair questions require research, testing, interpretation of observations and data, and a degree of analysis to answer. If it is too simple, it probably won't hold anyone's interest…not even the student's.

- **The answer can't already be known by the student.** Researchers are not likely to learn much more than they know already, or be motivated to follow through if their questions are too straightforward or they already know the result. Good science fair questions offer students the opportunity to learn something new, or create new knowledge. Students who postulate questions for which they already have an answer think it will be easier; but as it violates the spirit of genuine inquiry, it makes it harder to finish**. It should be something the student *suspects* to be true.**

- **The question has a clear focus.** Some **focus** is required to allow productive research. An initial *general* question can get things started, but it will also need to be revised and focused as the research continues. How the question is refined will depend on the student's interests and discoveries in their initial research. The final question should be as direct and specific as possible, or have clear sub-questions.

- **The questions must not have a premise.** For example: Why do we only use 3% of our brain? With this question comes the assumption that everyone only ever uses 3% of our brain. A better alternative might be: What influences the percentage of our brain that we use? This question doesn't make any initial assumptions and leaves room for many possible alternatives.

- **Make sure you have defined all the terms in your question so you know exactly what you are asking.** If you are using subjective terms such as "latest" or "most recent", be sure to define exactly what you mean by this. For example, "most recent" as in the last century? the last decade? the last two years?

- **The questions must have some objective basis for an answer.** "Why did the dinosaurs become extinct?" is ultimately unanswerable *in that form* because no humans were around to know for sure. Try "Could X have caused the extinction of the dinosaurs?" Questions based on value judgments don't work for similar reasons. You can't objectively answer "Which tastes better, Coke or Pepsi?" These questions need to be adapted to have an objective basis for an answer. "Which cola do more people prefer?"

- **The question cannot be *too* personal.** "What brand of food does my dog like the best?" might inspire some level of interest, but in most cases people want to know about how a breed of dog or dogs in general will behave. If students want to do behavior testing, they will need a *large* sample size to make generalizations, not just their family and friends, or their pets.

- **A new question can be asked once all your information is gathered.** A good project never really completely ends. It should trigger new questions and things to be curious about.

- **Having the right answer matters.** This may seem an odd thing to include but it is at the foundation of inquiry. Motivation comes from needing to know the answer to a question, or researching a question where the answer has consequences. Anything short of this isn't genuine inquiry.

American Psychological Association (APA) Formating and Style Guide
(Adapted from U of Madison-Wisconsin and Hodge's Harbrace Handbook)

Introduction: APA style provides a standard system for giving credit to others for their contribution to your work. The parenthetical documentation means that citations to original sources appear in your text. This allows the reader to see immediately where your information comes from and it saves you the trouble of having to make footnotes or endnotes.

The APA style calls for three kinds of information to be included in in-text citations. The author's last name and the work's date of publication must always appear, and these items must match exactly the corresponding entry in the references list. The third kind of information, the page number, appears only in a citation to a direct quotation.

Also see: www.apastyle.apa.org and/or www.citationmachine.net

Parenthetical references **(in-text citations)**

Idea-focused. Place the author(s) and date(s) in parenthesis at an appropriate place or at the end of a sentence.

> **Researches have pointed out that the lack of trained staff is a common barrier to providing adequate health education (Fisher, 1999) and services (Weist & Christodulu, 2000).**

Source with three to five authors. **In the first citation, use all authors' names with the year, and the first author's name followed by et al. for subsequent citations.**

> **First citation (Baldwin, Bevan, & Belshalke, 2000).**
> **Subsequent citation (Baldwin et al., 2000).**

Source with no author. **Use the first few words of the title, in quotation marks for article or chapter, in italics for self-contained item.**

> **("Mad Cow," 2001).**
> **(*Sleep Medicine*, 2001).**

Researcher-focused. Place only the date in parentheses.

> Fisher (1999) recommended that health education be required for high school graduation in California.

Chronology-focused. Integrate both the author and date into your sentence.

> In 2001, Weist proposed using the Child and Adolescent Planning Schema to analyze and develop community mental health programs for young people.

Web site. Include the URL in-text.

> The University of Wisconsin's Writing Center Web site is an excellent source of information on writing (http://www.wisc.edu/writing/).

References

Books, general.

Author. (Date). *Title with only the first word and proper nouns capitalized.* Publication city: publisher.

Book, single author

Baxter, C. (1997). *Race equality in health care and education.* Philadelphia: Balliere Tindall.

Book with more than one author

Fish, B.C., & Fish, G.W. (1996). The Kalenjiin heritage: Traditional religious and sociological practices. Pasadena, CA: William Carney Library.

Book, editor in place of authors

Stock, G., & Campbell, J. (Eds.). (2000). *Engineering the human genome: An exploration of the science and ethics of altering the genes we pass to our children.* New York: Oxford University Press.

Chapter in edited work

Roy, A. (1995). Psychiatric emergencies. IN H.I. Kaplan & B. J. Sadock (Eds.), *Comprehensive textbook of psychiatry*. (6th ed., pp. 1739-1752). Baltimore: Williams & Wilkins.

Edition after the first

Kelly, D. H. (1989). *Deviant behavior: A text-reader in the sociology of deviance* (3rd ed.). New York: St. Martin's.

Government document

National Institute of Mental Health. (1998). *Priorities for prevention research* (NIH Publication No. 98-4321). Washington, DC: U.S. Government Printing Office.

Journal Articles, single author

Roy, A. (1982). Suicide in chronic schizophrenia. *British Journal of Psychiatry, 141,* 171-177.

Journal Article, paginated by issue

Baldwin, C.M., Bevan, C., & Beshalske, A. (2000). At-risk minority populations in a church-based clinic: Communicating basic needs. *Journal of Multicultural Nursing & Health, 6* (2), 26-28.

Magazine article

Greenburg, G. (2001, August 13). As good as dead: Is there really such a thing as brain death? *New Yorker,* 36-41.

Newspaper article with author

Dershowitz, A. M. (1999, December 18). Why justice had to get out of town. *The New York Times,* p. A31.

Newspaper Article, no author

Mad-cow may tighten blood-donor curbs. (2001, April 19). *The Gazette* [Montreal], p. A13.

Article in an online journal

Greenburg, M.T., Domitrovich, C, & Bumbarger, B. (2000, March 30). Prevention of mental disorders in school-aged children: Current state of the field. *Prevention and Treatment, 4,* Article 1. Retrieved August 24, 2001, from http;//journals.apa.org/prevention/volume4/pre0040001a.htm

Article in an online magazine

Py-Lieberman, B. (1999, November). The colors of childhood. *Smithsonian.* Retrieved December 19, 1999 from the World Wide Web: http://www.smithsonianmag.si.edu/smithsonian/issues99/nov99/object_nov99.html

World Wide Web page

Dorman, B., & Lefever, J. (1999, December 28). *The Autism Society Home Page.* Bethesda, MD: Autism Society of America. Retrieved January 6, 2000 from the World Wide Web: http://www.autism-society.org

Intel International Science and Engineering Fair (Intel ISEF) Forms

Because The Vermont State Science & Math Fair is affiliated with the Intel ISEF, all high school projects in compliance with ISEF rules are elegible for the ISEF trip and related prizes. To make sure that all rules are being followed, you need to fill out forms. The forms may be filled in on-line in a PDF format and printed neatly for submission to your teacher, who will forward them to the SRC/IRB, the committee that oversees the projects.

All projects need these four forms:

- Checklist for Adult Sponsor (1)
- Student Checklist (1A)
- Research Plan (which isn't a form, but gives you the format)
- Approval Form (1B), which is signed by the student and a parent or guardian.

Other forms may be needed for projects involving hazardous chemicals or devices, human subjects, vertebrate animals, or potentially dangerous biological organisms such as bacteria or fungi. You can find out which forms you need by following the steps on the Rules Wizard.

http://www.societyforscience.org/isef/students/wizard/index.asp
The forms are also available on-line from this web site.

Ask your teacher if you are not sure; it is better to make sure you have the proper forms before you get started!

A Note About Sample Size

As you are planning your experimental design, keep in mind that to have valid conclusions, you must have adequate data.

The Super Science Fair Sourcebook has the following suggestions for sample size and number of trials for different types of projects:

Sample size:

Subjects:	suggested number of subjects per group:
Plants	10-50
Live vertebrates or invertebrates	10-15
Humans	50-100

Number of trials:

Type of Project	Minimum	Suggested
Physics	20	50-100
Animal Behavior	10	25-50
Other	5	20-50

This book is aiming at good (INTEL) level projects.
Science Fair

Background Rubric

Category	4	3	2	1
Overall Organization	Information is very organized with well-constructed paragraphs and subheadings. The paper flows.	Information is organized with well constructed paragraphs. One or two transitions not smooth.	Information within paragraphs organized, but transitions not apparent.	The information appears to be disorganized. Topics jump from one to another without flow.
Amount of Information	The paper is five or more pages long.	The paper is 4 pages long.	The paper is 3 pages long.	The paper is less than 3 pages long.
Experimental Variables discussed	Both independent and dependent variables of the experiment were considered and equally discussed. A possible relationship between the two was addressed.	Both the independent and dependent variables were considered, but not on an equal basis. A possible relationship between the two variables was addressed.	The independent and dependent variables were both discussed, but one far more than the other; or, the relationship between the two variables was not addressed.	One of the variables was totally neglected in the introduction of the paper.
Quality of information	Information clearly relates to the main topic. It includes several supporting details and/or examples.	Information relates to the main topic. It provides 1-2 supporting details and/or examples.	Information clearly relates to the main topic. No details and/or examples are given.	Information has little or nothing to do with the main topic.
Sources	All sources for information and graphics are accurately documented in the desired format.	All sources are accurately documented, but a few are not in the desired format.	All sources are accurately documented, but many are not in the desired format.	Some sources are not accurately documented.
Mechanics	No grammatical, spelling or punctuation errors.	Almost no grammatical, spelling or punctuation errors.	A few grammatical, spelling, or punctuation errors.	Many grammatical, spelling, or punctuation errors.
Paragraph Construction	All paragraphs include introductory sentence, explanations or details, and concluding sentence.	Most paragraphs include introductory sentence, explanations or details, and concluding sentence.	Paragraphs included related information, but were typically not constructed well.	Paragraphing structure was not clear and sentences were not typically related within the paragraphs.
Significance and reasons for choosing.	Compelling implications and relevance. States the application possibilities. Reasons for choosing project were compelling and well stated.	Significance is mentioned, but not clearly. Reason for choosing the project could be stated more clearly.	Reason for choosing the project is discussed, however the implications and application of the project are not.	Missing.
Purpose of Experiment	Clear, well-stated and concise. Purpose makes sense.	Clear, some wordiness. Purpose makes sense.	Somewhat unclear. Purpose does not make sense.	Missing.
Hypothesis	Based on sound scientific reasoning. Clearly and concisely stated.	Attempted to explain reasoning, but is unclear.	Is not explained or supported by scientific reasoning.	Missing.
Format	12 point font, double spaced, one inch margins, Times or Times New Roman	A formatting instruction was not followed.	Two formatting requirements are missing.	Three or more formatting instructions were not followed.

Comments:

Introduction Checklist

Use the following Checklist to make sure that you've covered everything in the Introduction to your project. This will be on your display under the title **Introduction**.

____***Introduction to topic*** The topic is introduced in the first paragraph.

____***Relevancy*** The importance of the topic in the real world is explained. You have made it clear that your project has significance and that you have a good reason for choosing this project.

____ ***Specialized terms*** unique to the topic are introduced and explained.

____***Variables*** are clearly recognized and defined.

Writing

_____ Logical organization/effective transitions

____ Sentence/paragraph structure

____ Grammar/ spelling

___***Diagrams and Illustrations*** Figures are appropriate for your topic, are referred to in the text of your paper, and are cited properly.

Example 1: Reptiles have three chambered hearts (see figure 1).

Example 2: A comparison of the hearts of snakes and birds is shown in Figure 2.

Conclusion

____Wraps up the paper neatly

____Suggests further research

____Clearly states the problem (question) that you are going to investigate with your Science Fair project, along with your hypothesis. Your hypothesis should be based on your background research.

General Format

____Citations (author, year) or detailed web site information, at least one in each paragraph (See the gold APA style sheet in your Science Fair packet.)

____Font , size (12 point, Times or Times New Roman), double spaced

____References to figures (drawings, diagrams, photographs and graphs) in proper format

____Does the writing material reflect your understanding of the research? (Do you understand what you wrote, and is it in your own words?)

___***Bibliography*** in APA format

___ ____ _____ Proofread by you, another student, and an adult

Guidelines for Writing the Results Section

RESULTS: This section of your paper should be titled "Results"

1. Describe the general trend of your results in one clear, concise sentence. For example, "My results indicate (illustrate, show, etc.) that watching fish decreases a person's heart rate significantly."

2. Elaborate on and expand your explanation of that trend or lack of a trend. For example, "The longer that people watched fish, the slower their heart rates became".

3. Give numbers and highlight differences. For example, "On average, people's heart rates decreased by five beats per minute after watching fish for ten minutes. After watching fish for twenty minutes, the average heart rate decreased by seven beats per minute (See table 1)."
Make sure to compare your data in this section. Do not simply list the numbers. Present the data by highlighting differences or similarities. Refer the reader to any tables or graphs that illustrate your data as was done in the example by using parentheses.

4. Describe any points that do not fit in the trend or any particular points of interest. For example, "It should be noted that one subject's hear rate increased by ten beats per minute after watching the fish for ten minutes."

5. You should include your data tables and graphs at the end of the written text. Any graphs should be at least a half a page. Each data table and graph should be properly titled with a number and a descriptive title. For example, "Table 1: Heart Rate versus Time Spent Watching Fish."

DO NOT: Do not attempt to explain your results in this section. This is done in the conclusion. For example, DO NOT include a sentence such as, " The average heart rate of the subjects decreased because watching fish is a relaxing exercise that calms the viewer". Simply present the data in an organized fashion that makes it easy for even the laziest reader to understand.

Guidelines for Writing the Conclusions Section

CONCLUSION: This section should be titled "Conclusion".

1. Restate the purpose of your project in a clear, concise sentence. (Remember, readers are lazy, they've forgotten what it was)

2. Restate the major findings of your study.

3. Explain why you think the results turned out the way they did. You should refer back to the research you did on the introduction. Do the scientific ideas presented in the introduction help you explain your results? If not, why not? If the experiment didn't turn out the way you thought it would, can you come up with an explanation for why? Use your scientific reasoning. The reader is looking for how logical you are and how much thought you have put into the interpretation of your results. This section should be the bulk of your conclusion. It is your job to convince the reader that you understand what your results mean and you can explain why they turned out the way they did.

4. What were some sources of possible error in how you performed your experiment that might have affected your results? This is particularly important if you have a specific point of data that doesn't seem to fit with the others. For example, "It is possible that the person's heart rate that increased by ten beats per minute did so because they were watching piranhas rather than angel fish. Piranhas are aggressive fish and they were consuming another fish as the person watched them. This behavior may have caused the viewer anxiety, thereby increasing their heart rate. Our study would have been better controlled if we made sure that all subjects viewed the same type of fish."

5. Explain why your results are relevant. How can they be applied in the world? What is their greater significance? For example, "The finding that watching fish tends to decrease a person's heart rate could be utilized by persons with chronic anxiety as a way to alleviate their nervousness. Doctors and dentists might also benefit from installing fish tanks in their waiting rooms. Patients, particularly young children, who may be nervous about visiting the office, might be calmed after watching the fish."

6. Any excellent project will end by suggesting further studies that investigates their topic in more depth or in another light. For example, "Further studies could investigate that if the type of fish that people watch affects their heart rate. Perhaps another study could examine if watching flesh-eating fish, such as piranhas, cause a person's heart rate to rise, while non-aggressive fish, such as kissing fish, cause a person's heart rate to decrease. This study could help people decide what fish to put in their tanks if they intended them for relaxation."

Abstract Activity 1

The abstract is the first section of your paper a reader sees, after your title.

An abstract is a summary of your whole project in one tidy paragraph. There are sentences that represent each section of your science fair paper. You need to choose your words carefully to get across the main ideas of your paper without taking a lot of the reader's time. Write a good abstract and people will want to go on to read more.

Directions: Read the following abstract, answer the questions, and then write your own abstract following the same format.

The Effects of a Missing Ingredient in Chocolate Chip Cookies

♡Chocolate Chip Cookies are America's favorite cookie. ⁎ The purpose of this experiment was to determine the effects, if any, of a missing ingredient on the appearance and taste of chocolate chip cookies. ☺ The procedure included making five batches of chocolate chip cookies: the control group with no missing ingredient and four experimental groups with a single missing ingredient in each –vanilla, brown sugar, white sugar and flour. Tests of both sight and taste were developed for study. ✡The results showed that the experimental cookies, especially those with no flour when compared to the control group, changed appearance the most according to the testers. Four of the five batches had a different taste when compared to the control group. Cookies with no flour had the worst taste followed by those with no vanilla, no brown sugar and no white sugar.☆The major conclusion found in the study was that a missing ingredient does have a significant effect on the appearance and taste of chocolate chip cookies.☾ Future research needs to focus on the effects of a missing ingredient on non-chocolate chip cookies.

Draw the symbol that precedes each section of a complete abstract:

_____ Introduction

_____ Purpose

_____ Experimental Design (materials and procedures)

_____ Results

_____ Conclusion

_____ Future Studies

Abstract Activity 2

Pretend you are talking to a potential employer for a summer job that pays a lot of money. To break the ice, your interviewer asks you about your science fair project. You don't want to talk about science fair for a long time, but to be polite AND you want impress your interviewer with your hard work and exceptional skill. What would you tell this individual about your project?

Sentence One. Write one 'grabber' sentence from your introduction.

_____

Sentence Two: Write one sentence explaining the purpose of your project.

_____

Procedure: Write one or two sentences summarizing your experimental design. (How did you attempt to answer your question?)

_____

_____

_____

Results: Write one or two sentences about your results.

_____

_____

Conclusion: Write one sentence summarizing your conclusion.

_____

_____

Further Studies: Suggest one or two studies that would follow up on aspects of your project.

_____

_____

Type up your abstract in paragraph form, and then have three people proofread it. The abstract needs to be "tight." In other words, use well-chosen words and be concise as possible.

Science Fair
Paper Grading Rubric

Category	4	3	2	1
Organization	Information is very organized with well-constructed paragraphs and subheadings.	Information is organized with well-constructed paragraphs	Information is organized, but paragraphs are not well-constructed	The information appears to be disorganized.
Paragraph Construction	All paragraphs include introductory sentence, explanations or details, and concluding sentence.	Most paragraphs include introductory sentence, explanations or details, and concluding sentence.	Paragraphs included related information, but were typically not constructed well.	Paragraphing structure was not clear and sentences were not typically related within the paragraphs.
Amount of Information	The text of the paper is at least 10 **pages**, including the introduction, the procedure and materials, and the results and conclusions.	The text of the paper is at least **9 pages**. Half blank pages because you started the next section on the next page do not count.	The text of the paper is at least **8 pages**. Half blank pages because you started the next section on the next page do not count.	The text of the paper is **less than 8 pages long**. Half blank pages because you started the next section on the next page do not count.
Experimental Variables discussed.	Both the independent and dependent variables of the experiment were considered and equally discussed. Possible relationships discussed.	Both the independent and dependent variables were considered, but not on an equal basis. A possible relationship between the two variables was addressed.	The independent and dependent variables were both discussed, but one far more than the other or the relationship between the two variables was not addressed.	One of the variables was totally neglected in the introduction paper.
Quality of Information	Information clearly relates to the main topic. It includes several supporting details and/or examples.	Information clearly relates to the main topic. It provides 1-2 supporting details and/or examples.	Information clearly relates to the main topic. No details and/or examples are given.	Information has little or nothing to do with the main topic.
Significance and Reasons for Choosing and Purpose of the Experiment	Compelling implications and relevance. States the application possibilities. Reasons for choosing project ware compelling and well stated. Purpose is clear, well-stated and concise	Significance is not clearly mentioned. Reason for choosing the project could be stated more clearly. Purpose of the experiment makes sense, but could be more concise.	Reason for choosing the project is discussed, however the implications and application of the project are not. The purpose is unclear or does not make sense.	Significance and Purpose are missing
Hypothesis	Based on sound scientific reasoning. Clearly and concisely stated.	Attempted to explain reasoning, but is unclear.	Is not explained or supported by scientific reasoning.	Missing
Materials and Procedures	All materials/equipment needed for the experiment are included. Clear/Precise description of all steps, written well enough so that someone else could repeat your procedure. (List form is easier to read)	Most materials/ equipment needed for the experiment are included. Clear/Precise description of most steps, written well enough so that someone else could repeat your procedure.	Some materials/ equipment needed for the experiment are included. Procedure steps are not clear to someone who was not present for the experiment.	Few materials/ equipment needed for the experiment are included. Description of steps is poor and uneasy to follow.
Design				
(A)Quality of Experiment	Sample size was ample and adequate for type of experiment	Sample size was adequate, but if larger you could have had more definitive results	Sample size was inadequate for experiment.	Sample size was clearly not considered
(A)Control	The experiment was Controlled extremely well. All controls were considered/measured and discussed.	The experiment was Controlled well. Most controls were considered/measured and discussed.	The experiment was not Controlled well. Few controls were considered/measured or discussed.	The controls were not considered or mentioned in the experiment

Engineering				
(B) Quality of construction	The Engineering project was well built with careful attention put into the design	Attention was put into the design, but there were some flaws in the construction.	The construction was carelessly and hurriedly put together.	The project construction was not built in a manner that could perform the task.
(B) Application of Design	The project has original and useful applications. You should apply for a patent.	The project was original, it has some usefulness.	The project was not original, but there are applications.	The project was not original and there are no apparent applications.
Results section	Results include at least **3 paragraphs** that present general trends, elaboration on trends or lack of trends, and points of interest (outliers) and reference to graphs. They accurately describe data.	Results include at least **2 paragraphs** that present general trends, elaboration on trends or lack of trends, and points of interest (outliers) and reference to graphs.	Results present general trends, elaboration on trends or lack of trends, and points of interest (outliers) and reference to graphs.	Results section is inadequate and does not discuss trends, points of interest or graphs.
Graphs	Graphs of results are informative and complete. They include all titles, labels, units and informative captions. Are appropriate for type of data	Graphs of results are informative but not complete and include most titles, labels, units and captions.	Graphs of results are present, but are missing some titles, labels, units, or captions.	Graphs of results are poorly or improperly presented. The are missing most titles, labels, units, or captions
Conclusions	**Purpose** of experiment and **major findings** are stated in a clear and compelling manner that is easy to read and encourages the reader to continue.	Purpose of experiment and major findings are stated in an adequate manner.	Purpose of experiment and major findings are stated in a manner that is difficult to interpret.	Purpose of experiment and major findings are missing.
	Support or rejection of research **hypothesis** by data is stated in a manner that is clear and concise.	**Support or rejection** of research **hypothesis** by data is stated.	**Support or rejection** of research **hypothesis** by data is alluded to, but it is not clearly stated.	**Support or rejection** of research **hypothesis** by data is missing.
	Explanations of findings are extensive. Many possibilities for causes and effects are offered.	Explanations of findings are presented in a clear manner. Two or more explanations for the results are offered as possibilities.	One explanation for the results is mentioned.	There is nothing to explain why the results turned out like they did.
	Sources of Error are extensive (3 or more) and Two or more **Recommendations for Further studies** are suggested.	Two sources of error are described and two recommendations for further studies are suggested.	One source of error and one recommendation for further studies is suggested.	Sources of error and recommendations for further studies are missing.
Abstract	The abstract was an accurate summary of the whole paper and includes at least one sentence from each section.	The abstract is mostly representative of the whole paper, but one section is not represented.	The abstract is missing representation from two or three sections.	The abstract does not include four or more sections of the paper.
Format	Paper followed all format directions (times, 12 pt, one inch margins, double spaced.)	One format instruction is not followed.	Two format instructions are not followed.	3 or more format instructions are not followed.
Mechanics	No grammatical, spelling or punctuation errors	Almost no grammatical, spelling, or punctuation errors.	A few grammatical, spelling, or punctuation errors.	Many grammatical, spelling, or punctuation errors.
Sources/Citations	All sources (information and graphics) are accurately documented in the desired format. Proper in-text citations. Bibliography is in APA format. 5 sources of correct types	All sources (information and graphics) are accurately documented, but a few are not in the desired format.	All sources (information and graphics) are accurately documented, but many are not in the desired format.	Some sources are not accurately documented.

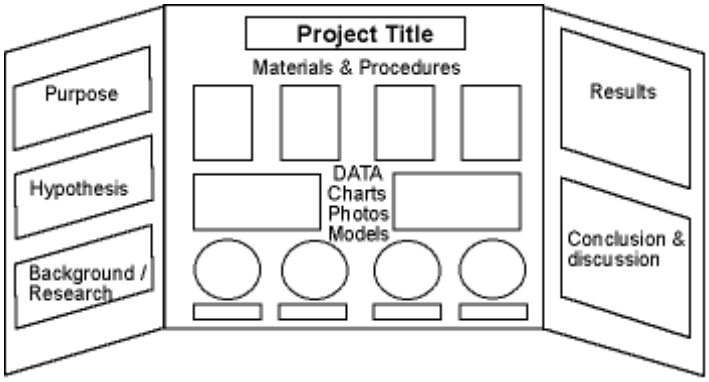
Science Fair Oral Presentation Date/ Time _____
Presenter_____ Project Title/Topic _____

Criteria (Points)	Points Earned
Timing-5-10 minutes. (10)	
Preparation-note cards, evidence of practice. Did not read from paper. (10)	
Organization- Did not jump around (10)	
Visual Aids used-pictures, a model, graphs. Visual Aid should be big enough for people to see without passing around *(10)	
Responses to Questions-Answered questions about project, came up with possible answers or suggestions of where people could look for answers if didn't know (5)	
Eye Contact (5)	
Ready to go (points off for postponing)	
Participation (asking thoughtful questions) (10)	
Total (60)	

Strengths:

Stretches:

Advice:



Assignment: Draw a diagram with labels included, of how you want to set up your display board.

Science Fair
Display Board Rubric

Name_____
Class_____

Category	Exceeds Expectations 100-90%	Meets Expectations 89-80%	Approaches Expectations 79-70%	Does Not Approach Expectations Below 70%
Paper Sections Represented	Title, Abstract, Purpose, Hypothesis, Materials, Procedure, Results, Graphs and Conclusion are all included on display board.	One section of the paper is not represented on the display board	Two sections of the paper are not represented on the board.	Three or more sections are not represented on the board.
Neatness	All edges are neatly trimmed and pictures/information presented is well organized and deliberately displayed.	Most edges are neatly trimmed and pictures/information presented is well organized and deliberately displayed.	Some edges are not neatly trimmed and pictures/ information presented is not organized or deliberately displayed.	The board is sloppy. It appears to have been put together in a hurry.
Visual Aid or Demonstration in Front of Board	Visual aid or demonstration in front of your board is of the highest quality and adds a great deal to explain your project.	Visual aid/demonstration in front of board adds to your display board.	You attempt to add a visual aid/demonstrations that will add to your display board.	No attempt is made at a visual aid or demonstration to add to your display board.
Appropriate Graphs and Diagrams with Captions	All graphs and diagrams are well labeled and appropriately chosen for the type of data they are showing. They add a great deal to your board!	Most graphs and diagrams are well labeled and appropriately chosen for the type of data. They add to your board.	Some graphs and diagrams are labeled and appropriately chosen for the type of data. They attempt to add to your board.	There is very little use of graphs or diagrams on your board. They lack labels or relevancy.
Spelling and Grammar	No grammatical, spelling or punctuation errors.	Almost no grammatical, spelling, or punctuation errors.	A few grammatical, spelling, or punctuation errors.	Many grammatical, spelling, or punctuation errors.
Artistic Appeal	Your entire display is eye catching and you have a good use of color. Your creative use of materials relates to the project and you have gone above and beyond the class expectations.	Most of your display is eye catching and you have a good use of color. Your use of materials relates to the project and you have met the class expectations.	Some of your display is eye catching and you have a good use of color. Your use of materials relates to the project and you approach the class expectations.	There is very little artistic appeal to your project. Your display lacks color or creative use of materials.
Copy of paper	Paper is included in front of display or in a pocket on the display board.	The paper you handed in is in front of your board with editing comments all over it.	Paper is pasted on your board.	Paper is missing.

2012 Vermont State Science & Math Fair

Rules and Requirements

The Science Fair is open to all Vermont middle and high school students in grades 5 through 12.

Each Individual Project must be the work of an individual student, and a Group Project must be the work of *two or three* students only. Group projects must reflect the work of *all* members. Members of a larger group may not be excluded to meet this requirement. Group projects will be located in a separate area and will be judged as one category. Group projects are open to all grades, 5-12.

A research project may be a part of a larger study done by professional scientists, but the project presented by the student(s) may only be their portion of the complete study.

Projects must cover research done over a maximum of 12 continuous months between January 2010 and May 2011.

Projects must be EXPERIMENTAL or INVESTIGATIVE (seek to answer a question or address a problem) in some area of science, engineering or mathematics. The areas are biology, chemistry, physics, computer science, engineering, geology, mathematics, and behavioral or experimental psychology. Projects that are demonstrations, 'library' research or informational projects, 'explanation' models or kit building are not appropriate for this fair.

Use of the SCIENTIFIC METHOD or the ENGINEERING PROCESS in answering a question or addressing a problem *is expected*. Adjust your hypothesis or redefine your problem if you see that the data do not agree with your original ideas, improve your experimental design or your prototype design. Don't forget to highlight all the new things learned!

The fair is a **VISUAL** presentation of your project. You will prepare an exhibit that illustrates your project and be expected to answer questions concerning your project. Each exhibitor will be given a display space 0.5 meter x 1 meter on a table or bench, and extending 0.5 meter directly in front of the table or bench area. The maximum height any part of the display may be is 2 1/2 meters from the floor. The display must function completely within the space provided. Project displays must meet all of the display requirements.

If animals, humans or anything hazardous (biological materials, or any materials, equipment, items or situations that might reasonably considered hazardous) are to be used in the project, students must follow the SPECIFIC RULES for their respective use. All projects will be screened for compliance to these rules, and projects that do not follow these rules will not be eligible for participation. While every effort will be made to ensure compliance to these rules before the day of the fair, projects found at the fair in violation of these rules will be removed and disqualified. Our judgment is final.

If your school will send a select set of projects, the school liaison must use the School application form. If your school does not send a select set of projects, individual students (and groups) must use the Project application form. The deadline for all application forms is February 17, 2012. Abstracts are no longer required for VSSMF application, but are still required for final registration.

To compete for ISEF-related prizes follow the ISEF Requirements. Please note that the application requirements and deadlines may differ from VSSMF. However, the general and specific rules of the VSSMF are congruent with the ISEF rules, which means all you will have to do to become eligible for ISEF-related prizes is fill out the ISEF forms.

To complete your registration, send a final abstract using the final abstract form by **March 9, 2012** (**February 25, 2012 for ISWEEEP and ISEF applicants**). The Final Abstract is a concise summary of your project, and must include the problem studied, hypothesis or design criteria, a summary of procedures used, your principle findings, and major conclusions. The Final Abstract must be 150-300 words and error free. Your judges will score your abstract, and points will be deducted for insufficient or excessive abstracts.

Students' projects must be in place and ready for judging by 9 a.m. If students are not at their project when judges come, the judges will leave a "Sorry I Missed You" card to let the students know they missed a judge. Judges will return once to a project. If a student receives two or more "Sorry I Missed You" cards, his/her score could be seriously affected. A 20-minute break will be provided mid morning for students to view other students' projects. Students who have received a "Sorry I Missed You" card or an appointment for the break are asked to remain at their project during this time for judging. Projects must remain in place until at least 12:30 p.m. for awarding of monetary prizes. You may take down your projects after 12:30 p.m. but before you go to lunch or wait until after the awards ceremony.

Material in this booklet has been adapted from work by the following authors:

From the Vermont State Science & Math Fair
Tricia Finkle

From The Good Hope School, Fredericksted, US Virgin Islands
Mr. Ken Mann
Mrs. Jane Coles
Ms. Adrienne Keefe
Ms. Amanda Sackey
Ms. Jill Brennan

From Winooski Middle School, Winooski, Vermont
Nancy Keller