Science Day Guide

by

JOANNE ZINSER MANN

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Edited by
LYNN EDWARD ELFNER

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· Science Day Guide

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Author: Joanne Zinser Mann
Editor: Lynn Edward Elfner

Address all inquiries to:

The Ohio Academy of Science
1500 West Third Ave. Ste 223
Columbus, OH 43212
Phone: 614-488-2228
FAX : 614-488-7629
Email: oas@iwaynet.net

Website: http://www.ohiosci.org

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· · FOREWORD · ·

· Purposes of this guide Written by JOANNE ZINSER MANN, this guide is the latest revision and expansion of the Academy's *Science Day Standards Handbook* developed originally in 1966 by the late KARL A. SHUMAKER. Although information in Shumaker's original publication has been included, a significant amount of new material has been added over the years.

This guide meets several objectives:

1. To provide a rationale for the educational value of science research projects;
2. To assist teachers in the logical sequencing of students through science projects;
3. To provide useful outlines, forms and checklists for developing science projects and science days;
4. To provide planning and management guidelines for a successful science day;
5. To outline Science Day Standards for students, judges, teachers, parents and others planning to conduct science days; and
6. To reinforce the objectives of The Ohio Academy of Science.

· Who should use this guide? Anyone who plans to involve students in scientific research projects to be presented at a Local, District or State Science Day should use this guide. While this guide is intended primarily for those wishing to develop or improve student research and Local Science Days, nearly anyone involved with these activities can learn something from this guide. All science day directors should follow the Science Day Standards if their students are going to participate in Local, District and State Science Days under the auspices of The Ohio Academy of Science.

· How to use this guide This guide was not written to be read cover to cover at one time. Rather, it was written as a reference to be used when specific questions arise. For example, if you have never involved students in scientific research, you'll find many suggestions on how to go about this task. If you've never planned and directed a local science day you'll find out how to do this, and if you need suggestions for recruiting judges, you'll find some direction here too.

The **Appendices** provide useful checklists and forms. FEEL FREE TO COPY PORTIONS OF THIS GUIDE FOR YOUR LOCAL EDUCATIONAL USE. The only reason this publication is protected by copyright is to prevent commercial exploitation. WE WANT YOU TO COPY IT AS LONG AS YOU GIVE THE ACADEMY CREDIT AS THE SOURCE.

· Acknowledgements Initial publication of this guide was made possible by a grant from The Standard Oil Company of Ohio. The Academy appreciates SOHIO's interest and support of science days in Ohio.

For nearly a decade various individuals have suggested that the Academy update its Standards Handbook, but nothing happened until Joanne Mann decided to take on this responsibility. During the development of this new publication many people were called upon for help and advice, but no one worked as hard as Mrs. Mann. She brings to this publication many years of success as a director of a local science day, several years of experience as school councilperson from the Central District of The Ohio Junior Academy of Science Council and as Director of Certification and Recognition of Judges.

Science educators in Ohio owe Joanne a great deal for her willingness to outline the ways and means to develop successful science days. She is a delight to work with, and I am sure you will find this publication of great help in developing and improving science research projects and local science days.

MR. LYNN EDWARD ELFNER
Chief Executive Officer
The Ohio Academy of Science

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· · INTRODUCTION · ·

· Goal of education One of the primary goals in science teaching is to develop a student's skills in critical thinking, inquiry and/or problem-solving. A Science Day Program offers each student the opportunity to define a problem and to design an experiment that will attempt to solve or investigate that problem, thus enabling the student to learn through discovery.

> *The stumbling way in which even the ablest of the scientists in every generation have had to fight through thickets of erroneous observations, misleading generalizations, inadequate formulations, and unconscious prejudice is rarely appreciated by those who obtain their scientific knowledge from text books.*
>
> JAMES BRYANT CONANT
> ***Science & Common Sense*** *(1951)*

> *One of the frailest of human faculties is the ability to remember isolated bits of information such as "rules" accepted on faith without understanding. The child who is made dependent on his ability to memorize is painfully vulnerable. When he forgets, he is helpless; when he thinks he remembers, he is never sure.*
>
> ROBERT WIRTZ
> ***Drill & Practice***

Preparing students for citizen participation in the development of science and technology policy and the utilization of science in everyday life are worthwhile goals often ignored in school curricula that can be achieved through a student research program.

· About the Academy ·

http://www.ohiosci.org

The Ohio Academy of Science strives to be the leading organization in Ohio to foster curiosity, discovery, and innovation and to unite all who value education, science, engineering, technology, or their applications, for the benefit of society. The Academy welcomes all interested in science—a researcher, a teacher, a corporate executive, an elected public official, an engineer, a student, a parent, or any citizen—to consider The Ohio Academy of Science as their organization. Members and volunteers are the principal source of inspiration, intellectual capital, volunteers and financial support.

· The Junior Academy Council The Academy maintains the Junior Academy Council in order to discover and foster interest in science and mathematics among students in grades 5-12. See: http://www.ohiosci.org/jac.htm

· Science Days Science days provide the first step on the ladder to success for many students. Many youth science opportunities are available through The Ohio Junior Academy of Science, including:

1. Local, District and State science days
2. Buckeye Science and Engineering Fair
3. Ohio Science Talent Search
4. Annual Meeting
5. The American Junior Academy of Science
6. The Ohio Journal of Science
7. Student and teacher membership in the Academy

The relationship between these and other youth science opportunities is shown in Appendix A. All of these activities have one thing in common:

a carefully planned and well researched science project.

· · SCIENCE IS BASIC · ·

More students need to become knowledgeable in science to meet demands of our technological society. However, many professionals and parents view science as an "extra," or a course to be taken only by the "gifted" students who will choose to specialize in a science field. It is this fallacy that needs to be discussed.

A creative science program offers much to many. It is for all students. Not only do students learn the principles and concepts of science, but they also develop skills in other curriculum areas, such as reading, language development, writing and mathematics.

· Development of reading skills Reading skills, foremost in importance, can be enhanced through a science program. Learning to read successfully requires a student to distinguish sounds (auditory discrimination), and objects or symbols (visual discrimination), to possess a vocabulary of spoken words (language preparedness), and to develop background experience which will add meaning to what is read. Early science activities provide the student with all these skills. Teachers include fact gathering, interpreting the story, predicting events, grouping vocabulary words, characters, etc., in their reading program, using unrelated stories as a context. Learning science process skills would accomplish goals for both disciplines by providing a meaningful context to stimulate the student's learning experience.

Science process skills such as observing - (using all the senses to describe an object, event, phenomenon); inferring - (to logically deduce beyond data given); interpreting data - (finding relationships, patterns, trends in the data collected); drawing conclusions - (reasonable judgments based on data), are directly related to the reading comprehension skills considered vital to the student's education. A glance at almost any reading workbook would provide a similar listing—getting the main idea, gathering and interpreting data, evaluating and drawing conclusions. Thus, science activities not only aid in students' science literacy, but also in their ability to read.

· Language development An inquiry-oriented science program is a means to language development. In this setting, when students are confronted with a problem or situation, they sort out factors and identify or formulate questions. They discuss the type of investigative procedure that would help answer their question and set up their experiment. Students may then use the data they collect to draw conclusions and make inferences or predictions. This experience can be communicated to others. Students will share their investigative procedure and results, and thus gain in developing functional language skills (following directions, communicating results).

· Development of logical, formal thought Certain educational experiences are necessary to develop logical, formal thought and critical thinking (problem-solving). Science provides an ideal context. It is important throughout life to be able to identify factors influencing a situation or problem and study the effects. Making deductions from hypotheses is also important in thought development. Science activities involving investigations enable students to suggest a solution to the problem and then set up an experiment to test the validity of their suggestion. Students may find it necessary to consider other variables and design a new experiment. Predicting outcomes and estimating results are also valuable thought processes enhanced by a strong science program.

· Development of writing skills Writing cannot be overemphasized in any of the disciplines. Students need to be taught the importance of written communication in science research, in reporting experimental data, and in writing proposals and abstracts. After discussing the why of writing, students must be taught the how. An interdisciplinary approach with the English and science teachers working together will promote the importance of writing. Students may begin the year by writing daily logs concerning their experiments followed by more in-depth writing of a research plan or proposal, experimental reports, and science abstracts. An experimental report should include:

1. Abstract.
2. Statement of the problem/question being investigated.
3. Review of relevant literature.
4. Statement of the hypothesis being tested.
5. Description of the design and procedures of the investigation.
6. Report of data after conducting the experiment (tables and graphs).
7. Statement of the relationship observed between the variables.
8. Comparison of the findings or results with the hypothesis (supports or refutes).

Science research reports should be an integral part of the science program. Skills in note taking, outlining, researching a topic, gathering and analyzing experimental data and compiling references will be necessary to complete an in-depth study of a problem.

An abstract should be a summary of all aspects of the investigation and should not exceed 250 words. It is written after the completion of the experiment and research report.

An abstract should contain the following components:

- Background statement
- Problem/Hypothesis
- Methods and materials
- Results
- Discussion/conclusion
- Importance/application

See **Appendices f**or samples of title page, contents page, abstract, and references.

· · EDUCATIONAL VALUE OF INDIVIDUAL SCIENCE PROJECTS · ·

· For ALL students Most would agree that the gifted and above average students should be involved in science. These students require the challenge, have the skills to grasp science concepts, and may consider a science career.

Students of lower academic ability are often said to need more work and practice in the "basics" and, therefore, are not always given the opportunity to become involved in the science curriculum. Research suggests, however, that this group may benefit most from an early exposure to an activity-based science program. Studies have demonstrated that such a program will help overcome other barriers, such as socioeconomic status and handicaps. These students have been found to ask a variety of thought-provoking questions, to have high curiosity levels, and to possess positive attitudes.

The obvious majority—the "average"—are given opportunities to learn science mostly from a textbook orientation and often are not expected to complete creative investigations. Research suggests that individual performance can be increased tremendously through conducting scientific investigations depending on the student's motivation and aspiration to achieve.

All students, regardless of any academic standing or handicap, should be given the opportunity to study science, thus enhancing their individual development and their place in society. Everyone needs to use scientific information to make choices and to engage in discussions of important science-based public policy issues.

· Relates to everyday life It is important that students have a positive attitude toward science and the facts, concepts, processes, and skills that are being taught. Students often want to know why it is necessary for them to study science and of what use it will be to them currently and in the future. Teachers should discuss the relevance of science to everyday living and science as a way of knowing. Discussions, debates, and demonstrations may be used to have students generate the personal use of science in day to day living. Today's public policy issues such as population, health care, pollution, and energy, must be understood by all citizens in order for them to make the necessary decisions as individuals and as voters. Science has become an essential in the workplace. An understanding of the processes of science will help people think creatively, to reason, and to solve problems.

Scientists can provide the technical knowledge and make recommendations, but members of society must evaluate the consequences.

· Enables students to become scientifically literate Because scientific knowledge is constantly changing, it is necessary to teach the development of processes, attitudes, concepts, and principles. Students possessing these skills will be able to apply them in decision-making and problem-solving.

Stressing the value of continuous questioning, verification of data, respect for logic, and consideration of consequences is imperative in educating students for their role in a democratic society.

It is important that students participate intelligently in decisions regarding critical science-related societal issues such as the environment, population, and technology. Thus, one of our goals must be to make all students scientifically literate.

· Instills confidence in students' own abilities One has only to visit a classroom of students working on science investigations to realize one of the most fantastic benefits of science inquiry - that of building a student's self-confidence. In this environment students are able to communicate the problem, procedures, and results of their experiments. They have constructed graphs to illustrate the data they collected and, of most importance, they are able to state their conclusions based on their own findings. Knowing because they discovered it to be true has a greater impact and is retained longer than knowing because they were told or read it in a text. All students who engage in science investigations have an opportunity to experience personal fulfillment.

· Promotes creativity Creativity has been defined as the recombining of known things to make something new. Science activities provide the content and the opportunity to promote this endeavor. Our society depends on the ability of scientists to produce new products and services, to promote a better lifestyle, and to make available more efficient methods.

· Develops language and reading skills
The development of both language and reading skills has been discussed previously. Science provides a unique environment for students to actively participate in project investigations. Students enjoy the "doing" of science, as well as the sharing of their findings. Language development occurs more rapidly in the context of meaningful activities. The opportunities to express their thoughts in both verbal and written form are extensive. Science assists in the teaching of reading from preschool to high school by reinforcing auditory and visual discrimination, vocabulary development, and oral and written skills. Comprehension of non-fiction text is essential for all students to be active citizens and decision makers.

Engaging students in science inquiry (investigations) provides an avenue for students to speak (oral communications) about the science content learned, write (written communications) about their questions, explanations, and conclusions and clarify their thinking by analyzing results of the experiment. Use of hands on materials will also enhance language development by giving students visual aids (materials) and equipment both to talk and write about.

· Provides opportunity for right brain tasks Hemispheric brain functioning emphasizes differences in processing. For most people auditory, visual and tactile information that is linguistic in nature is processed in the left hemisphere. The right hemisphere primarily processes visual-spatial, synthetical and non-linguistic materials. Complex thinking involves both hemispheres on either verbal or non-verbal tasks.

Studies of hemispheric brain functioning imply that a school program restricted to a left brain approach to reading, writing, and arithmetic will educate only one hemisphere. An activity-oriented "hands-on" science program provides opportunity for right brain tasks. Science investigations require critical thinking and problem solving which offer integrated experiences for more meaningful learning as implied in the hemispheric model.

Current brain research suggests that students' prior knowledge needs to be linked with the science content being taught and that personal and social material should be included in the science curriculum. New material will fade from memory unless it is connected to related material already in long-term memory. Initially the brain pays primary attention to the emotional content of information.

· Stimulates student interest in science, mathematics, and engineering careers
Studies are continuing to alert us as to the crisis in science and mathematics education. Our ability to compete in the world economy and to prepare our citizens to live in an increasingly complex world influenced by technology is being challenged. An increase in student enrollment in advanced science and mathematics courses is necessary. Student interest in these higher levels of science will be fostered by their participation in a research project. Students will have the opportunity to meet and work with active scientists at colleges, universities and industry. These role models will encourage students to choose careers in science, engineering and technology.

· · OUTLINE OF A SCIENCE DAY PROGRAM · ·

· Objectives

1. To enable students to work toward maximizing individual potentials

2. To enable students to improve their self-concept - feeling a sense of accomplishment and then, success in completion

3. To enable students to become more aware of current issues in science

4. To give students the opportunity to participate in various programs offered through The Ohio Academy of Science
    - Local, District and State science days
    - Buckeye Science and Engineering Fair
    - Ohio Science Talent Search
    - Annual Meeting
    - The American Junior Academy of Science
    - *The Ohio Journal of Science*
    - Student and teacher membership in the Academy

5. To enhance other curriculum areas
    - Strengthen processes of reading and written expression
    - Develop research skills
    - Maximize verbal communication skills
    - Extend language and logic development
        - Independent, critical thinking
        - Multiple interpretation of data
    - Utilize mathematical and statistical concepts, procedures and problem solving

· Project components

1. An identified problem/question in which the student has designed an experiment to test an hypothesis
2. An approved research plan
3. A detailed research report
    - Title page
    - Table of contents
    - Abstract - maximum of 250 words
    - Introduction - (problem and hypothesis to be investigated)
    - Methods and materials used to study problem
    - Analysis of collected data to infer results
    - Conclusions and implications for further research
    - Graphs, tables, diagrams to illustrate investigation
    - References
4. A physical display
    - A totally self-supporting poster display
    - Exhibit tables, diagrams, graphs, models, etc.
    - Dimension - 36" wide x 30" deep and a maximum of 7 ft. from floor
    - Posters should be neat with correct terms used
5. An oral presentation

    Students should use note cards if necessary rather than memorization to prepare an explanation of their investigations. Background information, methods used, data collected, and all visuals should be discussed. Note cards are to be used for reference and are not to be read to judges.

· Implementation

1. Preparing Students
    - Class Investigations and discussions
    - Time Schedule (begin with target completion date and work backward)
    - Identifying a Problem
    - Stating a Hypothesis
    - Locating Information
    - Collecting and Organizing Data
    - Analyzing and Interpreting Results
    - Research Report Content
    - Display
    - Oral Presentation
    - Checklist
2. Planning and Management of Science Day
    - Set Date and Location
    - Coordinate Volunteers
    - Acquire Support
    - Schedule
    - Recruit and Instruct Judges
    - Prepare Entry Forms
    - Prepare Program
    - Prepare Floor Plan
    - Prepare Name Tags
    - Setup Tally Room
    - Acquire Supplies

- Prepare Awards
- Conduct Awards Ceremony
- Develop Publicity
- Judges' Folders

· · IMPLEMENTATION OF A SCIENCE DAY PROGRAM - PREPARING STUDENTS · ·

Science teachers are usually the directors in charge of the program. They are responsible for the organizational aspects of a school Science Day and are primarily involved with advising students throughout their project work. After deciding on a Science Day Program, teachers should contact The Ohio Academy of Science and their district council persons to obtain materials and dates of the District and State Science Days. The local Science Day should be scheduled several weeks before the District Science Day to meet entry requirements.

See: http://www.ohiosci.org/dsd1.htm .

· Class investigation Teachers advising for the first time may wish to follow this Class Investigation plan.

1. Acquaint students with project work by showing videotape and slide presentations, or by simple demonstration using posters and pictures of previous science projects. Visual displays will give students an overview of project components and expectations. Students should be provided with a project component listing. (See Appendix D).

2. All students should be involved in several investigations prior to the selection of their project. These activities will give them ample opportunities to design experiments, collect data, analyze results and discuss possible conclusions. Some Science Days are criticized for displaying projects that are not scientific—those that are reports about a topic rather than investigations of a problem. Students who have been involved with experimentation will be knowledgeable concerning the need to define or identify a problem and suggest a procedure to test their hypothesis. A simple investigation that may be used with the entire class is that involving cereal color and birds (See Appendix E). This is a good project topic to explain the need to have the research plan reviewed in advance by a Scientific Review Committee. See http://www.ohiosci.org/newrule.htm . It is recommended that the entire class complete the same experiment to enable participation of all students in the discussion of variables, controls, validity, reliability, etc. Students should be given the opportunity to pursue other investigations following the same format.

3. An activity that may help to initiate appropriate questions for science investigations would place students in a lab team of two or more. Each group would be given science topics, and, as an assignment, they would create possible questions or problems that may be investigated. For example, using the topic of plant growth, students may suggest investigating the effect of light, temperature, soil type, water, or minerals on the growth of a plant. A class follow-up discussion of the suggested problems of each lab team and the workability of each should be implemented. Suggested problems may then be selected so that the scientific methodology necessary to complete an investigation could be discussed (See Appendix F).

Continually stress the importance of a scientific method approach in solving a problem. Present and discuss as many investigations as possible to emphasize the importance of producing investigative rather than report projects. Academy Standards, available at http://www.ohiosci.org/sds.htm , require the use of scientific methods.

Students may need guidance in narrowing their project topic (See Appendix G), choosing a research problem, locating information, collecting and organizing data, analyzing and interpreting results, designing their equipment or physical display, and/or the technical writing of the research paper. The teacher/director may assist students in all of these areas as necessary without actually doing any project work. Students may also be referred to experts in their chosen fields.

· Time schedule checklist A time schedule is very important to the inexperienced project worker. (See Appendix I) Teachers should announce the project completion date and suggest reasonable check points to ensure individual compliance. Also necessary for the teacher having several classes of students involved in project work is a check sheet for each student on which will be noted each time the teacher and student meet to discuss project progress. (See Appendix J) This enables a teacher not only to know at any given time what each student is working on, but also to monitor progress in outlining, note taking, location of references experimental data, etc. This listing will also aid in parent conferences and in determining the degree of pupil involvement in the projects.

· **Identifying a problem** Identifying a problem to study is often the most difficult aspect of a science research project. After a student has been given an overview of what is expected and the criteria that will be used to evaluate his/her work, the student is ready to assess his/her own goals and objectives and choose an investigation that will meet these priorities. Students should consider hobbies, special interests, and current societal issues. Several sources of ideas should be available to students. For example, abstracts of previous student research projects at the Intel International Science and Engineering Fair are available at
http://www.sciserv.org/isef/document/aborder.pdf

When formulating the question/problem, the student must consider: a) the type of information that will be necessary to collect (facts, attitudes, skills); b) how the data will be collected (experimentation, survey, collection comparison); and c) from whom the data will be collected (random choices must be used to keep prejudices from affecting the results).

· **Stating a hypothesis** The hypothesis should state precisely what will be tested. A hypothesis—a simple declarative sentence—is a tentative explanation made to test ideas. It guides investigations to answer the questions. Students should consider realistic implementation of the experiment. Design of the investigation and the statistical treatment should be considered simultaneously. Questions such as how the data will be analyzed and evaluated need to be answered. A representative number of subjects are necessary to generalize to the larger group that the sample is intended to represent. The validity of the experiment should be addressed—did the experiment test the stated hypothesis? Students may also consider the reliability of their results. Possible replication of the original experiment may be used to determine the consistency of the results.

· **Locating information** Once the students have identified the problem and formulated an hypothesis they wish to research, a review of the literature on that topic is necessary. Most students need direction as to the various types of reference material available. Students will have to be reminded of the importance of current writings from science periodicals. Minimum numbers of references should be designated. Proper style is essential. Locating information will be expedited if students' library skills are reviewed, and school librarians are versed as to the requirements for the research study. Direct interviews, videotapes, visitations, and written correspondence should be encouraged as a means of gathering information.

Students should be encouraged to expand their search for information beyond their school. Consider the many resources available in the community: public library, business, industry, governmental agencies, trade and professional organizations, colleges, universities, museums, park districts, health departments and nature centers.

· **Collecting and organizing data** Students need guidelines for collecting and organizing data. An outline that may assist them follows:

1. Determine the kinds of information needed to test the hypothesis.
    - Measurements
    - Observations
    - Attitudes
    - Facts
    - Skills

2. Discuss methods and procedures that will be used to collect data (including but not limited to):
    - Simple controlled experiment - an experiment in which there is only one group or subject that gets the experimental treatment. The control, another group or subject, does not get the experimental treatment but is otherwise treated the same.

- Counter balancing or crossover design experiment - an experiment which is done twice with the same subjects. The second time, the groups are "crossed over" - thus, the control becomes the experimental, and the experimental becomes the control.
- Blind and double-blind experiment - In a blind experiment, the subject, although being knowledgeable about the experiment, does not know if he/she is a part of the control group or experimental group. In a double-blind experiment, both the experimenter and the subjects are uninformed as to which group received the treatment.
- Scientific observation and careful description
- Case study - the detailed observation or study of an individual or event
- Anecdotal record - one's personal experience given as a story (lesser quality scientific evidence)
- Naturalistic observation - observing a natural situation (people, animals, societies, etc.,) with the least amount of disturbance to the subjects
- Survey - a sampling of opinions or collection of data from a designated group (people, plants, animals, minerals, etc.)

3. List and locate materials that are necessary to complete the experiment.

4. Keep a detailed written diary or log book of all observations, findings, procedures, etc., or dictate information into a tape recorder for later transcription. Be sure to date the records, indicating time if applicable.

Thoughts concerning the investigation should be included. Important details become vague after awhile and items not initially considered important may later be an answer for further questions.

5. Use several methods of organizing data.
   - Tables
   - Graphs
   - Diagrams
   - Charts

It is necessary that a complete, accurate description of the experiment be given for replication purposes.

· Analyzing and interpreting results

Student guidelines for analyzing and interpreting results of a study are also necessary. There are several questions to be considered.

1. Using the tables, charts, graphs, and diagrams prepared from written observation - what is the relationship between variables?
2. Consider the sampling used - is it representative of the larger group for which it is being generalized?
3. Did the results answer the original question?
4. Was the experiment a reliable test of the hypothesis?
5. Will the same results occur if the experiment is replicated?
6. Complete Statistical Analysis

Some type of statistical comparison should be completed to indicate significant findings. Simple forms might include:
1. ranking the measurements of specimen and comparing pairs or groups,
2. finding the arithmetic means (averages) of control and experimental groups and comparing the mean difference.

· Research report content The research report should include:

1. Abstract

Students must summarize the investigation in a maximum of 250 words. Writing should be concise, accurate, and complete (See Appendix N).

2. Literature Search
   - Background information
   - Studies involving similar problems, methods, or instrumentation
3. Scientific Methodology (Technical Discussion)
   - The problem/question to be investigated
   - The statement to be tested - hypothesis
   - The methods, procedures and materials used during the investigation
   - The data collected
   - Presentation and analysis of data
     - Figures
     - Graphs
     - Diagrams
     - Charts
     - Maps
     - Photographs

- Tables

  Tables should be on separate pages with data arranged so that the columns of like material read down. Figures include graphs, pictures, drawings, maps, etc. Tables and figures are numbered independently of each other.

- The significance of the results - generalizations and conclusions
- Questions for further study

A complete report will also include a Title Page, a Table of Contents, and a list of References (See Appendices for samples). The title should include the variable to be measured and the specific organism or condition to be investigated. For example, "Acid Rain" in an *unacceptable title* whereas "The Effects of Acid Rain on the Growth of Spirulina Algae" is acceptable. Scientific papers do not use a table of contents when published. However, it is suggested that the in-depth research report include a table of contents to assist with the organization and development of a logical progression. References should be listed in a standard format alphabetically by author's last name.

· **Display** Students should participate in several workshops given by teachers or experienced students dealing with display preparation. Instructions as to the construction of accurate graphs, tables, and diagrams are extremely important. Sessions that involve evaluating sample posters or displays are valuable in giving students an opportunity to view and discuss the use of stencils, markers, color, computer generated text, graphs, etc. Accuracy of displayed information is most important. The display should represent the sequence of the project and be a concise representation of the experiment (See Appendix P). **SPECIAL NOTE: At science days students should be expected to present the RESULTS of their research. They ARE NOT expected to PERFORM or DEMONSTRATE an experiment.** They should have already completed an experiment or conducted many research trials and thus have adequate RESULTS in the form of charts, graphs, data tables, logbooks, and laboratory notebooks-all recorded with dates- which should be with the project. Most equipment used in student research is not needed for presentations and is best left in the laboratory or at home. Use photographs or drawings of equipment on the poster boards, in the research report and in the project logbook or laboratory notebook to document and explain the equipment used. Items on the display backdrop, or poster boards, should be used as visual cues to keep the student's oral presentation to the judges on track or to refer to when asked questions. The whole project, in simple form, should be visible on the poster boards. Abstracts, project logbooks, laboratory notebooks, technical reports, and additional data should be in folders or binders close at hand for reference.

· Oral presentation

Students are responsible for reporting all of the findings made during their investigation devoid of any prejudice or preconceived notions. The diary or log book previously mentioned is of primary importance. Keeping it in its original form (not copied) can contribute information experienced and noted that at the time seemed irrelevant, but is later viewed as significant. Students should be knowledgeable concerning the research aspects of their study as presented in their written paper, the scientific methodology of their investigation, and all data and vocabulary used on their display.

Students will find that communicating their results in an organized manner (chronological, graphing, etc.) and using all available visuals to assist them will lead to a comprehensive overview of their investigation.

· Checklist

Student confidence in communicating their research study results will be enhanced by following these do's:

- √ Do have a complete scientific study of a question: cite problem, hypothesis, procedure, and results to demonstrate use of a scientific method approach.
- √ Do have accurate written data collected to be referred to or inspected.
- √ Do have data summarized in tables, charts, and graphs for easy reference in showing relationships.
- √ Do have reference to the sampling and validity of the study to demonstrate

knowledge of such factors and their impacts.

√ Do have some statistical analysis when referring to results or outcomes being significant.

√ Do offer some conclusions resulting from your study being careful not to over-generalize your outcomes.

√ Do consider further questions to be investigated generated by your investigation.

√ Do have a good, basic knowledge of the theories and principles in the field of science in which you have completed your investigation.

√ Do consider revisions that may improve your study.

√ Do practice your presentation in a logical sequence.

√ Do exhibit confidence and be proud of your accomplishments!

· · IMPLEMENTATION OF A SCIENCE DAY PROGRAM - PLANNING AND MANAGEMENT · ·

Once the students are working independently, the director must address the second major task—that of Local Science Day planning and management. A suggested time line for the director is available in Appendix Q. The following guidelines may be followed to insure completion.

· **Set date and location** The date and place of the event should be cleared with school administration and announced to staff and students as soon as possible. Before setting the date, check deadlines with the director of the District Science Day. See http://www.ohiosci.org/dsd1.htm

· **Coordinate volunteers** Meet with fellow teachers who will be involved and discuss the program to be offered. It is important that constant communication is maintained throughout the several months leading into the actual date.

· **Acquire support** Initiate support from parent and community organizations. Supply background information concerning project work and specific ways that they can be involved: a) various tasks during Science Day, b) purchase of certificates and other awards, c) recommending and recruiting qualified judges, and d) preparing judging cards. Here again, a successful program is a cooperative effort - keep everyone informed.

· **Schedule** The day's schedule must be posted well in advance in all science rooms, student bulletin boards, and office. Being considerate of the staffs' and students' other responsibilities will ensure positive relationships and a successful day. This schedule should be included in the letter sent to judges; therefore, it should be finalized and accepted two months prior to Science Day (See Appendix R).

· **Recruit and instruct judges** The major management task of the director is that of acquiring qualified judges and briefing the judges using The Ohio Academy of Science standards and assessment. Please see http://www.ohiosci.org/sds.htm . A first step is to begin a listing of possible candidates that includes their address, phone number, science area, and a column for comments (See Appendix T). The first group to contact is the administrative office personnelincluding the Superintendent, Assistant Superintendent, curriculum supervisors, school board members, school nurses, etc.. Next, ask teachers and principals from other schools in the area. It is best not to involve any faculty who have direct contact with the participating students. Consider the community. Contact persons in the medical fields (veterinarians, optometrists, dental hygienists, pharmacists, and lab technicians), in industry, in colleges, in universities, in vocational and technical schools, in senior citizen groups, in professional societies, and in local government (county and city engineers, water and sewage treatment plants) (See Appendix S). When determining the number of judges to be invited, consider the number of projects and their fields of entry. Judges should spend a minimum of ten minutes with each student and should not be expected to judge more than five projects. The Academy expects schools to have two judges per student and to evaluate each project on the following criteria:.

- Knowledge achieved
- Effective use of scientific method
- Clarity of expression

- Originality & creativity
- Teamwork (team projects)

When calling potential judges, it is necessary to mention the date and time involved. First, a full explanation of the program will often be necessary unless the candidate has judged at other Science Days. Therefore, be sure to mention that the criteria and ratings being implemented are those recommended by The Ohio Academy of Science. Most apprehension can be eliminated if the phone call is followed up by a letter that includes: 1) the schedule, 2) procedures, 3) map of school location, 4) the judging criteria and, 5) a sample judging card. The director should include a phone number that judges may call for additional information.

The responsibility of acquiring qualified judges cannot be overstated. Students have worked months in preparing for this event and it is most important that they go home satisfied that they were evaluated by a professional in the field. It is recommended that careful consideration be given to parent involvement in the judging process. Certainly the individual, the number of participants, the science field, and the availability of candidates all have to be considered. However, the utmost professionalism must endure throughout the day.

To ensure that judges understand the evaluation criteria, plan to meet with the judges before they proceed to interview students. During this session, quickly cover the program objectives and what is expected of each participant. Be sure to mention that particular projects are to be evaluated by being compared to the criteria as stated in the Standards for Science Day (not one project versus another). Ask colleagues to review the project cards and exchange any cards as deemed necessary due to knowing the students, or having a project that is out of their field of study. Using the guide sheet sent to judges previously, discuss the criteria and answer any questions. Always give judges the flexibility to return a judging card or to request a second opinion on a project.

Review judging ethics, too:

* Remember the primary function is "to discover and foster interest in science..."
* No prior involvement with student's project
* Adhere to Academy guidelines
* Avoid discussion of ratings with others prior to public release of the results
* Listen carefully to student's complete presentation
* Be exceptionally courteous to all students
* Judge students against CRITERIA not against other students
* Consider age and grade level
* Evaluate theoretical and applied projects without bias toward either
* Provide written, constructive criticism and suggestions for improvement to the student

· **Entry form** An entry form that includes the student's name, grade, homeroom, project category, and project hypothesis will be useful throughout the Science Day preparation. Be sure to set a due date being both fair and firm in adhering to all stated rules and dates. Students must accept the responsibilities involved with being a Science Day participant. Arrange the entries in alphabetical order according to categories (See Appendix U).

· **Program** A program of student names and project titles or categories is a nice keepsake for parents, and students find it rewarding just seeing their name in print. It also affords the director an opportunity to formally thank those who sponsored various aspects of the Science Day. Using the alphabetically arranged entry forms, an accurate listing of participating students can be easily acquired.

· **Floor plan** A floor plan should be designed to help organize the event. Grouping projects according to category will assist judges in locating exhibits. State standards specify a three foot (wide) space not to exceed seven feet in height from the floor per display. A card table works well if other tables are not available. Aisles should be as wide as possible to enable judges and guests to easily view projects and to provide handicapped access. Space assignments (exhibit number) and table arrangements should be made well in advance.

· **Name tags** Name tags for participants, judges, runners, and other staff are essential. The stick-on variety are easiest: the name of the participant, space number, and homeroom can be printed from the information on the entry forms. Distribute these prior to having students set up projects so they can be easily identified at all times.

· **Tally room** Selection and supervision of the staff working in the tallying room is also the director's responsibility. A professional atmosphere must prevail at all times. There should be no discussion of students personally or of judges or of the evaluations themselves. Only designated staff should be allowed in this room during the actual tallying of cards. As student judging cards are returned, they must be matched (if two evaluations were completed), the scores should be checked and averaged with a final rating assigned. Blue, red, green and black crayon marks corresponding to the ratings are often used to expedite the process. The student's certificate is then located and the rating is typed, stamped, or printed neatly. If ribbons and/or other awards are given, student names and other information can be added at this time. (See Appendix V)

· **Supplies** Judging cards and certificates may be purchased from The Ohio Academy of Science, 1500 W Third Ave Ste 223, Columbus, OH 43212; phone: 614-488-2228. It is strongly suggested that the judging criteria indicated on these cards be used at the local level with adherence to the minimum number of points necessary for earning each rating. Students are misled and may experience difficulty at the district level of competition if other criteria and standards are used at the local level. Students will recognize the judging cards to be similar at the local, district, and state levels. Order supplies six weeks in advance of your science day.

· **Awards** Ribbon and/or trophy selection should be discussed with appropriate staff and ordered well in advance of the event (2 months). Students tend to "let down," become discouraged three to four weeks before the Science Day. It is a real incentive to create a school display of the awards to be presented along with newspaper articles and pictures of previous Science Days.

· **Award ceremony** The presentation of awards should be a special portion of the Science Day. All students deserve to be recognized for their project work regardless of the rating earned. It is recommended that certificates be awarded to all participants, and ribbons, medals, and/or trophies at the discretion of the director. An awards program is more effective when carefully planned and conducted in the presence of peers, as well as parents. Students earning positions at the district level of competition should be recognized.

· **Sponsored awards** Many professional societies, industries, colleges, universities, and government agencies demonstrate their interest in student research by offering a variety of awards at Local, District and State Science Days. Although these organizations develop their own criteria and present their awards to the students they evaluate as exemplifying their objectives, the science day director should provide sponsors with the Academy's judging criteria and urge their use.

· **Publicity** Publicity is essential for increasing community support and obtaining recognition for participating students. Be sure to call local radio, TV, and newspapers in advance to ensure their promotion of the event (See Appendix W for sample news release).

· **Judges' folders** Prepare a folder for each judge. Judges' folders should include: 1) the projects assigned (according to expertise), 2) schedule of the day, 3) map of the floor design, 4) judging criteria with explanation sheet, and 5) thank you letter. The folders can be assembled in advance. On Science Day, place folders on a table in alphabetical order with the name tags on the outer cover. The judges will be given their folders as they arrive, thus giving them an opportunity to review the criteria and the projects they will evaluate. Adjustments can be made by the director for those judges not in attendance.

· · OHIO ACADEMY OF SCIENCE STANDARDS · ·

· **Instructions to participants** You <u>MUST</u> Check the Latest Standards Here
http://www.ohiosci.org/sds.htm

Participation in a Science Day can be a rewarding experience. It offers young people an opportunity to learn and practice the principles of scientific research, to meet others interested in science, and to earn recognition for academic excellence. Thus, those involved should not be limited to the gifted, although all should be made aware of the long and tedious work involved in science investigation. First time student researchers should be guided through a science investigation. Accurate prediction of a student's potential is impossible until he/she has attempted a project a number of times. Most will not achieve perfection on the first attempt, but proficiency will come to those who are persistent.

All students in grades 5-12 who participate in district and State science days are expected to complete research plans prior to beginning their research. Modifications in the plans are permitted during the process of the research. A research plan shall be included in the student's research report. All students MUST complete a Checklist for Adult Sponsor, Research Plan (1A), and Approval Form (1B) in advance of their research as developed by Science Service for participation in the Intel International Science and Engineering Fair. See website below. Classroom teachers who expect their students to compete in a District Science Day leading to State Science Day may approve research plans, in lieu of review by a local Scientific Review Committee if the proposed research does not involve recognized research risks or issues. **Student research projects involving**

- **(1) live vertebrate animals including observation projects,**
- **(2) humans subjects,**
- **(3) recombinant DNA,**
- **(4) controlled substances,**
- **(5) hazardous substances and devices,**
- **(6) human and nonhuman animal tissues, or**
- **(7) pathogenic agents**

MUST be approved in advance of the research trials, data collection or actual experimentation by a locally appointed Scientific Review Committee. The research plan MUST use and adhere to all protocols for research risks and issues identified by the Rules for competition in the Intel International Science and Engineering Fair as determined by the local Scientific Review Committee. The membership of the local school Scientific Review Committee (minimum of three persons with specific roles and expertise) may be expanded to serve as an Institutional Animal Care and Use Committee for review of vertebrate animal projects and/or an Institutional Review Board for review of projects with human subjects.

A student with a project involving research risks or issues and special protocols (see 1-7 above) will be accepted for competition at District and State Science Days **only if** a copy of the approved Checklist for Adult Sponsor, Research Plan (1A), Approval Form (1B) and perhaps other special forms, as needed, are attached to the student's District and State Science Day registration forms.

Students in grades 9-12 who expect to compete in a Regional Fair or in one of the Buckeye Science and Engineering Fairs leading to the International Science and Engineering Fair (ISEF) MUST complete a Checklist for Adult Sponsor, Research Plan (1A), and Approval Form (1B) in advance of the research, and perhaps other special forms required for ALL projects.

Current Rule booklets, with all the forms, are available for $1.25 each from Science Service, 1719 N Street, NW, Washington, D. C. 20036. You may download forms from the following website:

http://www.sciserv.org/isef/document/

IMPORTANT DETAILS FOLLOW:

SEE Standards (http://www.ohiosci.org/sds.htm)

· **Instructions to judges** The attitudes and conduct of the judges determine the success of any Science Day activity. Therefore, it is vital that each judge understands thoroughly his/her duties and obligations. Judges should also have knowledge of all the requirements of the participants. All judges need to have a genuine interest in young people combined with a desire to offer encouragement and guidance in their efforts to pursue learning in the various fields of science.

·See Important Details on Judging
http://www.ohiosci.org/sds.htm

·See Important Details Including Rules for the Use of Animals
http://www.ohiosci.org/animal.htm

·· REFERENCES ··

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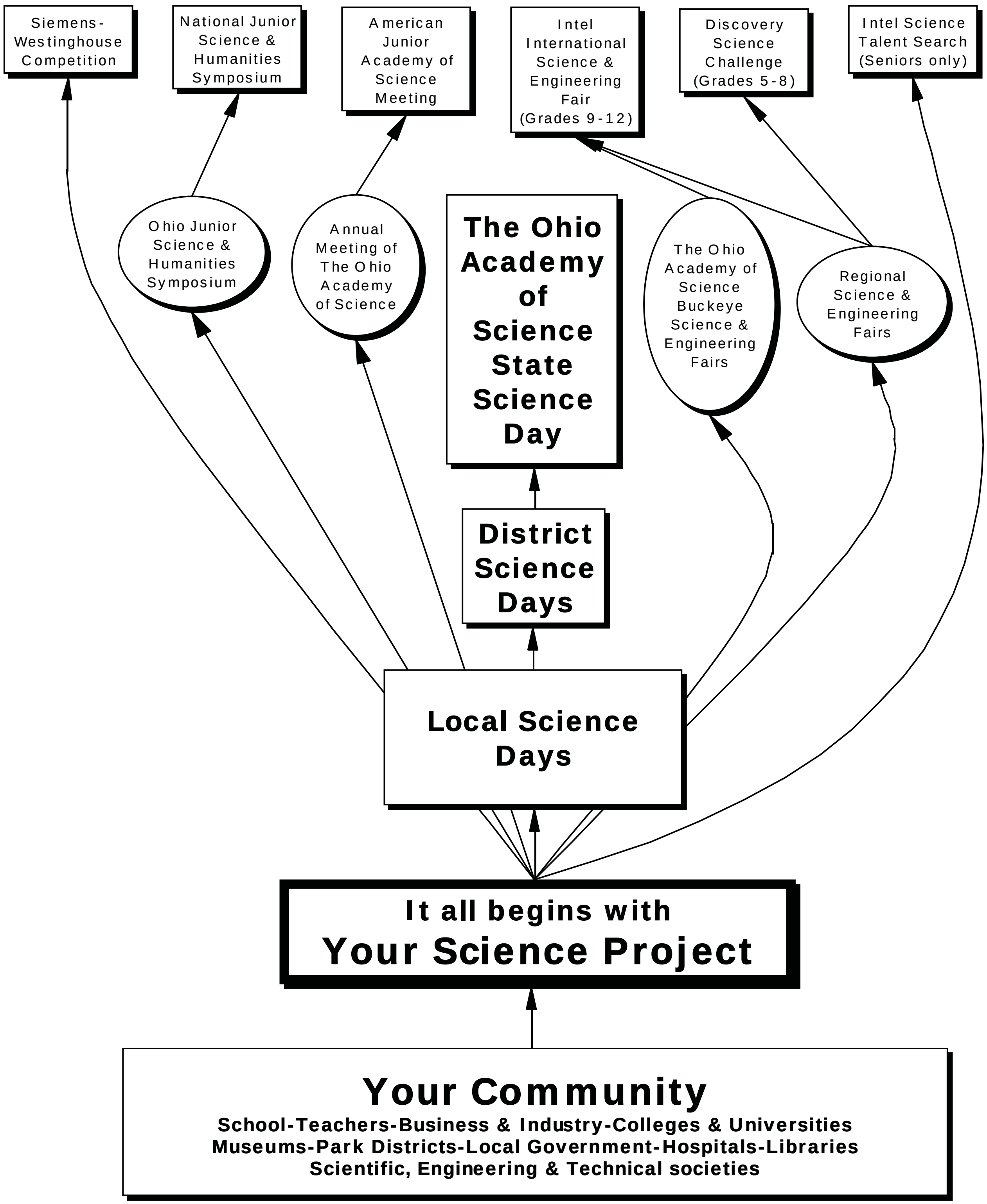
·· NOTES ··

Youth Science Opportunities



· · APPENDIX B · ·

· Regional and Intel International Science & Engineering Fairs

Ohio has several regional science and engineering fairs and the Buckeye Science & Engineering Fair (BSEF) where students may qualify for participation in the International Science and Engineering Fair (ISEF).

SPECIAL RULES AND FORMS apply to regional fairs and the BSEF. THESE RULES MUST BE FOLLOWED AND FORMS COMPLETED PRIOR TO THE START OF THE RESEARCH.

Please see the following webpages:

BSEF
http://www.ohiosci.org/bsef.htm

Intel ISEF
http://www.sciserv.org/iisef.htm

· · APPENDIX C · ·

· Student Research Plan

See the following website for the Academy's Science Day Standards: http://www.ohiosci.org/sds.htm

All projects are expected to have a Student Research Plan.

To participate in a District or State Science Day, students must use special forms available at the following website:

http://www.sciserv.org/isef/document/

Student Project Guide Sheet

Time Schedule - Projects should be started as soon as possible and a schedule maintained in order to ensure completion of all project components.

Project Ideas - Check all available sources for possible project ideas. Consider hobbies, special interests, and current societal issues.

Identify a problem - Students must consider the realistic implementation of the experiment. Design of the investigation and the statistical treatment should be considered early in the planning. Questions such as how the data will be collected, analyzed and evaluated should be considered.

Stating Hypothesis - A hypothesis is formed to answer the stated question. It suggests a prediction that can be tested or observed under experimental conditions.

Locate Information - A thorough review of the literature is necessary. Be sure to include current science periodicals, current non-fiction books, and interviews with specialists.

Collect and Organize Data - Consider methods and procedures that will be used to collect data. List and locate materials that are necessary to complete the experiment. Keep a detailed written diary of all observations, procedures, etc. Include date, time and all other relevant information.

Analyze and Interpret Results - Use graphs, tables, and diagrams to determine relationships between variables. Consider sampling, reliability, and a type of statistical comparison.

Research Report Content - A complete explanation involving the scientific methodology, and the literature researched should be included. An abstract, tables, and graphs aid in summarizing research projects and are required. to earn a superior rating.

Display - Accuracy of displayed information is very important. The display posters should represent the sequence of the project. The posters should be a concise representation of the experiment. Equipment and other paraphanalia used in your project shall **not** be displayed.

Presentation - Students should be knowledgeable concerning the research aspects of their study as presented in their written paper, the scientific methodology of their investigation, and all data and vocabulary used on their display. A brief comprehensive summary of the project will be given orally by the student at the time of judging.

Checklist

Confidence of students in communicating their research study will be enhanced by following these do's:

- ✓ Do have a complete scientific study of a question: cite problem, hypothesis, procedure, and results to verify use of a scientific method approach.
- ✓ Do have accurate written data collected to be referred to or inspected.
- ✓ Do have data summarized in tables, charts, and graphs for easy reference in showing relationships.
- ✓ Do have reference to the sampling and validity of the study to demonstrate knowledge of such factors and their impacts.
- ✓ Do have some statistical analysis when referring to significant results or outcomes.
- ✓ Do offer some conclusions resulting from your study, being careful not to over generalize your outcomes.
- ✓ Do consider further questions for study or exploration that your investigation generates.
- ✓ Do have sound, basic knowledge of the theories and principles in the field of science in which you have completed your investigation.
- ✓ Do consider revisions that may improve your study and anticipate questions from judges.
- ✓ Do practice your presentation in a logical sequence.
- ✓ Do exhibit confidence and be proud of your accomplishments!

· · APPENDIX D · ·

· Project Components and Judging Criteria for Science Day Projects

1. **An identified problem or question for which the student has designed an experiment to test an hypothesis.**

2. **A detailed research report**
   Title page
   Table of contents
   Abstract (250 words or fewer)
   Introduction-(background, problem and hypothesis to be investigated)
   Methods and materials used to study problem
   Results including an analysis of collected data including graphs, tables, diagrams, to illustrate investigation
   Discussion including conclusions and implications for further research.
   References

3. **A table-top poster display**, totally self-supporting , is expected (Maximum of 3 ft. wide and - 7 ft. from floor.). Use data tables, diagrams, charts, photographs and graphs on posters. Scientific equipment and supplies, other apparatus or research paraphanalia are **not permitted** at a display. Log books are expected. Battery-powered computers may be used only for simulation or animation integral and essential to the project **results or data display** and not for general PowerPoint presentations. Free-standing floor exhibits are not permitted.

4. **An oral presentation** — Students should use note cards or their display rather than memorization to explain their work to judges. Background information, problem and hypothesis,methods used, data collected, and all visuals should be discussed.

Individual and Team Judging Criteria

	SUPERIOR	EXCELLENT	GOOD	*SATISFACTORY
KNOWLEDGE ACHIEVED	10-9	8-7-6	5-4-3	2-1
EFFECTIVE USE OF SCIENTIFIC METHOD	10-9	8-7-6	5-4-3	2-1
CLARITY OF EXPRESSION	10-9	8-7-6	5-4-3	2-1
ORIGINALITY & CREATIVITY	10-9	8-7-6	5-4-3	2-1
TEAMWORK (for Teams only)	10-9	8-7-6	5-4-3	2-1

*There is no "Satisfactory" rating given at State Science Day.

Minimum number of points for each rating:

Individual: Superior 36, Excellent 24, Good 12, Satisfactory 4 (Not given at State Science Day)

Teams: Superior 45, Excellent 30, Good 15, Satisfactory 5 (Not given at State Science Day)

To receive a superior award at local, district or state science days, the student shall have an abstract and a written report which documents that the student has searched relevant literature, stated a question and/or tested a hypothesis, collected and analyzed data, and drawn conclusions. An **individual project** shall receive a minimum of 36 points based on the four criteria of (1) knowledge achieved, (2) effective use of scientific method, (3) clarity of expression, and (4) originality and creativity. A **team project** (with a maximum of three students) shall receive a minimum of 45 points based on the five criteria of (1) knowledge achieved, (2) effective use of scientific method, (3) clarity of expression, (4) originality and creativity, and (5) teamwork.

· · APPENDIX E · ·

· Class Investigation

NOTE: This is a good project to explain the need to have the research plan ***reviewed in advance*** by a Scientific Review Committee.

See http://www.ohiosci.org/newrule.htm

Concept - Setting up an Experiment.

Purpose - To give students practice in setting up an experiment.

Activity - Student will choose a type of cereal e.g. Rice Krispies™, and, using safe food coloring, dye 100 Red, 100 Green, 100 Yellow, and use 100 Natural. Student will place ten pieces of each color of cereal in a container or bird feeder outside. They will record the amount of cereal eaten of each color for ten days. They should also make several observations relating to the kinds of birds seen eating at their food station, the weather conditions, etc.

Evaluation

Student will formulate a hypothesis.
Student will complete a log of observations and a table of the data collected.
Student will analyze results and state conclusions.

Amount of Food Eaten

	Day of observation										
	1	2	3	4	5	6	7	8	9	10	Total
Cereal Color											
Red											
Green											
Yellow											
Natural											

NOTES:

· · APPENDIX F · ·

· Student work sheet - Initiating Investigation Ideas

Concept - Initiating investigative topics.

Purpose - To generate possible scientific questions to be investigated.

Activity
Students will form groups and be given a science topic (plants, animals, rocks, environment, consumer products or the typical judging categories: Behavioral Science, Biochemistry, Botany, Chemistry, Computer Science, Earth Science, Engineering, Environmental Science, Gerontology, Health Science, Mathematics, Medicine, Microbiology, Physics, Social Science, Space Science, Zoology)

Each group will write a list of 5-10 possible questions or problems that may be investigated. For example:

Topic: Plant Growth
Question: Will the color of light affect the growth of *Petunias*?
Each group will have an opportunity to present their list to the class.
Class members will discuss the workability of each question and how it might be implemented in a scientific investigation.

Name ____

Topic ____

Questions or Problems:

1. ____
2. ____
3. ____
4. ____
5. ____
6. ____
7. ____
8. ____
9. ____
10. ____

· · APPENDIX G · ·

· Narrowing the topic

ENERGY

USES PHYSICS SOURCES

Natural Gas Oil Nuclear Coal Solar Wind

Availability Economics Regulations Environmental Engineering

Project title: "The effects of blade design on wind turbine performance"

Once you have some idea of your area of interest, you should begin to **narrow the topic.**

A serious error of first time researchers is trying to do too much. You'll be able to do a better job if you narrow your topic.

For example, let's say you choose energy as a general area of interest. In order to formulate a question or problem, you need to understand that information can be broken down into smaller units. Soon you'll reach an area that is limited enough to allow you to proceed until you begin to exhaust the available sources of information.

The broad subject of energy may be divided into:

Uses
Sources
The physics of energy

Sources may include natural gas, oil, nuclear, coal, solar, and wind. If you are particularly interested in wind you'll soon discover that you can be even more specific.

Projects on wind may be concerned with availability, economics, environmental aspects, regulations and engineering.

Engineering may be limited to the problem or question of:

"How will blade design affect the performance of a wind turbine?"

· · APPENDIX H · ·

· Library checklist

Student's name: ____

Science area: ____

Hypothesis: ____
____
Project title: ____
____

Key words for cross-reference: _______________________________

Check:

__ Card catalog (including online computerized catalogs); author, title, and subject of circulating non-fiction and non-circulating reference or closed reserve books

__ Indices - author's name and subject heading

__ Readers Guide to Periodical Literature

__ Newspaper and magazine indices

__ Science encyclopedias

__ Handbooks of Chemistry, Physics, Medicine and others

__ MSDS (Material Safety Data Sheet) Search for at : http://www.msdssearch.com/

__ Abstracts

__ Biological, chemical, mathematical, social sciences, environmental, energy journals

__ Computerized databases (online and CD-ROM) including internet searching

__ Vertical or open file collection of brochures, magazine articles and other resource materials on a specific subject area

__ Teacher, advisor, library or school approved or suggested websites

· · APPENDIX I · ·

· Time line for Science Day participants

TASK	Due Date	Date Completed
Preview sample projects	___________	___________
Review scientific method approach	___________	___________
Complete a simple experiment	___________	___________
Develop a research plan	___________	___________
Identify problem or question	___________	___________
Review literature	___________	___________
Formulate the hypothesis	___________	___________
Design and implement experiment	___________	___________
Understand judging criteria, project categories, and specific fair rules for your project	___________	___________
Organize data from experiment	___________	___________
First draft of research report	___________	___________
Construct graphs, tables, diagrams	___________	___________
Write abstract	___________	___________
Complete title page, table of contents, reference listing	___________	___________
Plan poster display	___________	___________
Develop oral presentation	___________	___________
Present project	___________	___________

==

Local Science Day Date	___________	___________
District Science Day Date	___________	___________
State Science Day Date	___________	___________

·· APPENDIX J ··

· Student record sheet

Student's Name ____________________________ Class or Grade Level _________

Judging Category: __ Behavioral Science __ Biochemistry __ Botany __ Chemistry __ Computer Science __ Earth Science __ Engineering __ Environmental Science __ Gerontology __ Health Science __ Mathematics __ Medicine __ Microbiology __ Physics, __ Social Science __ Space Science __ Zoology

Identified Problem: ____
____
Hypothesis: ____
____

Experimental Method Checklist:
Student has:

___ chosen a design (e.g. controlled experiment, counter balancing, blind/double blind, naturalistic observation)
___ considered variables
___ set up a procedure to collect data
___ provided for adequate sampling
___ checked need for approval ***before beginning research trials or experimentation*** by local Scientific Review Committee (SRC) (animals, human subjects, DNA etc.)
___ had review completed and approved; made changes if required by SRC
___ located equipment and materials

Preliminary Outline: Completion date _______ Quality _______

Research Plan: Completion date _______ Quality _______

Literature Search:

Date	Qualitative and Quantitative Description of Notes	Reference Noted
___________	____	____________________
___________	____	____________________
___________	____	____________________

Collection of Data:	Quantity	Quality
First Check	_______	______
Final Check	_______	______

Interpretation of Data: Tables ______ Figures ________ Other _______

Conclusions and Implications: Completion date _______ Quality _______

First Draft: Completion date _______ Quality _______

Abstract: Completion date _______ Quality _______

Physical Display Completion date _______ Quality _______

Final Research Report Completion date _______ Quality _______

Oral Presentation Completion date _______ Quality _______

· · APPENDIX K · ·

· Sample Log Book Entry

3

NW 1/4 Sec 35 T7N R 16W
Huntington Twp. Gallia Co. 7.5' Vinton Quad

24 Jan 75 . . . Griffith RR#2 Vinton

S. of Vinton – Flood Plain

- Pawpaw
- red maple
- Sycamore
- river birch
- tulip tree
- spicebush
- Elm
- Phytolacca americana

Fairly strong under ice
Carduus [illegible]
Lysimachia ~~[illegible]~~
nummularia
wild grape

- Sambucus canadensis
- ironwood? alder?
- poison ivy
- Hickory?
- greenbrier
- beech
- ~~[illegible]~~ Sugar maple
- honeysuckle
- ~~Elm~~ Rubus
- sweet gum
- dogwood
- black cherry
- red cedar
- grape
- Sensitive fern

also red? brown pith

- Agrimony
- Swamp white oak
- tulip tree
- Castanea
- Butternut
- white ash
- Buckeye

· · APPENDIX L · ·

· Sample title page

*TITLE REFLECTING THE PURPOSE AND RESULTS OF

YOUR INVESTIGATION

to

The Ohio Academy of Science

by

George M. Smithman
4455 Kendall Avenue
Central City, Ohio 43111

May 10, 2002

Science Advisor: Mr. John Mauderly

Central City High School
462 Main Street
Central City, Ohio 43112

*** NOTE:**

AVOID SHORT, "CUTE" TITLES. The title should tell *what you studied.* For example: "Catching the Wind" or "Wind Energy" are UNACCEPTABLE titles.

"The Effects of Blade Design on Wind Turbine Performance" is a better title because it tells WHAT WAS STUDIED.

· · APPENDIX M · ·

· Sample Table of Contents

Contents

Page

· · APPENDIX N · ·

· Sample Abstract Form

How to write an abstract:

1. The student(s) must submit a one page (8.5"x11"), single-spaced abstract containing no more than 250 words. The heading must contain the project title and name(s) of the author(s). The heading does not contribute to the word count.

2. The purpose of an abstract is to provide a summary of your project that will inform interested individuals of the contents. The wording must be written in a manner that any scientifically minded individual, who may not be familiar with your topic, can understand the project's important points.

3. The following should each be summarized in a few sentences:
   a. Background information necessary to understand the abstract and its importance.
   b. The problem that was investigated and the hypothesis.
   c. Outline of the materials and methods used in the experimentation (research trials).
   d. Summary of the results obtained from your experimentation.
   e. The conclusions drawn from the results.
   f. The importance or potential applications your research offers.

4. Do not be concerned with including all of the details. The key point to remember when writing an abstract is to keep the wording brief and concise. **OMIT NEEDLESS WORDS.** Use complete sentences. Avoid personal pronouns like "I" and "my." Abstracts should provide only information needed to understand the project's basic points and importance.

Example of an Abstract

Heading

A PRELIMINARY INVENTORY OF AQUATIC MACROINVERTEBRATE TAXA FROM RESTORED AND NATURAL WETLANDS OF THE BEAVERCREEK WATERSHED. Mollie D. McIntosh, mdmcintosh@ud.edu, Joseph S. Valaitis, Brian T. Condon, M. Eric Benbow, Albert J. Burky, University of Dayton, Dept of Biology, Dayton OH 45469-2320. .
Wetlands are som Background, Purpose ological systems in the
Midwest, with ma er, there have been recent
restoration efforts. Understanding successional dynamics of plants and animals is needed to
monitor restoration projects. Aquatic macroinvertebrates are important components of wetland
food webs and secondary production (e.g., food for waterfowl). Bimonthly, qualitative benthic and
w Methods ons were taken from May - October 1998 in order to establish a baseline
inventory of aquatic macroinvertebrates from relatively natural and restored wetlands of the
Beavercreek Watershed. It is hypothesized that natural wetlands will Hypothesis
macroinvertebrate faunal assemblage. Preliminary data, pooled from both wetland types, revealed
at least four phyla and 19 families. For the first month of data, the natural wetland appears more
diverse, especi Results ata and Coleoptera. Fingernail clams (e.g. *Musculium sp.*) and
Ephemeropte d in the natural and restored sites, respectively. These initial
data show that wetlands at different successional stages may contain very distinct aquatic
macroinvertebrate assemblages which may be important to the food web and other functional
processes of wetlands. Conclusions/Applications

·· APPENDIX O ··

· Sample Reference List

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***This is the style guide followed by *The Ohio Journal of Science,* the official publication of The Ohio Academy of Science. Ask your school or public librarian to buy this guide or consult it at a college library.**

****This is a classic guide for *ALL* writing. Everyone should have a copy.**

· Science Day Display

1. **An identified problem or question for which the student has designed an experiment to test an hypothesis.**

2. **A detailed research report**
   Title page
   Table of contents
   Abstract (250 words or fewer)
   Introduction-(background, problem and hypothesis to be investigated)
   Methods and materials used to study problem
   Results including an analysis of collected data including graphs, tables, diagrams, to illustrate investigation
   Discussion including conclusions and implications for further research.
   References

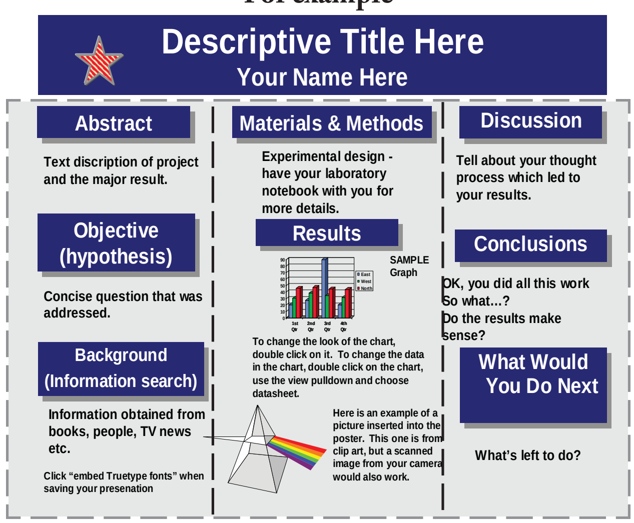
3. **A physical poster display**—3-6 panel poster display - totally self-supporting for placing on a table top; data tables, diagrams, graphs, logbooks, etc.; **Scientific equipment and other apparatus is not permitted at a display**. Log books, research plans and protocols are expected. Dimensions - maximum of 3 ft. wide and - 7 ft. from floor.

4. **An oral presentation**—Students should use note cards or their display rather than memorization to explain their work to judges. Background information, problem and hypothesis,methods used, data collected, and all visuals should be discussed.

A typical display at a science day should have the following elements:

- Title
- Abstract
- Background information including objective, problem and hypothesis
- Experimental Design (Methods & Materials)
- Results including tables and graphs of data
- Discission/Conclusion(s)
- Technical Report
- Logbook, research plan and protocols/forms
- Photographs of equipment, samples or other items from your experiment (Display **only photographs or drawings**, not the actual equipment or samples).

For example



This illustration was created by Richard Sunburg by using PowerPoint software.

Expectations of Display:

Students are expected to present the RESULTS of research. They ARE NOT expected to PERFORM or DEMONSTRATE an experiment. Students should have already done an experiment or conducted many research trials and thus have adequate RESULTS in the form of charts, graphs, data tables, logbooks, and laboratory notebooks--all recorded with dates-- which should be with your project. Most equipment used in research is not needed for a presentation and is best left in the laboratory or at home. Use photographs or drawings of equipment on the poster boards, in the technical report and in the project logbook or laboratory notebook to document and explain the equipment used. Items on the display backdrop, or poster boards, should be used as visual cues to keep the student's oral presentation to the judges on track or to refer to when asked questions. **The whole project, in simple form, should be visible on the poster boards.** Abstracts, project logbooks, lab notebooks, technical reports, and additional data should be in folders or binders close at hand for reference. Electricity will not be provided. Battery-powered computers may be used only for simulation, modeling, animation or data display integral and essential to the project results and not for general PowerPoint™ presentations.

Items Allowed at Project with the Restrictions Indicated

Posters should display an abstract, data tables, diagrams, charts, photographs and graphs. Project logbooks, research reports, research plans and documentation of research protocols **are expected** and may be in notebooks or folders on the table.

Information such as postal, web and e-mail addresses, telephone and fax numbers are allowed for the exhibitor only.

The only photographs or visual depictions of identifiable or recognizable people allowed are photographs of the exhibitor, photographs taken by the exhibitor (with permission of individuals received), or photographs for which credit is displayed (such as from magazines. newspapers, journals, etc.).

Battery-powered computers may be used only for simulation, modeling, animation or data display integral and essential to the project results and not for general PowerPoint™ presentations.

Items NOT ALLOWED at Project Display

Scientific equipment and supplies, other apparatus or research paraphernalia are not permitted at a display at District or State Science Days.

Living organisms, including plants. Petri dishes or culture tubes with living or dead cultures are NOT permitted.

Taxidermy specimens or parts

Preserved vertebrate or invertebrate animals

Human or animal food

Human/animal parts or body fluids (for example, blood, urine) (**NO** Exceptions for : teeth, hair, nails, dried animal bones, histological dry mount sections, and completely sealed wet mount tissue slides)

Free-standing floor exhibits are not permitted.

Plant materials raw, unprocessed, living, dead, or preserved. Petri dishes or culture tubes with living or dead cultures are NOT permitted. (Exception: commercial wood used in building the display or paper in reports.)

Laboratory/household chemicals including water (Exceptions: sealed bottled water for human consumption.)

Poisons, drugs, controlled substances, hazardous substances or devices (for example, firearms, weapons, ammunition, reloading devices, pyrotechnics and explosives)

Dry ice or other sublimating solids

Glass containers (**No exception** for plastic labware)

Sharp items (for example, syringes, needles, pipettes, knives)

Flames or highly flammable materials

Batteries with open-top cells

Awards, medals, flags, etc. (Exceptions: Academy membership or State Science Day lapel pins)

Empty tanks that previously contained combustible liquids or gases

Any apparatus with belts, pulleys, chains or moving parts

Lasers of any type

Large vacuum tubes or dangerous ray-generation devices (Exceptions: computer monitors on battery-operated notebook computers)

Pressurized tanks that contain combustibles or non-combustibles

Any apparatus producing heat above room temperature (e.g. heatlamp, hotplates, Bunsen burner)

Soil, waste, or plant samples **even if** permanently encased in a slab of acrylic.

· · APPENDIX Q · ·

· Timeline for Science Day Director

Four or more months prior
Start student project work
Ask support from parent organization (volunteers, awards, "snacks" for judges)
Confirm date and place and schedule Local Science Day two to three weeks prior to District Science Day; Check first with District Director: http://ohiosci.org/dsd1.htm
Prepare judges' source listing

Two months prior
Begin contact with judges
Order materials necessary
- judging cards
- certificates
- ribbons, plaques, other

Acquire supplies
- name tags
- pencils, pens, markers
- folders for each judge
- stamps for ratings or special certificates with ratings
- masking tape, scissors
- stapler, paper clips

Develop and test computerization of records
- Check facilities- gym or place of event - judges meeting room
- room for tallying judges' cards
- award presentation - public address system

Entry forms due (5 weeks prior for local science day)

One month prior
Mail letters to judges
Design floor plan
Produce and assemble printed programs
Make space assignments
Complete judging cards
Display awards
Contact media
Print certificates
Complete name tags for participants, judges and officials
Confirm list of volunteers (time available & preferred task)
Conduct poster sessions for participants

One week prior
Review entire schedule with participants - offer encouragement and support
Assign judges to projects
Assemble judges' folders
Recontact media

Science Day
Meet with volunteers
Issue participant name tags
Project set-up
Use adding machine tape and rule 36" sections marking space numbers. Place the numbered tape on the floor the night before.
Call students into the Science Day area according to space number at the local level. Students will be given an exhibit number at district and state levels at the time of registration.
Distribute programs to participants

Judges' briefing
- Folders arranged in alphabetical order -
- Name tag paper-clipped to folder
- Review judging criteria, procedures and ethics
- Emphasize the need for judges to write constructive comments on judging card that must be returned to students
- Discuss floor plan for locating projects
- Superior rating 36-40 points necessary for advancement to District Science Day

Emphasize the following statement:

To receive a superior award at local, district or state science days, the student shall have an abstract and a written report, which documents that the student has searched relevant literature, stated a question and/or tested a hypothesis, collected and analyzed data, and drawn conclusions.

Tally room
- Recheck totals - average cards for two judgings
- Type or stamp ratings on certificate
- Prepare certificates
- Complete listing for other awards and superiors
- Designate District Awardees

Awards program
- Recognize all students individually (certificate)
- Distribute ribbons and/or trophies if applicable
- Name superiors eligible for District competition (Check with District Science day on any quota that may limit participation)
- Make special awards

Thank all teachers, volunteers, and judges for their participation
Issue Summary news release immediately

· · APPENDIX R · ·

· Sample Science Day Schedule

Weekday

8:45 - 11:00 AM	Project set-up
11:30 - 12:30	Judges luncheon and briefing
12:30 - 3:00 PM	Project judging
7:00 - 8:00	Public visitation of projects
8:00 - 8:45	Award ceremony

Saturday

8:00 - 9:30 AM	Project set-up
9:00 - 9:30	Judges briefing
9:30 - 11:30	Project judging
11:30 - 1:00 PM	Visitation of projects
1:00 - 1:45	Awards ceremony

NOTE: Time allotments may need adjustment depending on the number of projects and judges participating. Some schools judge immediately after school, and then on the second day open the projects to school visitation by younger classes and have a public awards ceremony that evening.

· · APPENDIX S · ·

· Sources for judges

School administrative office

- Superintendent
- Assistant Superintendent
- Curriculum Supervisors
- School Board Members
- Principals
- School Nurses

Personnel from surrounding districts

- Teachers
- Principals
- Curriculum staff

Community

- Medical fields
- Optometrists
- Veterinarians
- Dental Hygienists
- Dentists
- Doctors
- Nurses
- Pharmacists
- Lab Technicians

Business fields and technical fields

- Manufacturers
- Public Utilities
- Research, Development & Testing Laboratories
- Engineering Consulting Firms
- Architects

College, university, and technical and vocational school personnel

Government agencies

- City and County engineers
- Water and Sewage Treatment Personnel
- Soil & Water Conservation Districts; Solid Waste Planning Districts
- City and Regional Park Districts
- County Extension Agricultural Agents and Health Departments
- Ohio EPA and Dept. of Natural Resources
- Office of the City and County Coroner
- Solid water management districts

Senior citizens organizations including retired teachers

Scientific, trade, and professional organizations - (regional councils and local chapters)

·· APPENDIX T ··

·Judging Candidates

Name	Address	Phone #	Email address	Science area	Comments

NOTES:

· · APPENDIX U · ·

· Student Entry Form

Due date _______________________

Name _________________________

Homeroom _____________________

Grade ______

Project judging category (check one): __ Behavioral Science __ Biochemistry __ Botany __ Chemistry __ Computer Science __ Earth Science __ Engineering __ Environmental Science __ Gerontology __ Health Science __ Mathematics __ Medicine __ Microbiology __ Physics, __ Social Science __ Space Science __ Zoology)

Project title: ____

Project hypothesis: __________________________________

· · APPENDIX V · ·

· Tally room: materials and tasks

Materials:

Extra signed but blank certificates
Sharpened pencils
Pens (blue, red and green ink)
Containers for separating judging cards
Staplers
Paper clips
Ink pads and rubber stamps of the ratings - Superior, Excellent, Good, and Satisfactory

Tasks:

Determine final rating from judges cards
Blue, red and green pens may be used to mark cards for easy identification of rating
Stamp rating on student's certificate or produce certificates with appropriate ratings.

Superior	40-36
Excellent	35-24
Good	23-12
Satisfactory	11- 4

SEE http://www.ohiosci.org/sds.htm for team ratings.

Arrange certificates in the order in which they will be presented

Note:
Select personnel that function well under stress and who can keep sensitive information CONFIDENTIAL.

· · APPENDIX W · ·

· Sample Press Release

Use XYZ school letterhead

Contact:
(Your name and phone
number here)

XYZ LOCAL SCIENCE DAY SET FOR (FILL IN DATE)

For immediate release

CITY (type date here) - The Ohio Academy of Science and (type name of sponsor or school name) today announced that (type number of students) will display the results of their research projects at the (type name of local science day) on (type day of week and date) at (type location). The projects may be viewed by the public from (give times), and the awards ceremony will be held at (give time) in (give room or auditorium).

The director of this year's event is (give name and school affiliation, grades and subjects taught) who said, "(quote yourself with something short and sweet)."

Superior rated students from (give name of science day) will attend (give name of District Science Day) at (name of college) on (date), an event also sponsored by The Ohio Academy of Science, where the students will qualify to attend State Science Day at (give name of college) on (date).

-end-

Editor's Note: Results of judging will be available from (name of person) by (time) on (date). Phone (____) ____________.

·· NOTES ··

Science Day Guide

by

JOANNE ZINSER MANN

Available on the World Wide Web at

http://www.ohiosci.org/ScienceDayGuide/SDGIndex.htm

Edited by

LYNN EDWARD ELFNER

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