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Developing a science fair packet for grades 4-6

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DEVELOPING A SCIENCE FAIR PACKET FOR GRADES 4-6

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By

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Project Summary

DEVELOPING A SCIENCE FAIR PACKET FOR GRADES 4-6

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Statement of the Problem

The purpose of this project was to provide a complete and comprehensive guide for implementing a science fair for grades 4-6. The guide included a teacher packet complete with planning strategies and student lessons to teach the developmental processes used in creating a science project. A student-parent packet was also included to familiarize students and parents with procedures of the fair, as well as with the development and construction of a science project.

The goal of science education is to motivate students to investigate and explain scientific phenomena. The writer of this project felt that the development of a science fair at the elementary level, offered a unique opportunity for elementary students to undertake scientific explorations.

Therefore, the curriculum materials developed in this project were designed so that even those (teachers, students, and parents) totally unfamiliar with organizing a science fair, or developing a science project, could do so successfully.

Procedure

A review of relevant literature indicated that an elementary student's cognitive and affective development in science is affected by the method of instruction. The research clearly demonstrated that an activity-based science program results in increased motivation and a higher retention of knowledge.

The intent of the science fair is to challenge students to seek answers concerning scientific concepts on their own. It offers a unique opportunity for students to learn about science through self exploration of the subject.

A science fair packet was developed by the writer to facilitate the organization of a science fair for grades 4-6. The packet provided a comprehensive list of planning procedures and guidelines, a teacher's resource packet, and a student-parent information packet.

The list of planning procedures and guidelines was intended to help the science fair coordinator consider details for planning, organizing, and managing the fair. The teacher's packet was developed as a series of lessons designed to help teachers lead students through the process of developing a science fair. The student-parent packet covered the basic procedures of the science fair. The intent was that it would first be used in the classroom to orient students with the procedures, then sent home to familiarize parents with all of the elements of the fair.

Conclusion

Development and implementation of a science fair enables students to find answers for themselves. Students become involved in learning how to learn. In developing a science project, the students are faced with a problem. In solving the problem the student actively participates in gaining information and knowledge. Their retention is increased. The rewards are inherent in discovering something on your own. This provides students with the intrinsic motivation to carry learning further. Students develop skills and attitudes which are essential for individual thought and learning.

The science fair provides us with the tools that can be used to improve current methods of science instruction. By making science more relevant and

useful to our students, we may increase their motivation to involve themselves in it. As students seek answers to scientific phenomena, they seek answers to life. They come to realize their potential in overcoming problems which confront them in their everyday living.

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INTRODUCTION

As individuals we ask questions. When we find answers to those questions we gain knowledge. The science project stimulates inquiry, which is a process that leads us to discover knowledge independently. Inquiry leads us to evaluate and synthesize our thoughts in a cognitive and affective manner.

The science fair stimulates students to investigate and explain scientific concepts. Students apply many of the skills and techniques used by scientists to organize knowledge and generate principles. Students learn how to use the scientific method, which will lead them to questions, speculate, explain, and predict scientific phenomena. Students learn to:

1. Put their questions into words
2. Formulate clear-cut hypothesis
3. Put these hypotheses to various tests
4. Interpret the results

Children are naturally inquisitive. An infant will explore an object for its texture, shape, color, and taste. The infant does this intrinsically, without guidance. The general goal of the science fair, is to help students develop the intellectual discipline and skills necessary to raise questions and search out the answers stemming from their own curiosity.

There are many benefits from planning a science fair. These include increased interest in science, heightened community awareness, and an exchange of scientific thought and ideas. A science fair presents a unique opportunity to highlight student achievements in science.

For the individual child, it provides additional motivation and an opportunity to apply acquired knowledge. It encourages children to undertake scientific explorations, apply creativity, and employ critical thinking skills. The science fair promotes individual research and furnishes an occasion to

communicate ideas effectively. It provides for public recognition of student effort and quality work.

For the school, a science fair presents a vehicle for strengthening the school's science program. As a culminating event, it furnishes an opportunity to reinforce and expand classroom science experiences and to focus student learning. It provides the potential for home and community involvement and establishes a means for exchanging scientific ideas between students, teachers, and parents. It also stimulates the cooperative effort for recognizing, encouraging, and developing the scientific potential of students.

For the student, development of a science project should follow a process. There is a discipline which must be practiced by the students, and understood by the teachers. Students should questions why certain events happen, while simultaneously acquiring and processing information. In the development of a science project, this process of inquiry aims to make students:

1. Independent in scientific thought
2. Systematic in their approach to a problem
3. Empirical in attitude toward natural phenomena
4. Inductive in their search for knowledge

The science project usually begins with the presentation of a problem. The problem should be based on discoverable ideas. Once the problem is established the students attempt to construct a reasonable theory (hypothesis) to account for it. Students formulate ideas and questions about the problem. The students' goals are to find out why, and to do this, they must relate what they have seen with what they think might have caused it to happen.

Initially, students may find it difficult to develop statements or make generalizations which explain the problem. The role of the teacher then becomes crucial. Discussion of the word "hypothesis" and the development of lessons

which lead them to understand this process will help students to gain confidence and the expertise in formulating their own ideas. Teachers may also be confronted with the problem of several hypotheses being offered to explain a problem. Teachers should be careful not to directly point out any weakness or errors in any one theory. The role of the teacher is largely to stimulate and support the creative and analytical thinking of the students. The teacher should help each student to arrive at and judge their own conclusions.

To test their ideas, students must experiment. In developing a science project, this is the core of their effort. There are usually two steps involved with experimentation: exploration and direct testing. Exploration is the early stage of experimentation. Here students randomly test or experiment to develop or confirm their ideas about the problem. A clear-cut method of operation has not been developed. Direct testing occurs after students have developed a hypothesis and then design an experiment to test the validity of their idea.

Students then interpret the results of their experiment. Processing and analyzing their data is a crucial step. Students should verify their experiments by making references to specific objects and conditions used in the test condition.

Finally, students must state their conclusions. Students should analyze and identify the various elements used or decided in making their conclusions. This phase of the process should help to make the students more conscious of the process. It should help them to be more systematic in their approach to problem solving. The conclusion serves principally to draw attention to the nature of knowledge and to the process by which it comes into being.

Development and implementation of a science fair will enable students to find answers for themselves. Students become involved in learning how to learn. In developing a science project, the student is faced with a problem. In solving

the problem the student actively participates in gaining information and knowledge. Their retention is increased. The rewards are inherent in discovering something on your own. This provides students with the intrinsic motivation to carry learning further. Students develop skills and attitudes which are essential for individual thought and learning.

The science fair provides us with the tools that can be used to improve current methods of science instruction. By making science more relevant and useful to our students, we will increase their motivation to involve themselves in it. As students seek answers to scientific phenomena, they seek answers to life. They come to realize their potential in overcoming problems which confront them in their everyday living.

REVIEW OF THE LITERATURE

During the winter, a deciduous tree stands leafless and dormant. A rather bleak sight when compared to its emerging in the spring. But our feelings and perceptions about this tree are radically different after it has blossomed and unfurled its leaves.

We can form an analogy between the tree and the attitudes that students have toward science. The tree visually stimulates our perceptions of spring. How unlike the tree is a science curriculum which motivates and stimulates a student to want to know more about science?

For the school, implementation of a science fair should be an important base of the science curriculum. The science fair provides a unique opportunity to generate interest in science. The science fair has the uncanny ability to reform the science curriculum of a school. It can unify a staff's commitment to the teaching of science.

Research conducted by Robert E. Yager and John E. Penick (1984), concluded that an elementary teacher's interest, attitude, and method of instruction plays a major role in motivating students to want to learn about science. The teachers who actively generate enthusiasm and employ activity-based science programs, stimulated students to want to learn about science. The science fair may serve to pull all of the strings together as teachers and students team up and get involved.

Lloyd E. Story and Iva D. Brown (1979), studied the link between the elementary students attitude toward science and the method of instruction. The study showed a significant increase in attitude for students involved in an activity-based science program. The implications of the study are exciting when one considers the science fair.

Linda Hough and Martha Piper (1982), studied the relationship of attitudes and the learning of scientific concepts of elementary students. Their study

found that there is a correlation between student attitude, method of instruction, and learning. The study demonstrated that an activity-based science program results in students retaining more knowledge (as opposed to a lecture-based program)./ Inherent in the development of a science project is the motivation and interest generated by actively participating in the discovery of scientific principles. It also seems evident that students may potentially retain more knowledge as they develop and study about their science project.

Teacher interest and enthusiasm play an important role in the development of a successful school science fair. Inservicing is a key element in involving a school's staff. The added bonus is that the interest rubs off into the general science program of the school. Dorothy Gabel and Peter Rubba (1978), examined the correlation between an elementary teacher's attitude toward teaching science and inservicing. Teachers will display much more confidence and a willingness to teach a subject if their knowledge of that particular subject is enhanced. Coordination of efforts between the science fair director and the staff is imperative then. By inservicing the staff, and supplying resource and curriculum materials, the director insures success for all concerned. The long-term benefits are increased enthusiasm, and an enriched science program.

Often, when teachers present a lesson to children, there is a tendency to tell all, to flood their minds with all of the potential knowledge that we are offering. Karran P. Raghubir (1979), states "teachers tell students too much; they deprive them of the opportunity to learn for themselves." Teachers have a reason for doing this: 1) to save time, and 2) it is easier. Raghubir argues that an activity-based science program will motivate and stimulate inquiry. He states that teachers should provide students with "the opportunity to develop the strategies and attitudes associated with those of the scientist." Raghubir

demonstrated that an activity-based program will lead to greater student achievement. "Students have shown significantly higher gains for these cognitive factors: formulating hypotheses, making assumptions, designing and executing investigations, understanding variables, observing carefully, recording data, analyzing and interpreting results, and synthesizing new knowledge; and for attitude development: curiosity, openness, responsibility, and satisfaction."[1] Tom Haladyna, Robert Olsen, and Joan Shaughnessy (1982), also observed this link between teaching style and learning.

All of these studies so closely align themselves with the general goal of the science fair, that the benefits of implementing a science fair are very clear. Students enjoy discovering things on their own. They enjoy answering their own questions. Students who have a positive attitude toward science are more likely to display higher achievement, view science as relevant, and feel better about themselves. The teacher's job is crucial. Teachers need to feel comfortable with their role in the development of the science fair. Clearly, success or failure of the science fair depends greatly on the knowledge and attitudes of teachers. Teachers also need to respect the opinions of their students and help to build critical thinking skills. The best way to do that is through an activity-based science program. It can begin with a science fair. The training and knowledge that students and teachers receive about science processes will increase interest in science and motivate teachers to want to teach science.

The science fair serves as the perfect vehicle to initiate and extend all of these ideas. The approach to the science fair must be calculative and well planned. The coordinator of the science fair must consider every detail, from preparing curriculum materials to acquisition of the site.

The intent of my project was to offer a guide, complete with resource materials that can be used to successfully implement a science fair. The guide offers the science fair coordinator, the teacher, and the student, a comprehensive plan to insure success. For the coordinator, planning strategies are examined in a step by step fashion. The teacher packet provides lessons that can be used to teach students the developmental processes that are used to develop a science project. The student-parent packet familiarizes students and parents with the procedures of the fair, as well as with the development and construction of their science project.

The overall objective was to provide the necessary resources for all concerned, on exactly why and how the fair will be organized. The guesswork is therefore eliminated, which allows the organizers and participants to achieve their goal of a successful science fair.

PROJECT DESIGN

The design of the project was threefold: 1) to provide a comprehensive list of planning strategies for organizing a science fair. 2) to provide a teacher's resource packet that may be used to instruct the students on the processes involved in doing a science project. A bibliography of resource books was also included. 3) to provide a student-parent science fair packet that discussed procedures and planning strategies concerning the science fair.

The science fair guidelines help the science fair coordinator to consider details for planning, organizing, and managing the science fair.

The teacher packet was developed as a series of lessons to help teachers guide students through the process of developing a science project. This was done as a series of seven lessons:

Lesson 1 discusses the areas of life, physical, and earth science.

Lesson 2 discusses the purpose and processes of developing a science project. A basic plan is outlined for beginning their project.

Lesson 3 familiarizes the students with the procedures of the science fair.

Lesson 4 is designed to assist students in deciding on a topic for their science project.

Lesson 5 assists students in determining what resources they will use for their project. Various types of resources are also discussed.

Lesson 6 discusses the definition of 'hypothesis', and reviews the processes (or steps) involved in using the scientific method.

Lesson 7 explains to students how to organize their science fair notebooks.

The student-parent packet covered the basic procedures of the science fair. The intent was that it would first be used in the classroom, then sent home to familiarize parents with the science fair. The contents included:

A. A statement of purpose

B. Safety regulations

C. Selecting a topic

D. Judging

E. Awards

F. Categories

G. Project starters

H. Project planning sheet

I. Construction of exhibit

J. Sample display

All of the resource materials included in this project, were intended for grades 4 through 6.

PROJECT OBJECTIVES

The current California State Science Framework Addendum expresses concern for the need of a model of expectations for learners' achievements in science. In 1978, the science framework set forth a coherent set of science education goals and objectives. The four major goals identified for science instruction were: 1) achieving scientific attitudes; 2) achieving rational and creative thinking processes; 3) achieving manipulative and communicative skills; and 4) achieving scientific knowledge. The current addendum expands these goals to add descriptions of the learning processes involved with science:

1. Observing - seeing, hearing, feeling, tasting, and smelling
2. Communicating - silent, oral, written, and pictorial
3. Comparing - sensory comparisons, relative positive comparisons, linear comparisons, weight comparisons, capacity comparisons, answer quantity comparisons
4. Organizing - data gathering, sequencing, grouping, and classifying
5. Relating - using space-time relationships, formulating experimental hypotheses, controlling and manipulating variables, and experimenting
6. Inferring - synthesizing and analyzing, generalizing, recognizing and predicting patterns, starting laws
7. Applying - using knowledge to solve problems, and inventing

These goals and processes as outlined in the state framework are inherent in the efforts of a child to develop a science project. Depending on the developmental stages of the learners, students will use most, if not all of these processes as a result of their own investigations.

The science fair provides the opportunities for students to apply the skills of using these processes. The science fair provides the structure that

can enable the students to attain concepts of science in a manner fitting their individual needs.

The science fair also enables students to develop fundamental skills and to acquire the knowledge necessary to explore the world of science that surrounds them. Students are motivated to look for explanations of objects and events, and to test their explanations through a demonstration or experiment. In addition, the skills that students learn, such as identifying problems, analyzing information, and drawing conclusions, will assist them in problem solving in other areas of their lives.

The science fair builds the self-esteem of students. Students can take pride in their accomplishments. It is a stimulating and motivating experience. The teacher will find a great deal of benefit from participation in the science fair. It can be a learning experience for them as well. It creates the opportunity for teachers to get involved in science, and extend this enthusiasm into the development of their own science program.

A well organized science program can motivate and enhance a child's curiosity. It can organize the knowledge they already have, and it can provide them with a way to broaden their knowledge and understanding of concepts they have yet to discover.

LIMITATIONS

Statement of Limitations

This manual was intended for use by a school science fair coordinator to plan and implement a school science fair for grades 4 through 6. The intention was to provide the basic outline, information, and resources that the science fair coordinator will need to consider in the planning and implementing of the fair.

Individual differences at any one school site may precipitate the need for changes in the organization of a science fair. The resources and information included in this packet may be adapted to fit those needs.

This material is not intended to replace nor supplant the base science program of any given school or district. The intent is that it will strengthen and support any existing science programs.

PREPARING FOR THE FAIR

Preparing for the Science Fair

The science fair is an excellent way to get students involved in science. It builds their self-esteem and it helps to create self-identity. Success of your science fair depends on careful planning and preparation. The following is a list of suggestions to help you plan and initiate a successful school science fair.

1) Start early in the year. Coordinators of the fair should be assigned as soon as the new school year begins.

2) Use the resources included in the manual to inservice the staff. Staff commitment to the science fair is the key to success. Coordinators should provide teachers with necessary materials, and keep them updated on the progress of the fair.

3) Make a timeline. By specifically outlining your plan of attack, you will insure success. Be sure to include such things as printing, inservice dates, parent letters, lesson pacing, ordering of ribbons and awards, arranging for judges, and the place and time of the fair itself.

4) The teacher packet provides lessons to stimulate and educate students on the hows and whys of the science fair. Consistency is a very important factor in keeping the students motivated and interested. Pacing of the lessons is very important. Be sure to allow adequate time between completion of the lessons in the teacher's packet and the fair. Daily reminders may be necessary. A strong activity-based science program at the school is one way to help insure students will maintain an interest.

5) At staff inservicing, it is important to brainstorm suggestions that the teachers at your school may have. Some teachers may have had a lot of experience in organizing science fairs. They may provide excellent suggestions.

6) You may find it beneficial to have each class at your school make a class project. These projects could be set up in a convenient place to demonstrate to your students what a proper science fair project should look like. They would help to guide the students at your school in developing their own science projects.

7) From the start, keep parents informed on the progress of the fair. Parents usually play a key role in the development of their child's project. The student-parent packet encourages parental participation. Parents can supply special materials, take students to the library, and serve as excellent resources. You may want to arrange for some parents to help on the day of the fair.

8) Choose your judges early. Inservice them by reviewing the judges evaluation form, and discussing the judging process you plan to use. Teachers, administrators, local business people, parents, etc., may all make excellent judges. The most important thing is their ability to interact with the students, and to get the most information out of the student concerning their science project. They should have some background in science. The judges should interview each participant and fill out a judge's evaluation form for each.

9) Awards should be given to all students who participate in the fair. Participation ribbons and certificates will make all of those who entered feel successful. 1st, 2nd and 3rd place ribbons should be

awarded according to the Danish system (that is, there are no ties. All participants who tie, receive the same place).

10) Arrange the publicity for your fair. Invite administrators, business persons, school board members, parents, the local paper, etc., to come to your school and witness this terrific event. It not only strengthens the relationship between the community and the school, but it will also strengthen the child's commitment to science.

11) Arrange to have your science fair at a site where all of the projects can be displayed together. Make a plan for setting up the projects. Don't underestimate the space you'll need. You never have enough! It is best to organize projects by grade level. You will need to consider accessibility, traffic, weather, availability of electrical outlets, refrigeration, and a water supply. Consider safety precautions such as loose cords, unstable panels, and fire extinguishers.

12) It is best to plan the fair in two stages. First, judge the projects. You may want to judge the projects in the classrooms. If that is not possible, judge them at the site the day before the fair. This gives you plenty of time to make your awards and display them on the projects. The second stage is the fair itself. Make a schedule for class visitations. Fifteen to twenty minutes is usually adequate time for a visitation. Allow two classes in at a time. Participants from the classrooms may wish to stand beside their projects and explain it to their classmates. It is best not to have the participants there all day.

13) The night of the science fair will be very exciting. Parents, grandparents, and friends will all be drawn to the event by the

students. Plan at least two hours for viewing of the projects. Students should not remove their projects on the night of the fair. Arrange to have parents pick the projects up the following day. All of your hard work will pay off on the night of the fair.

TEACHER PACKET

Lesson 1 Instructional Time -One Class Session

Objectives

At the conclusion of the lesson, 80% of the students will understand the difference between earth, physical, and life science, as demonstrated by their ability to classify various objects under one of the three major science areas.

Introduction

Discuss what the word "science" means to the students. Let them brainstorm, and write their responses on the board.

Activity

Write the words earth, physical, and life on the board. In columns, ask them to help you categorize the words you wrote on the board from the brainstorming session. Arrange the words in their proper columns. Briefly discuss why you grouped their responses as you did.

Write the following list on the board:

1. weather
2. snakes
3. insects
4. volcanos
5. electricity
6. rocks

Have volunteers come up to the board and list them under the proper headings.

Extension

Distribute 12 X 18 sheets of construction paper. Have the students fold the paper in half to make a folder. Using old newspapers or magazines, have students cut out pictures that relate to earth, life or physical science. Have students paste their pictures on the cover of the folder. If you have access to

a plastic laminator, you may wish to laminate their folders for added durability.

Review

Have the students check the newspaper at home and bring in articles related to the three areas of science. Allow them to share their articles with the class.

Lesson 2 Instructional Time - One Class Session

Objective

At the conclusion of the lesson, 80% of the students should be able to: 1) describe the purpose and processes for completing a science project. 2) explain the basic plan for implementing a science project.

Introduction

Ask the students if they have ever been to a fair. Ask them to describe what they saw, what it was like. Write "science fair" on the board. Ask them to comment on what they know about a science fair. Distribute Worksheet 1, A Science Project. Have students make observations about the science project displayed on the worksheet.

Activity

Distribute Worksheet 2, What Is a Science Fair? Students should complete Part 1. Discuss student responses to each item.

Extension

Outline the basic plan for a school science fair. Include the following:

A. theme	D. display rules	G. judging
B. procedures	E. publicity	H. parents role
C. resources	F. awards	I. calendar dates

Review the science fair timeline to show how the planning of the fair will proceed.

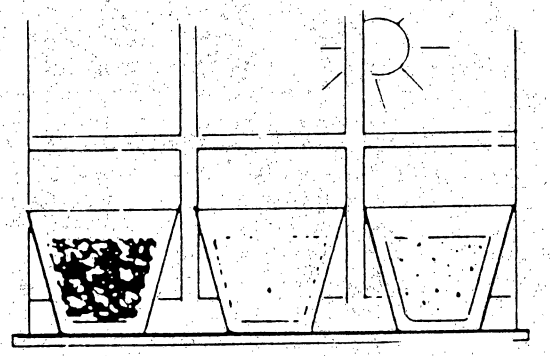
Review

Have the students discuss the science fair with their parents at home. They should complete Part 2 of Worksheet 2 at home.

Worksheet 1

Looking At a Science Project

Directions: This is a sample display of a science project. Study the display carefully, and answer the questions below the picture. Be prepared to discuss your answers in class.



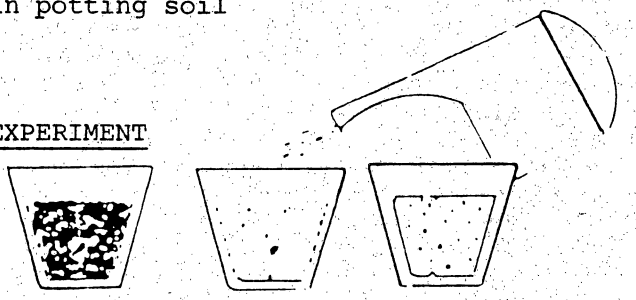
PROBLEM

Does soil affect the growth of plants

HYPOTHESIS

Plants grow best in potting soil

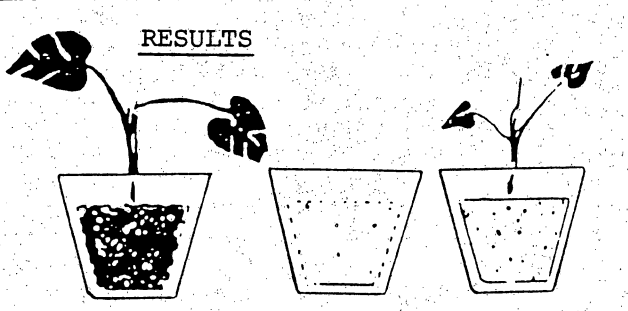
EXPERIMENT



potting soil water sand

Each plant receives the same amount of water and light

RESULTS



potting soil water sand

CONCLUSION

Plants grow best in potting soil

1. What are the headings?_____

2. What is this project trying to prove?_____

3. What are words in the project you will probably need to know more about?

Worksheet 2

WHAT IS A SCIENCE FAIR?

1. Which statements most accurately describe the purposes of a science fair? Place a check beside the statements.

_____working like a scientist

_____solving a problem by investigation

_____learning something new

_____becoming skillful in doing research

_____displaying how much you learned

_____a chance to get recognition for your work

_____showing parents and the community what the school program is like

_____spending more time on regular school science work

_____learning how to plan and organize a science topic

_____keeping careful records to find answers to science questions

2. Write three questions you want answered about the school science fair. Share these questions in a class discussion.

A.

B.

C.

Lesson 3 Instructional Time - One Class Session

Objectives

To familiarize students with the purpose and procedures that will be used for the school science fair. At the conclusion of the lesson, 80% of the students will be able to successfully identify appropriate topics for a science fair.

Introduction

Ask students the reasons for having a school science fair. List their responses on the board.

Activity

Distribute the student-parent science fair packets. Review the contents of the packet.

Extension

Allow students to react to the contents of the student-parent science fair packet. Ask them what important decisions they are going to have to make in order to get started on their science projects. Discuss various types of projects that they could consider. Ask if any of the students have ever done a science project before. Have those that have, describe the projects to the class.

Review

Have the students take the student-parent science fair packets home to discuss their projects with their parents.

Lesson 4 Instructional Time - One Class Session

Objectives

At the conclusion of the lesson, students will be able to choose an appropriate topic for their science project.

Introduction

Pour vinegar into a beaker with a tablespoon of baking soda added to it. Ask students to make observations about what happened. List their observations on the board. Ask students what questions they have about what they saw. Write a list of their questions on the board. Have them examine the list. Ask them which questions can be answered by measuring. Ask which questions interest them the most and why. Ask which questions would require research to answer.

Activity

Distribute Worksheet 3, Science Topics. Have students classify the topics in the categories of earth, life or physical science. Have them underline topics that they think would interest them. Have them go back and look at the topics they underlined. Explain that these topics may be the best ones to consider for a science project.

Extension

Write the following statements on the board:

1. It is a topic that interests me.
2. It is a topic that involves investigation.
3. There are available resources to study this topic.

4. It is a topic related to everyday life.

Using these statements as the criteria, have the class decide which of the following topics would be most appropriate for the science fair:

A. The affect sunlight has on the growth of plants.

B. Does excessive exposure to sunlight cause skin cancer?

Discuss the four key statements and how they relate to the given topics. Students should be able to demonstrate that topic B would be a difficult project to attempt because of the need for sophisticated research and equipment.

Review

Before students make a final decision on their topic, distribute Worksheet 4, Investigating Topics. This should help students to finalize their decision.

Worksheet 3

SCIENCE TOPICS

Directions: Classify the following science topics by placing an E in front of the topics represented by earth science, an L for life science, and a P for physical science. Then underline topics that you think would interest you as a topic for the science fair.

___1. air pollution
___2. heredity
___3. nutrition
___4. blood
___5. butterflies
___6. crystals
___7. mechanical energy
___8. alternative power
___9. migration of whales
___10. weather
___11. vitamins
___12. food preserving
___13. fabrics
___14. lasers
___15. bacteria growth
___16. social animals
___17. radiation
___18. sea shells
___19. human systems
___20. motion
___21. reaction time
___22. purifying water
___23. lenses
___24. seeds
___25. changing colors
___26. minerals
___27. optical illusions
___28. pulse rates
___29. molds
___30. insects
___31. insulation
___32. erosion
___33. temperature
___34. machines
___35. plant growth
___36. air pressure
___37. light sources
___38. direction finders
___39. salt
___40. minerals
___41. echoes and sound
___42. static electricity
___43. baby animals
___44. invisible world
___45. acid rain
___46. populations
___47. habitats
___48. soil
___49. biomes
___50. protists

Worksheet 4

INVESTIGATING TOPICS

Directions: Place an X in the space before each topic you consider appropriate for the science fair. Use the key to help you make decisions.

Key

1. It is a topic that interests me.
2. It is a topic that involves investigation.
3. There are available resources to study this topic.
4. It is a topic related to everyday life.

____A. How do the number of coils of wire of an electromagnet affect the number of paper clips it can attract?

____B. How do horses sleep?

____C. How do different kinds of light affect growth of a plant?

____D. What elements react best in a nuclear fusion reactor?

____E. Does age affect a person's reaction time?

____F. What are the travel patterns of an ant colony?

____G. How are locations for oil exploration determined?

____H. How do mealworms react to sound?

____I. How do galaxies move?

____J. What room designs provide the best musical sounds?

Lesson 5 Instructional Time - One Class Session

Objectives

At the conclusion of the lesson, students will be able to:

1. Determine the problem question for their topic, and
2. Consider available resources for their topic.

Introduction

Write the following words on the board: cells, clouds, and erosion. Explain to the students that developing a question concerning their topic is a very important step in the development of their project. Ask the class what kinds of questions you could ask about the words written on the board. Write their responses on the board. Discuss how each question would be appropriate or inappropriate as a problem question. For example, asking how clouds form would be appropriate because it is easy to demonstrate, it is related to everyday life, and there are available resources. A question such as, "are clouds on earth similar to clouds on Jupiter?" would not be as easy to demonstrate.

Activity

Distribute Worksheet 5. Explain that Worksheet 5 will help them in finding and using resources for their topic. Explain that it will probably take several weeks for them to completely fill out the various categories. Also explain that they may not have to use all of the categories.

Extension

Pass out Worksheet 6, the Science Fair Application. Explain that this will be used as an entry form into the school science fair. Use the board to

demonstrate how they may use this worksheet to construct a simple timeline for development of their project. Explain that teacher and parent monitoring will help to insure that they stay within their time frame.

Review

Have students list the resources most easily available to them. Have them order this list with the most helpful resources first. Explain that using the sources at the top of the list would benefit them the most.

Worksheet 5

FINDING RESOURCES

My science topic is _____

_____

1. Books that I have used (textbook, library, reference)

	Title	Author	Pages
a.			
b.			
c.			
d.			
e.			
f.			

2. Magazines that I have used

	Name	Title of article	Pages
a.			
b.			
c.			
d.			

3. Films or filmstrips I have used

	Title
a.	
b.	
c.	

4. Other written resources (newspapers, pamphlets)

a.

b.

c.

5. Agencies, organizations, stores, museums, individuals

a.

b.

c.

d.

Worksheet 6

SCIENCE FAIR APPLICATION

Teacher _____

Project Title _____

Working Plan	Date Due	Date Completed	Teacher Initials	Parent Initials
1. Select topic				
2. Explore resources				
3. Start notebook				
4. Form hypotheses				
5. Find materials				
6. Investigation				
7. Prepare results				
8. Prepare summary				
9. Plan display				
10. Construct display				
11. Complete notebook				
12. Prepare for judging				

Write a brief paragraph describing the hypothesis, materials, and procedures you will include in your project:

Lesson 6 Instructional Time - One Class Session

Objectives

At the conclusion of the lesson, students will be able to:

1. define a hypothesis
2. describe the steps used in the scientific method

Introduction

Show the class a pitcher filled with water and an empty cup. Pour water from the pitcher into the cup. Have each student come up and pour water from the pitcher into the cup (pour it back each time). Do not explain the purpose of this activity. Use a class list to record the hand with which the students pour from the pitcher into the cup. When the students have finished, write the following on the board:

> Right-handed students usually pour from a pitcher with their right hands. Left-handed students usually pour from a pitcher with their left hands.

Activity

Explain to the students that the statements you wrote on the board are explanations that describe what you think will happen. Explain that this is a hypothesis. A hypothesis is a logical guess, or theory to explain a scientific event.

Show them a ball. Ask them to state a hypothesis that will explain what happens when you drop it. Write their hypothesis on the board. Drop the ball to test their hypothesis.

Write the following on the board:

1. asking questions and making observations
2. coming up with ideas or hypothesis
3. testing the ideas or hypothesis
4. carrying out an experiment
5. recording results and making conclusions

Refer students to the hypothesis made about right and left handed students. Have students suggest ways in which the hypothesis can be tested. List their suggestions on the board. Share the results of your test with the class. Ask if the data you recovered supports your hypothesis. Explain that they may need to collect additional data to absolutely support the hypothesis.

Guide the class in developing ideas for recording information about larger numbers of people that may be used to support the hypothesis. Students may want to conduct further investigations on their own. Here is a sample chart that might be used for such an investigation.

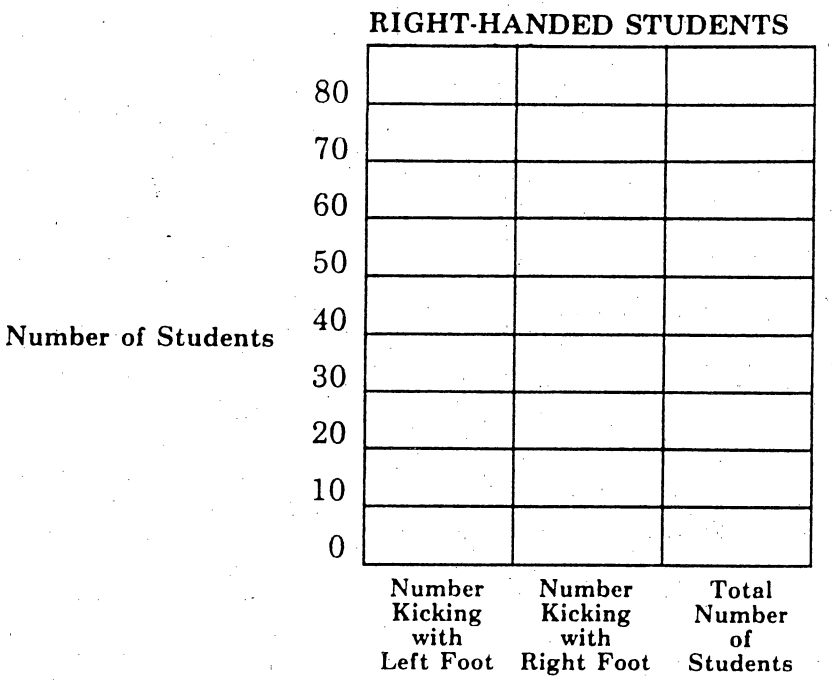
	Number of Students	Percentage
Right-handed students		
Poured with right hand		
Poured with left hand		
Left-handed students		
Poured with left hand		
Poured with right hand		

Once the data is collected, have the students analyze the results. Have them relate these results to the hypothesis you wrote on the board. Based upon their observations, the students should decide if the hypothesis is supported or

disproved. If they are unsure, explain that additional testing may need to be done.

Extension

Have students conduct a test of their own using the graph.



Review

Have students share the results of their data.

Lesson 7 Instructional Time - One Class Session

Objective

At the conclusion of the lesson, students will be able to describe the contents of their science fair notebook.

Introduction

Ask the students to imagine that they are astronauts, sent to Mars to study weather of the planet. Ask them what they would have to do in order to remember the weather patterns they observed on the planet. Guide students to conclude that observations would have to be recorded. Have the students suggest the various elements of their observations. Possible responses might be dates, times, temperatures, wind velocity, etc.

Activity

Explain that a science fair notebook should include much the same information as an expedition to Mars. Ask students to list the various topics that they think should be included in a science fair notebook. List their suggestions on the board. These should include:

Title page

Table of contents

Hypothesis

Materials

Research

Investigations

Conclusions

Bibliography

Distribute Worksheet 7. Discuss each element with the students.

Extension

Explain that the notebook is like a ship's log and that neatness, while important, is not to be overly emphasized. The notebook should contain all of the worksheets used in previous lessons. The notebook should be submitted just as it is prepared daily by the students.

Review

If you have copies of notebooks prepared by former students, it may be helpful to share these with your class.

Worksheet 7

SCIENCE FAIR NOTEBOOK

Notebook Components:

A. Title Page - This is a statement of the hypothesis, student's name, teacher's name, and date of the science fair.

B. Table of Contents - This is a listing of the pages that follow and their page numbers.

C. Hypothesis - Here the hypothesis is restated along with an explanation of why you decided to test this hypothesis.

D. Materials - This page contains a list of all materials used in testing the hypothesis.

E. Research - This section should include all background information collected before the investigation was started.

F. Investigation - Here you should detail all the steps taken in testing your hypothesis.

G. Conclusion - In this section, you should analyze the data collected during the investigation, and then determine whether the data supports the hypothesis.

H. Bibliography - List all of the books, magazines, newspapers, pamphlets, interviews, etc., summarized in the Research section. Here are some examples of the correct styling for listing sources:

Smith, John. All About Science. New York:Superior Book Company, 1985. Periodical

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Sund, Robert B., Bill W. Tillery, and Leslie W. Trowbridge. Investigate and Discover: Elementary Science Lessons. Boston: Allyn and Bacon, Inc., 1975.

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STUDENT PARENT PACKET

SCIENCE FAIR

As individuals, we ask questions. If we find answers to those questions we gain knowledge. The science fair stimulates inquiry, which is a process that leads us to discover our ability to gain knowledge independently. It leads us to evaluate and synthesize our thoughts in a cognitive and affective manner.

The science fair stimulates students to investigate and explain scientific concepts. Students apply many of the skills and techniques used by scientists to organize knowledge and generate principles. Students learn how to use the scientific method which will lead them to question, speculate, explain, and predict scientific phenomena.

For the school, a science fair presents a vehicle for strengthening the school's science program. As a culminating event, it furnishes an opportunity to reinforce and expand classroom science experiences and to focus student learning. It provides the potential for home and community involvement and establishes a means for exchanging scientific ideas between students, teachers, parents, scientists, and local leaders. A science fair invites a cooperative effort for recognizing encouraging, and developing the scientific potential of tomorrow's leaders.

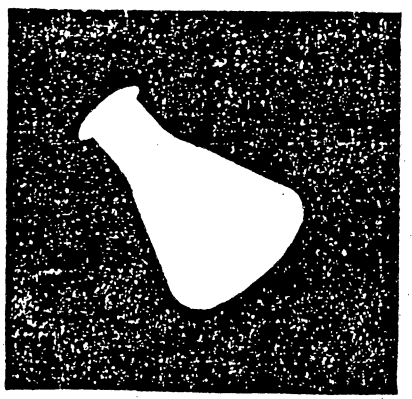
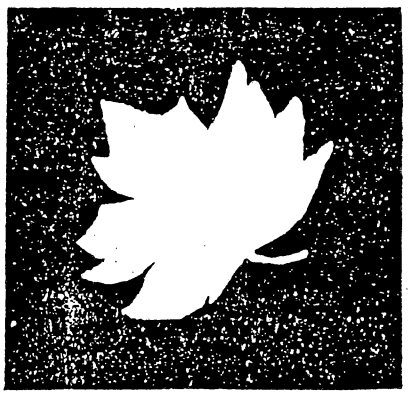
Student Responsibilities

The student is responsible for: (1) selecting a project topic (2) gathering resources and materials (3) meeting science fair rules and time requirements (4) completing the project and (5) understanding the project well enough to explain it to someone else.

Parent Responsibilities

Assist your child where needed in all of the above areas. Special help is usually needed in the areas of planning projects and working within a time deadline. Remember that the important thing is the learning process through which your child will be going. Help your child as much as possible while making sure that your child understands that it is his/her project. You do not have to be an expert in science to help your child. What you don't know, the two of you can learn together.

The last parent responsibility is to have fun. Make this an enjoyable experience for your child that will encourage him/her to further explore science.

SAFETY

Appropriate precautions for safety should be considered for all science fair projects. The number of choices available for science fair projects is so vast, that students should easily be able to select an investigation that is safe for them to do.

The "Project Planning Sheet" in this booklet provides an abundance of ideas that students may employ for planning a project.

RULES REGULATIONS AND SAFETY PRECAUTIONS

1. Dangerous substances may not be used. This would include items which are flammable, explosive or toxic. Check the label of any substance you may want to use.

2. Live vertebrate animals may not be used. Photographs or models may be used in their place.

3. Electrical materials must be safe. Wiring must be properly insulated and fastened. High voltage wiring must be grounded and shielded and switches located out of reach of observers.

   110 bolt connecting cords must be of the proper load carrying capacity, grounded, and use legal (3-pin) connectors.

4. Only one exhibit is allowed per student. Group projects will be allowed in grades 4-6 or special education classes.

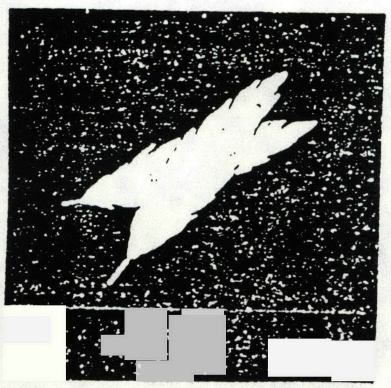
5. Two students may "team" to work on a project. More than two is not allowed.

JUDGING

All entries will be judged. Students will be interviewed in person by the judges at their displays. See the Judge's Evaluation Form for judging criteria.

AWARDS

All entries will receive a participation award. 1st, 2nd, and 3rd place awards will be given in each category. The Danish system of award will be used in the event of a tie. Using this method allows for those who have tied, to all receive awards for their respective places. For instance, if there were a three way tie for 1st place, all of the participants would receive 1st place.



CATEGORIES

All projects will be entered into one of three categories:

Category 1 - Classroom projects

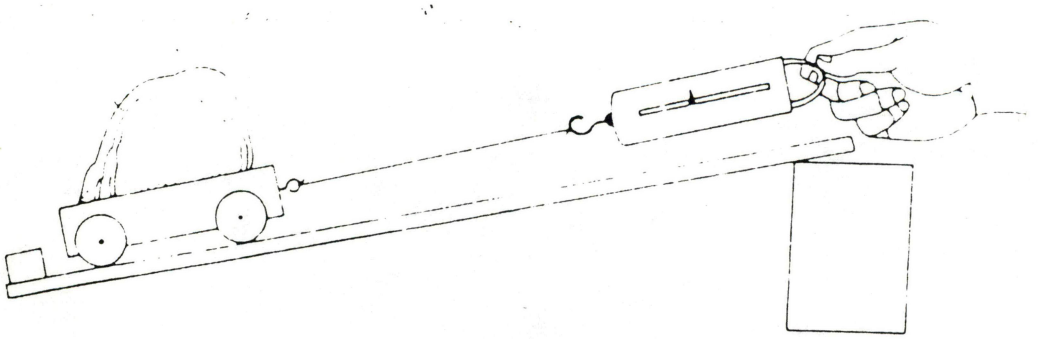
Category 2 - Demonstration projects

Category 3 - Experimentation projects

SELECTING A TOPIC

Students frequently have difficulty narrowing the scope of their projects to a manageable, specific topic. Guidance is often needed to move from a category or branch of science, such as physics, to a topic area, such as simple machines, and then, finally, to a single question for investigation. An example of such a question would be, "How does the angle of an inclined plane influence the amount of work required to lift an object?" The Science Fair Project Starters list provides some of the sample project topics. Students may begin their investigations by using their school science books.

Your child's teacher will be presenting a series of lessons designed to guide your child through the process of developing a science project. This will be done in a step by step process. It would be to your child's benefit to wait until these lessons are complete before starting his/her project.



SCIENCE FAIR PROJECTS STARTERS

1. How does a greenhouse work?
2. How does sunlight affect plant growth?
3. What mixtures will a filter separate?
4. How can you make an electromagnet stronger?
5. What factors influence plant growth?
6. How do ants find their food?
7. Sound travels best through what kind of materials?
8. How does the shape of a lens bend light?
9. How can steel be kept from rusting?
10. Which filtering systems work best to clean water?
11. How does the color of light affect plant growth?
12. How do different soils affect the growth of plants?
13. What conditions affect the growth of mold?
14. Can a plant follow a maze of light?
15. How do temperature conditions affect yeast cell reproduction?
16. How does exercise affect your pulse and respiration rates?
17. How does the angle of an inclined plane influence the amount of work required to lift an object?
18. Which surfaces provide the least amount of friction?
19. What fruit and vegetables make good indicators for acids and bases?
20. What kind of rocks give off carbon dioxide in the air?
21. How does water depth affect water pressure?
22. How are brine shrimp affected by the concentration of salt in the water?
23. Which materials insulate best against cold?
24. Which materials conduct electricity?
25. How does the shape of a reflective surface affect the reflection of light?

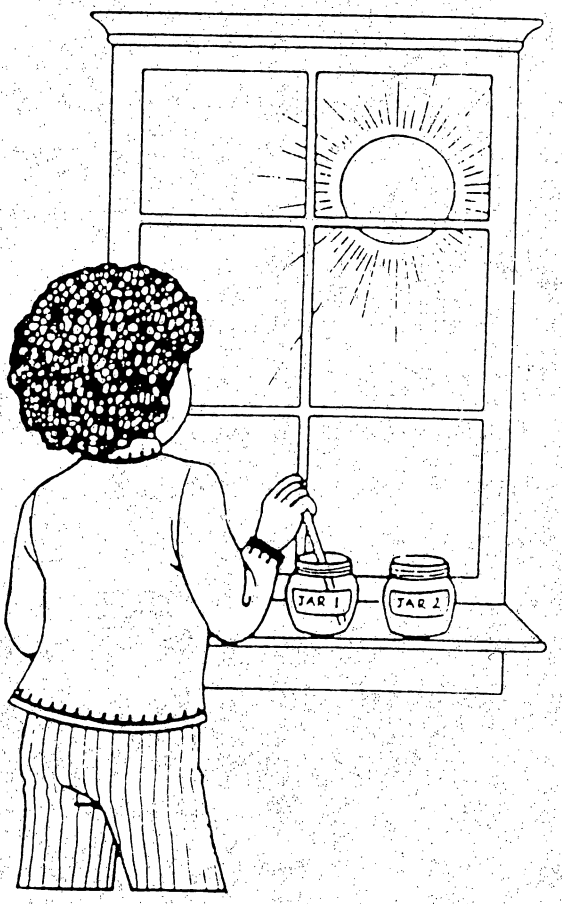
26. How does the bacteria count vary when foods are exposed to ultraviolet light?

27. What is the relationship between magnification and the focal point of a lens?

28. How do offspring reflect parent's traits?

29. What parts of the plant can be used to propogate new plants?

30. What affect do plants have on erosion?



Name_____

SCIENCE FAIR

PROJECT PLANNING SHEET

The Project Planning Sheet should be completed only after your teacher has completed the lessons included in the teacher's packet.

1. Choose a general area of science (earth, life, or physical) that interests you. Within that area, what topic would be good for a science project?

_____

2. What question will your project answer?_____

_____

3. Begin by seeing what information your school science book has on your topic.

Where can you find further information?_____

_____

4. What materials are you going to need?_____

_____

_____

5. Estimate how long it will take you to complete your project._____

6. Make a list of what you will need to do.

A._____ D._____

B._____ E._____

C._____ F._____

7. Draw a picture of what your project will look like when it is finished and on display.

8. Decide on the title of your project._____

_____

9. Will you need the help of an adult?_____If so, who can help you?

_____

10. Tell your parents what you plan to do. After planning, check with your teacher to be sure your project is on the right track and that it is safe.

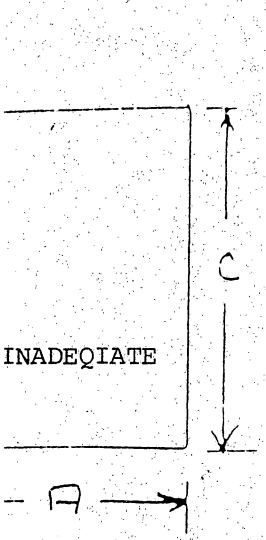
_____ _____

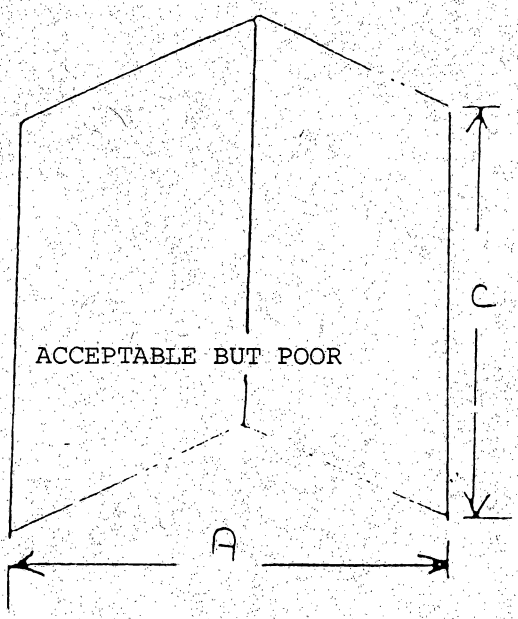
Parent's signature Teacher's signature

TIPS FOR CONSTRUCTING THE EXHIBIT

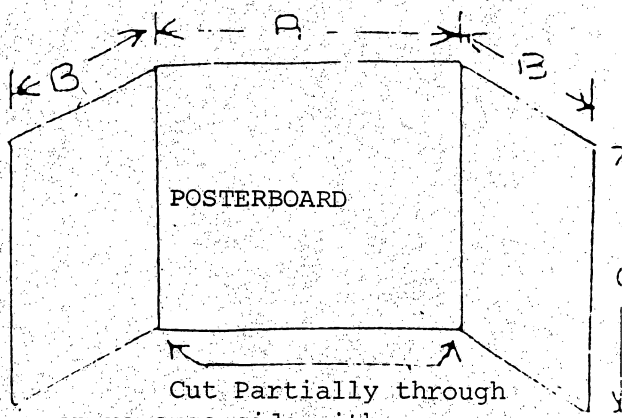
1. Each student will be allocated an equal amount of space (see sample display sheet).
2. Exhibits can be constructed of 2 to 4 panels made of sturdy material such as oaktag, cardboard, pegboard, or wood. Panels should be able to stand and support themselves after being fastened together with tape or hinges (see sample display sheet for more details).
3. All titles should be done neatly and they should be self-explanatory. The titles of the project should be placed across the top of the panels. The title is related directly to the hypothesis. Subtitles should follow the scientific method, and include such headings as problem, hypothesis, experiment, methods, results, and conclusion.
4. Graphs can be done as a line, bar, or pie graph. Color graphs have eye appeal and are encouraged.
5. Visual displays such as photographs, computer graphics, and drawings are valuable additions to a panel display.
6. Care should be taken with text materials to insure for easy reading of typed, or neatly written copies.
7. You may want to include a pocket for booklets, pamphlets, or other resources used.
8. Exhibits should be designed so that no dangerous conditions exist with the materials and equipment on display. Electrical connections should be disconnected when equipment is not in place. All safety rules will be strictly enforced (see the Safety Regulations included in this packet.

SAMPLE 3-D DISPLAY BOARD



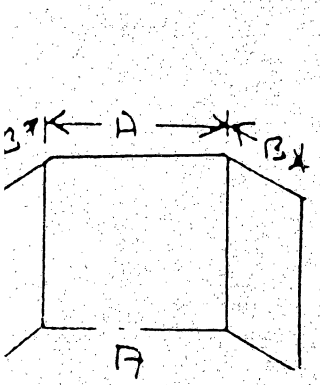


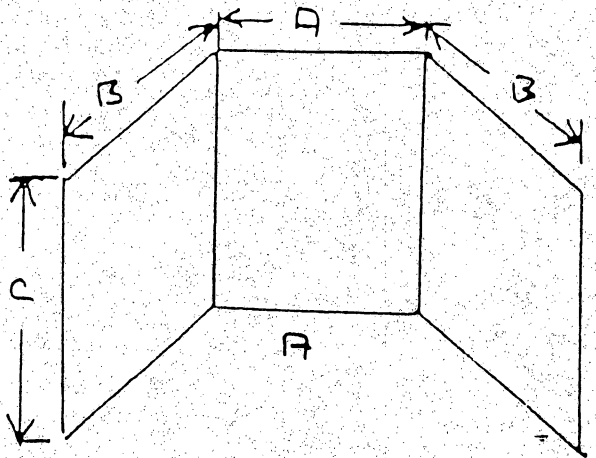
Most Acceptable

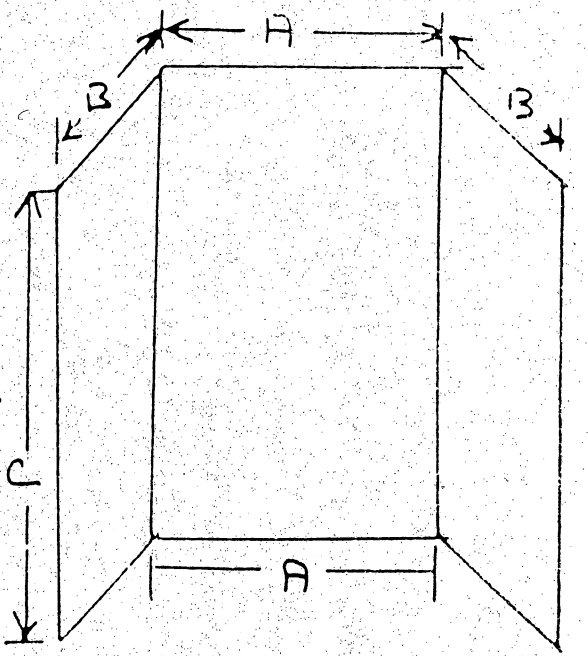


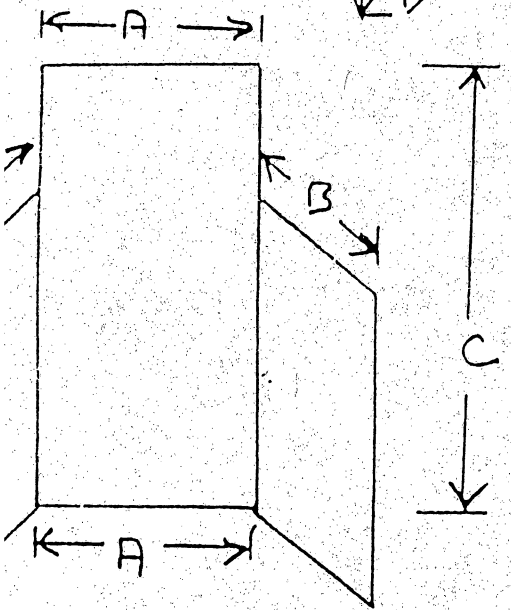
Cut Partially through on reverse side with a razor blade.

SAMPLE SHAPES: Using plywood, masonite, paneling, hardboard etc.





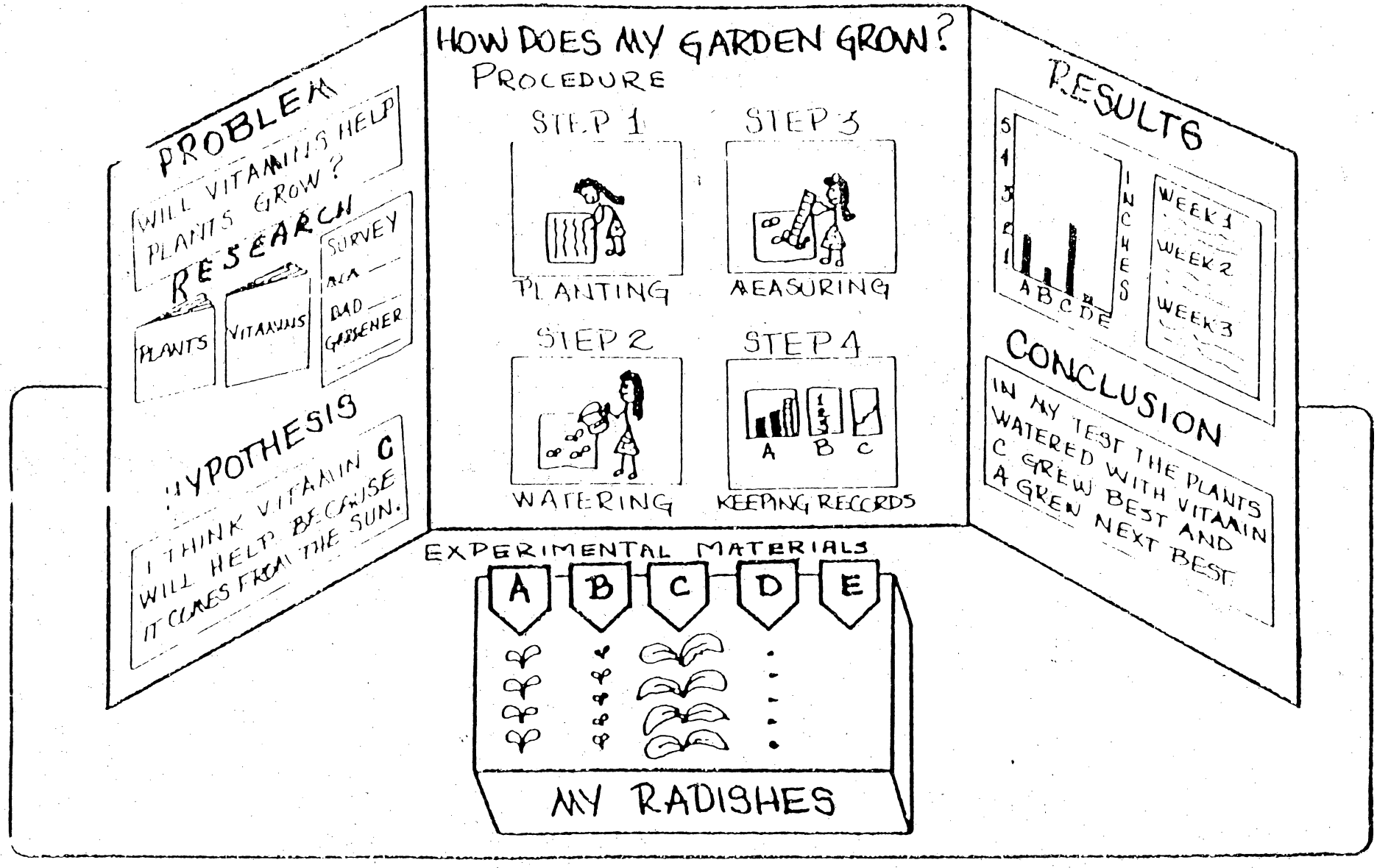


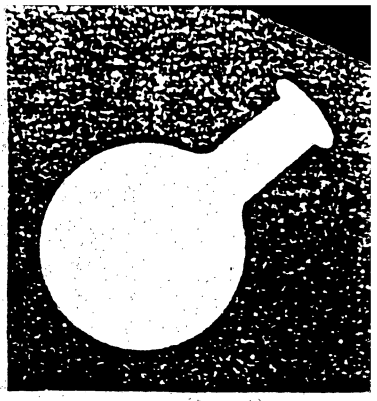


MAXIMUM DIMENSIONS

	METRIC	ENGLISH
A = WIDE	120 cm	48 in.
B = DEEP	76 cm	30 in.
C = HIGH	240 cm	96 in.

SCIENCE FAIR





JUDGES EVALUATION FORM

Exhibit No._____

Grade_____

1. Exhibit Construction and Display (10) points ....._____

   Creativity, neatness, organization, visual appeal, workmanship, clarity

2. Exhibit Notebook (5) points....._____

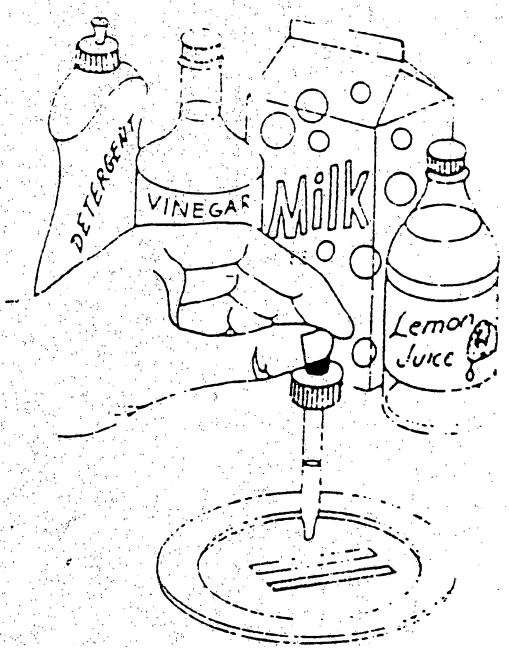
   Thoroughness, scientific thought, investigative skills, organization and presentation of data, resources

3. Knowledge of Topic (10) points....._____

   Accuracy and completeness of information, clarity of data and results, understanding of topic

Total....._____

Judge's signature_____



HELPFUL HINTS

1. Collect various types of information concerning your topic. These may include maps, graphs, charts, drawings, newspaper clippings, and magazine articles. Be sure to include these in your display, or in your notebook.
2. Write letters to individuals or companies who may be able to assist you with your project. Do this early to allow ample time for them to respond.
3. Read as much as you can about your topic. Become an "expert" in your field. Read a variety of materials. Try not to limit yourself to one reference source (such as the encyclopedia).
4. Interview parents, teachers, friends, etc., who may have a working knowledge of your topic.
5. Provide models, samples, or pictures of your project. A photograph diary is an excellent way to demonstrate your project. If that is not possible, provide illustrations.
6. Plan to visit museums, universities, or other local facilities which may provide helpful information. If you are unable to visit personally, make a phone call.
7. Check television listings for programs that may deal with your topic.
8. Be sure to start early and follow your timeline. You will have fun, and learn a lot while developing your project.

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