PARENT INVOLVEMENT
in a
SCIENCE, TECHNOLOGY, ENGINEERING and MATHEMATICS
FAIR GUIDE

Revised July 30, 2008

Prince George's County Public Schools

PGIN 7690-1214

BOARD OF EDUCATION OF PRINCE GEORGE'S COUNTY, MARYLAND

BOARD OF EDUCATION
OF
PRINCE GEORGE'S COUNTY, MARYLAND

Verjeana M. Jacobs, Esq., *Chair*

Ron L. Watson Ph.D., *Vice Chair*

Donna Hathaway Beck

Pat J. Fletcher

Heather Iliff

R. Owen Johnson, Jr.

Rosalind A. Johnson

Linda Thornton Thomas

Amber P. Waller

Edward Burroughs III, *Student Board Member*

William R. Hite, Jr., Ed.D., *Superintendent of Schools*

Bonita Coleman-Potter Ph.D., *Deputy Superintendent*

A. Duane Arbogast, Ed.D., *Chief Academic Officer*

Gladys Whitehead, Ph.D., *Director, Curriculum and Instruction*

Kara Miley-Libby, Ed.D., *Coordinating Supervisor, Academic Programs*

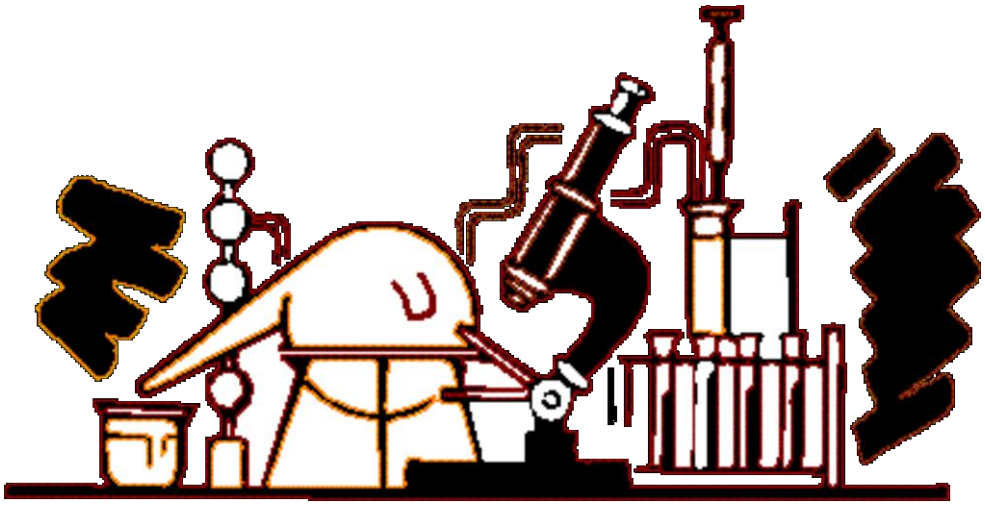
Treesa Elam Respass, *Science Instructional Specialist, K-8*

Table of Contents

Page

A Working Definition of Science

Science is a human activity through which problems and questions dealing with natural phenomena can be identified and defined, and solutions proposed and tested. In this process, data are collected and analyzed, and available knowledge is applied to explaining the results. Through this activity, investigators add to the store of knowledge, thereby helping people better understand their surroundings. Applications of this knowledge also may bring about changes in society and the cultural order and may have a direct bearing on the quality of life.



What is a STEM Fair?

an event where every project entry must have a testable question and data gathering

an event that showcases the connection between science, technology, engineering. and mathematics

STEM
an acronym for Science, Technology, Engineering, and Mathematics

an opportunity for students to explore the natural world and apply scientific skills and processes while seeking knowledge

an opportunity for schools to showcase student accomplishments

How Can I Help My Child?

A parent's support is important in making the STEM Fair Project process an exciting one. The following guide provides suggestions for assisting your child with their project.

Choosing A Topic – Review with your child the list of topics at the back of this guide, from your child's teacher, or online from Science Fair websites. Several links are provided on the Prince George's County Public Schools' Science home page and can be found by clicking on the "Journey into the World of Science." The url for this page is:
http://www1.pgcps.org/science/index.aspx?id=20548&ekmensel=c580fa7b_1532_0_20548_5

*** *Be sure to check the Topic Guidelines Summary and Pre-Approval Project Key located in this guide or your child's Science Fair or STEM Fair Student Journal. These pages will help determine whether the topic/project is an acceptable one or what needs to be done for approval.*

Review Deadlines – Discuss with your child the various deadlines provided by the teacher. Post these dates in a place as a reminder of the various time limits for each stage (e.g., when a topic and/or question is due, abstracts – required in grades four and up, project boards, etc.). Projects are not a one night assignment. They can take weeks to complete so it is important for students to meet deadlines and begin early.

Review the Steps for the Scientific Method – Students will need to perform several activities for the completion of their project. As students research their topic and gather background information, they will also follow specific project guidelines. Ask your child to review with you the steps for the scientific method and project completion.

Technology Assistance – Assist your child in taking pictures of their work along the way. Students enjoy documenting their work with digital cameras/photographs and are encouraged to add pictures to their project display boards. Parents may provide assistance in this area by taking a few pictures of their child as they perform their test trials as well as setting up their experiment.

Safety Measures – Once a project has been approved by your child's teacher and the School Safety Review Board (if applicable), review all procedures for the experiment. Are there any safety concerns? Discuss this with your child. All precautions must be taken to complete an experiment including adult monitoring or participation where and when required. The School Safety Review Board form must have all required signatures for any project that goes to this level of approval.

Final Recommendations – ***"****Real-world scientists know that discoveries and breakthroughs are built on learning what doesn't work as much as what does. Science fairs aren't about having "right answers." They're about learning--and fun."* (http://school.familyeducation.com/science/extracurricular-activities/38839.html). This fun can include both parents and children through family involvement.

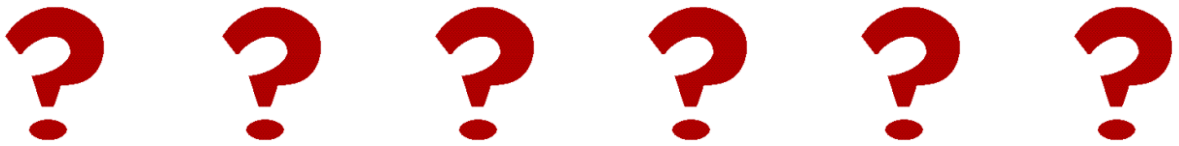
It is in the practice of science that children learn to approach challenges in a systematic way. *"What's important is that they believe in their greatness by experiencing small successes along their journey." Madeline Binder*

PARTS OF A STEM FAIR PROJECT

THE QUESTION

A STEM Fair project starts with a question. For most students, a difficult part of STEM Fair is selecting a good question (topic.) It is important the question be one that is interesting to the student. The question should be one that can lead to an experiment project where something is changed and the result is measured.

A good question…
- must lead to an investigation (experiment) **not** a report, a demonstration or a model. The question may ask about the **effect** of one thing upon another.
- should be one from which you can collect data (ideally measurements or direct observations) **rather than** opinions.
- should be specific rather than really broad
- is one which the materials needed to experiment with are easy to find.



Examples of good questions:

How does temperature affect the bounce of a ball?
What type of conditions do mealworms prefer?
What shape of container will allow water to evaporate the quickest?
Does the drop height of an object affect the size of the crater it will make?

Examples of poor questions:

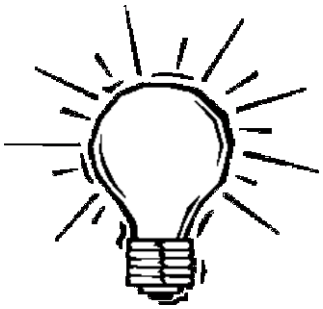
How do volcanoes erupt? This question is poor because it is a model not an experiment, is too vague (broad,) and will not involve data collection.

Why are there craters on the moon? This question is not an experiment and would require only research not scientific experimentation to answer.

How do bean plants grow? This question is too broad and would require research rather than experimenting and collecting data.

See the last section of this booklet for some recommended STEM Fair projects and excerpts from the Science Fair or STEM Fair Student Journal that will determine whether or not a project is acceptable.

PREDICTION

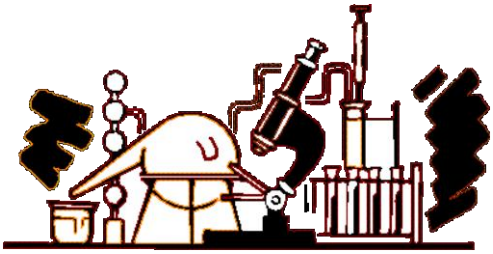


A prediction is an attempted answer to the question being investigated. The prediction is a reasonable guess about the outcome of the experiment and suggests a possible reason for this outcome. Many times, the word hypothesis is used instead of prediction. A hypothesis is a prediction that can be tested. It should be based on prior knowledge, observations, or research and is accepted or rejected by the results of the investigation. It should include the expected cause and effect in a given circumstance or situation. Information from research or prior knowledge should be part of a hypothesis statement.

MATERIALS

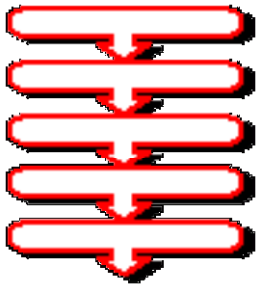
Materials include the equipment and supplies that were used to complete the experiment. Materials need to be listed in specific amounts and sizes. **Metric** units should be used. The materials list allows other people to repeat the experiment exactly to see if they get the same results.
Example:

one 100 mL beaker
50 mL of water
three plastic cups
30 grams of salt
one hand lens



PROCEDURE

The procedure includes all the steps that were followed in setting up the experiment and collecting the data. The procedure is written in a clear, sequential manner so that someone else could follow the same steps to complete the experiment. Numbering the steps is helpful to someone who is reading the procedure. Factors that can affect the outcome of the experiment, called variables, must be identified and controlled as part of the procedure. The variables (which are discussed on the next page,) should be listed as part of the procedure.



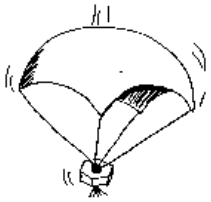
The procedure should be written in sequential order.

There are three types of variables that must be considered when determining the procedure to be followed:

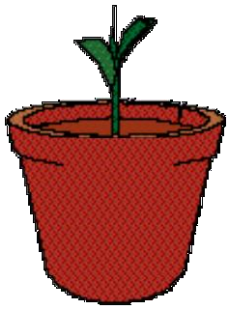
- **Independent variable** - the factor that will be intentionally changed during the experiment to find out what effect it has on something else. An example of an independent variable is using different types of materials (silk, felt, canvas, paper, tissue, etc.) to construct a parachute to observe the effect the type of material has on the drop time of the parachute.

- **Dependent variable** - the factor that is observed and measured to see if it is affected by the change made in the independent variable. The dependent variable in the parachute material investigation would be the time the parachute took to drop.

- **Variables that are controlled** - the factors in the experiment that must be kept exactly the same to make sure that they are not having any effect on the dependent variable. Variables that would need to be controlled in the parachute experiment would be the size of each parachute made, the same mass tied on the end, and the height the parachutes were dropped from.



The procedure also should reflect that enough data were collected to support the conclusion. Large amounts of data are collected by repeating the experiment many times (repeated trials.) The more trials completed, the more conclusive the results will be. For most projects, the procedure should also show that adequate sample size was used. When working with plants, it is not acceptable to plant one seed in the light and one seed in the dark and then generalize from the results gained from planting one seed in each condition. Planting twenty or more seeds in the light and twenty or more seeds in the dark would provide an adequate sample size for this project. A project testing whether mealworms prefer dry or moist conditions needs to use multiple mealworms and repeated trials. Using a number of mealworms and repeating the experiment many times with the same worms will give a good representation of how mealworms react to dry or wet conditions.



*One is **not** an adequate sample size*

Actually, there are no magic numbers to determine how big a sample size to use or how many times to repeat the experiment. There should never be less than three trials for any experiment but the size of sample used and number of repeated trials should be determined by the nature of the project (time, expense, ease of use, etc.) Keep in mind that the **more data** collected about more objects will provide **better evidence** for determining a conclusion to the question.

RESULTS

The results of the experiment include measurements taken and observations made, as well as a written explanation. Along with the written explanation, results should be displayed in the form of data tables, graphs, and photographs.

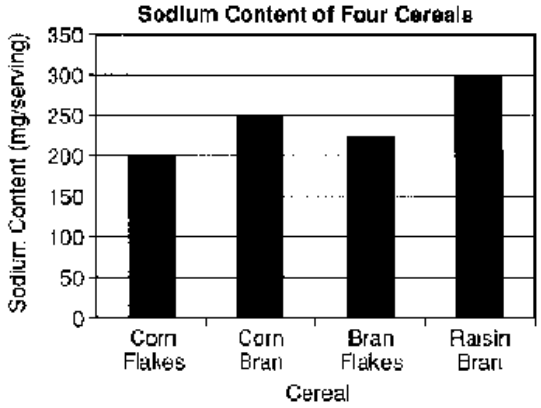
Data are best organized in a table. The data table should match the project design. Use the independent (what you are changing) and dependent (what you will measure) variables to help organize the table. They will often be the heading for columns or rows. When constructing a data table, it should be remembered that repeated trials of the experiment must be conducted and the mean/average of the data should be calculated. The data table should include a title and should state the units of measurement used. A good data table is shown below:

Effect of Glycerin on the Size of a Bubble

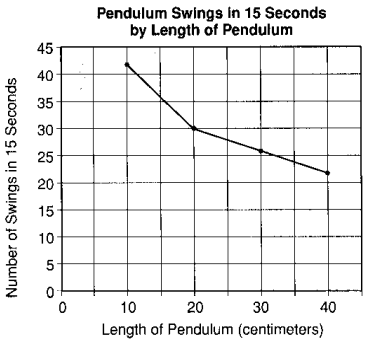
	Size of Bubble in Centimeters						
#of Drops of Glycerin	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Mean
5 drops							
10 drops							
15 drops							
20 drops							

Data from the project should be analyzed and graphed. A statistical analysis of the collected data to include the mean, median, mode, and range can be completed. It is helpful to display the data in the form of a graph so that the data illustrated can easily be interpreted. The two most commonly used types of graphs for science experiments, bar graphs and line graphs, are detailed below.

Bar graphs are used to display discrete data, or data that is distinct and separate from other information. Data shown on a bar graph often reflect measured or counted amounts. For example, the average number of seeds taken from six different fruits would best be shown on a bar graph. The bars drawn on a bar graph must all be the same width and are separated by spaces in between them. A bar graph showing the sodium content of four different types of cereal would look like this:



Line graphs are used to display continuous data or data that goes on without a stop or break. Experiments that have dependent variables involving temperature, time, mass, height, or distance will usually yield data that should be graphed as a line graph. Line graphs are useful to analyze relationships among collected data. In particular, line graphs can show trends in data; increasing, decreasing, or staying the same. The dissolving time of a solid in a range of different temperatures would be an example of data best displayed on a line graph. A line graph showing how the number of pendulum swings change as the length of the string changes is shown below.



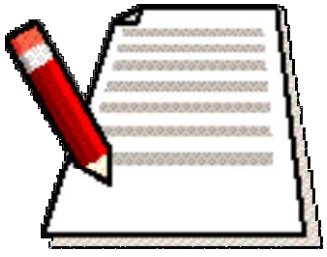
On a graph the independent variable is represented on the horizontal (x) axis of a graph and the dependent variable is represented on the vertical axis of a graph. The graph should also have:

- numbers (scale) in even intervals (l's, 2's, 5's, 10's, 100's, etc.),
- labels for both the horizontal (x) and vertical (y) axes,
- a title that reflects the information that is being represented on the graph.

CONCLUSION

A conclusion has four parts:

1. It should answer the original question that started the investigation and include results (numbers) used as the basis for that conclusion.
2. It should reflect back on the original prediction and state whether it was supported or not.
3. It should include inferences that can be made from the results of the experiment.
4. It should include any additional questions that could be investigated or information that could be researched in the future. In addition, any problems that were experienced during the experiment can be discussed.



Guidelines, Ideas and Checklists for a Successful STEM Fair Project

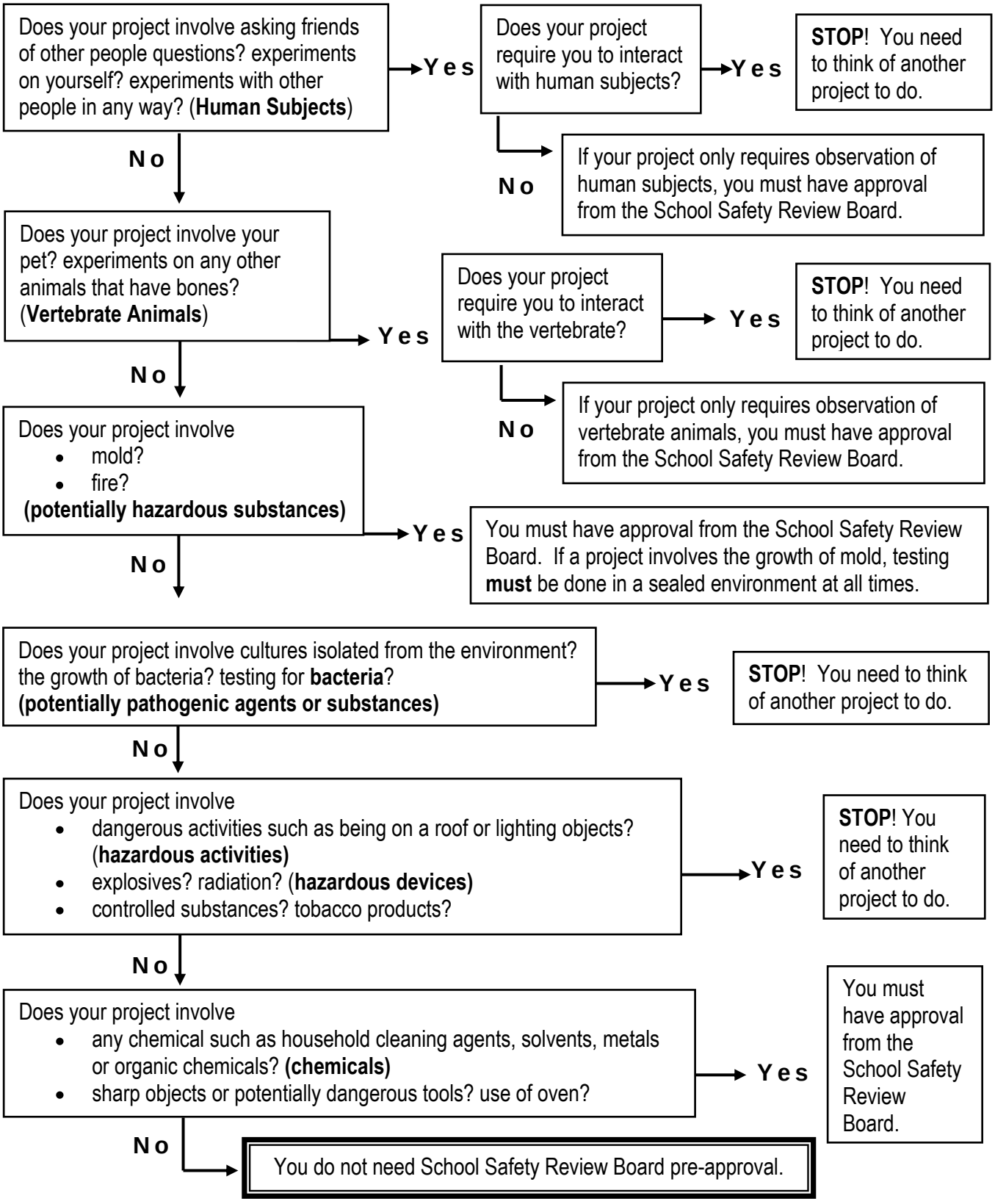
Schedule for the Student's STEM Fair Project			
Week	**What You Should be Working On**	**Due Date**	**Check√**
	• Make sure you understand what you need to do for the science Fair project. Ask questions if you're not certain about any aspect of the assignment. Be sure to follow all deadlines given by the teacher and guidelines on types of projects allowed. • Find time to use books, encyclopedias, magazines, websites, or newspapers for research. Look for a topic that is interesting to you. Keep bibliographic **notes** on the books and magazine articles where you get your ideas. You may want to visit museums, hospitals, universities, zoos, and science centers. You will write this information in the form of a paper later.		
	• With your project idea firmly in mind, write the question, prediction, materials needed, and procedures. • Show your written material to the teacher and discuss your project for approval.		
	• After the STEM Fair project has been approved by the science teacher, begin to gather the necessary materials and equipment and begin your project.		
	• Conduct the experiment and collect data. • Keep careful, written records of your results in a log (notebook.) Record the day and time you make observations. Be as specific as you can about the amount, size, and type of materials you use. The log can be displayed in front of your backboard.		
	• Organize the **results** of your experiments in **table** form. • Construct a **graph** from the data. • Write a **summary** interpreting the data found on the table and graph. • Write a **conclusion** to the experiment.		
	• Write your research paper. Include a table of contents, your question, background research on your topic, prediction, step-by-step explanation of your experiment, results, conclusion, and bibliography.		
	• Construct your exhibit. Be careful with your spelling and grammar. Be creative but also neat in the creation of your backboard. Use stencils or a computer for lettering if possible. Do not use more than three colors on your backboard.		
	• Prepare an oral presentation for the judge(s.)		
	• Add finishing touches to your project. • Come to the STEM fair and present your project.		

Topic Guidelines Summary

Acceptable Topics or Projects	Non-Acceptable Topics or Projects
Projects that have a testable question and data gathering	**Models**
Observational projects of vertebrates. Information or data obtained by observing vertebrates, including humans, in their **natural environment** with **no interaction** between the researcher (student) and the vertebrate. **Acceptable** examples of observational projects include: • tabulating the number and kinds of birds observed at a bird feeder over a period of time; • the observation and recording of data related to left-handedness in males /females by observing a public access door over a period of time; • comparison of the frequency of tree chirps with the ambient temperature over a period of time; and • studies using mathematical or computer models rather than live subjects. **Acceptable** examples of survey projects include: • research involving the observational of legal public behavior; • research involving collection or study of existing publicly available data or records; • research involving normal educational practices; and • research on individual or group behavior or characteristics of individuals where the researcher does not manipulate the student's behavior; the study does not involve perception, cognition or game theory; and does not gather personal information; has the potential for emotional distress or invades a person's privacy.	**Testing of Vertebrates**–Animals with a backbone including humans. **Unacceptable** examples of observational projects include: • watching the running of mice through a maze • monitoring (observing) heart rates or respiration after exercise; • "observing" reactions after the administration of a substance; • treating vertebrates, such as: tapping fish tank before feeding fish; and • testing vision wearing various color glasses. **Additiona**l examples of activities that are more than "minimal risk" and are also **unacceptable**: • Exercise other than ordinarily encountered in DAILY LIFE by that subject; • Ingestion (eating, drinking, etc) of anything (this includes gum) and • Exposure to potentially hazardous materials. **Unacceptable** examples of survey type projects include: • projects in which a **treatment** such as **exercise, ingestions, touching, inhaling, injection, some type of learning**, etc., is done such as comparing the learning rates of girls/boys after a learning treatment has been administered. • monitoring (observing) heart rates or respiration after exercise; and • any observational or survey projects where the student (researcher) is the subject or another vertebrate is the subject of the investigation.
Invertebrates where **no harm/injury** to the animal is involved	Invertebrate projects that can cause **potential injury/harm** to the organism
Natural growth of mold in food products in a sealed environment at all times (closed plastic bags or clear containers)	**Pathogenic and Potentially Pathogenic Agents** (things that could cause disease)**:** Unacceptable examples are cultures of washed and unwashed hands, cutting boards, kitchen sponges and/or saliva. Projects that involve the growth of bacteria
Projects that include the use of fire, high temperatures, or any household chemicals must have authorization from the **School Safety Review Board**. **Kids for Science" Safety Review Board** will have the final say on any questionable projects entered into the "Kids for Science" STEM Fair.	**Hazardous and/or Controlled Substances** ethyl alcohol, tobacco products, explosives or gunpowder, sharp objects or objects that could potentially cause harm, and over-the-counter or prescription drugs

Elementary PRE-APPROVAL Project Key

Do I need to get pre-approval from my school's Safety Review Board before I can begin my project?



Elementary PRE-APPROVAL Project Form
School Safety Review Board

Fill in the information required for your project and submit to your teacher. Approval by the School Safety Review Board is required before experimentation. If chosen as a "Kids for Science" STEM Fair participant, this pre-approval form must be submitted with your packet. The School Safety Review Board or school system's Safety Review Committee reserves the right to deny any project due to safety concerns. For further questions about "Kids for Science" STEM Fair rules, see Appendix.

Student's Name_____ School _____

Title of Project _____ Grade _____

1) Describe the purpose of your investigation and the reason you responded to a **yes** on the **pre-approval key**. If a survey or questionnaire (**for vertebrate animals and human subjects**) is being used, please attach.

2) Describe any potential risks or areas of concern that need to be addressed and approved before experimentation.

3) Describe: the procedures that will be used to minimize risk; safety measures taken; disposal procedures that will be followed (when applicable); and sources of safety information.

The following section is to be completed by the School Safety Review Board prior to experimentation.

Safety Review Board SIGNATURES (The first three signatures are required)

1) Science Fair Coordinator: _____ (print name) _____ (signature and date)

2) Science Teacher: _____ (print name) _____ (signature and date)

3) School Administrator: _____ (print name) _____ (signature and date)

For projects that involve human subjects or chemicals:

4) School Health Aide/Nurse: _____ (print name) _____ (signature and date)

To be completed by Parent/Guardian: _____ (prior to participation) (print name)

Yes	No	
☐	☐	I have read and understand the conditions and risks above and consent to the participation of my child.
☐	☐	Project testing/trials will be supervised by an adult at all times.
☐	☐	I have reviewed a copy of any survey or questionnaire used in my child's research. (if applicable)
☐	☐	I consent to the use of visual images (photos, videos, etc) involving my child in this research.

_____ parent/guardian's name (please print) _____ parent/guardian's name signature and date

TIPS FOR CREATING OUTSTANDING DISPLAYS

- **BE NEAT-** Avoid frayed or ripped edges of paper, glue globs, lots of cross outs or white outs etc.

- **USE COLORS TO ATTRACT ATTENTION BUT DON'T OVER DO IT-** No more than (3) three colors should be used on a project except for special situations. Too much color can be distracting. Instead develop a color pattern that is pleasing to the eye.

- **FRAME OR MATTE YOUR WORK-**Use construction paper or other colored materials to provide a background for your written work and labels (construction paper, newspaper, wrapping paper, old wall paper, contact paper etc…)

- **TITLES SHOULD BE SHORT, CATCHY AND RELATED TO THE PROJECT IDEA**
  For example:
  Color of Cool Cubes is better than The Melting Rate of the Different Colors of Ice Cubes.
  Sizing Up Seeds is better than The Relationship between the Size of the Seed and the Size of the Plant.

- **WRITING SHOULD BE NEAT AND LEGIBLE**- If you choose to use a computer or typewriter, stick to one or two fonts to type your work. Too many fonts can be distracting and difficult to read. If you hand write your work, print or use cursive, don't mix the two. Also, if you are hand writing the information, be extra careful to write so it can easily be read by others. Pen is easier to read than pencil. Messy or illegible writing can really lower your score.

- **SPELLING DOES COUNT**-Take time to check over your work before you put it on your display board. Don't overuse white out. Scratching out mistakes is not acceptable. If you do recognize an error after finishing, place a single line through it and write the correct word above. However, too many of these types of marks will affect the overall appeal of your project.

- **PRACTICE YOUR LAYOUT-** Do not glue down the parts of your project on your board until you have, practiced moving them around on your display board. They should be evenly spaced and centered. Crowding together or large gaps can take away from your project's appearance. Trying to rip off or move things once they are glued down can be messy and often ruins the paper or display board.

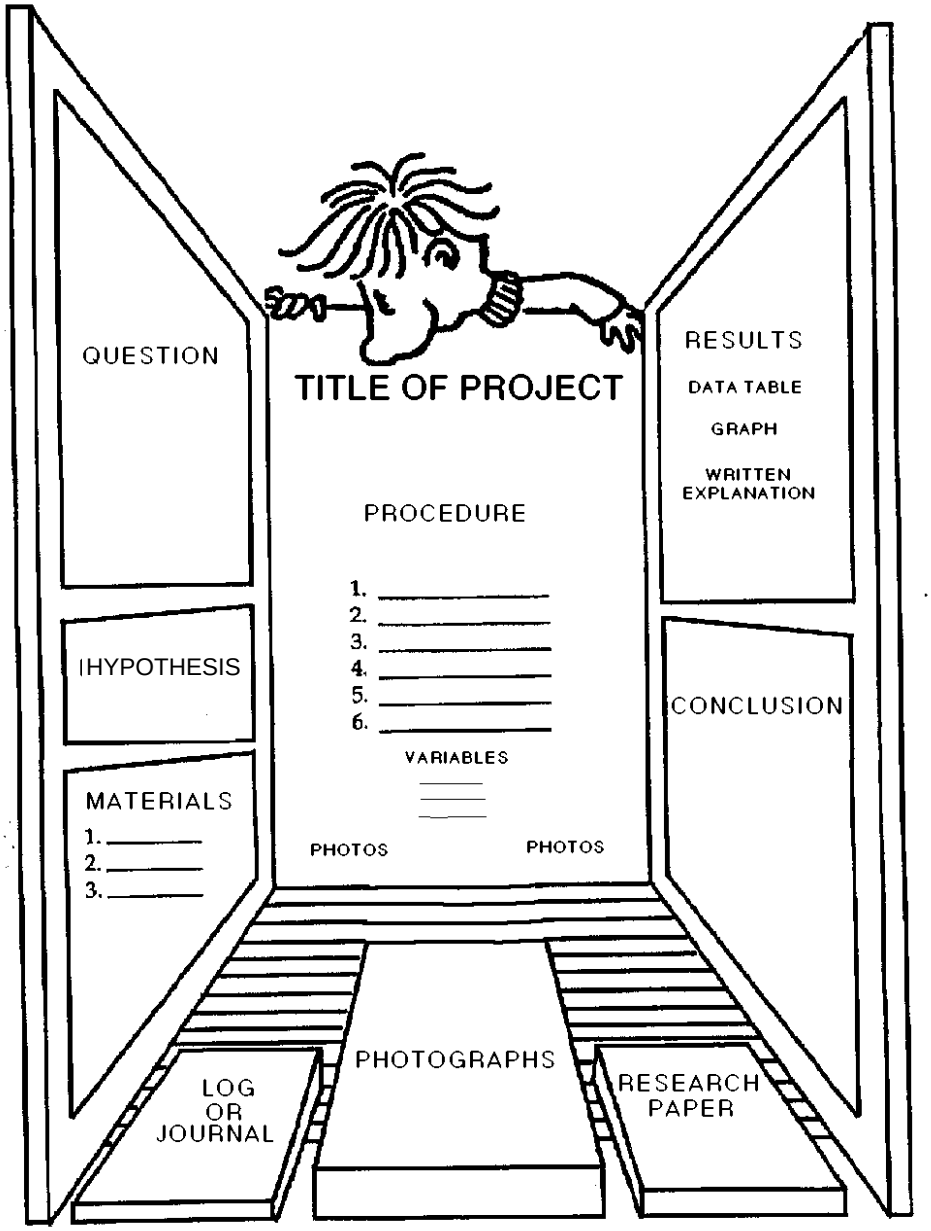
- **DON'T GLUE ON MATERIALS FROM YOUR PROJECT**- Do not glue on any food or decomposing items such as M & M's, popcorn or moldy bread to the board. Food products attract bugs; can lead to mold bacteria growth; or other problems. This also includes wrappers from foods. Don't place samples of chemicals or their containers on the board. This includes household items such as vinegar, dish soap, oil etc.

- **TAKE PHOTOS OR DRAW PICTURES/DIAGRAMS OF THE ITEMS FOR DISPLAY-** This will help you to avoid attaching materials from your experiment to your display. **Inappropriate materials** will be removed from the board before allowing it to be displayed in the fair.

- **RESEARCH REPORTS ARE PLACED IN FRONT OF THE DISPLAY**- **Do not attach the report** to the display board. It is placed in front of the display.

STEM FAIR PROJECT DISPLAY INFORMATION

Title:	short, catchy, related to the topic and results of the experiment
Question	the question to be tested
Hypothesis:	the predicted answer to the question/problem asked with a reason
Materials:	a list of the supplies, equipment to be used
Procedure:	a list of the steps followed to perform the experiment
Results:	data displayed in table and graph form to include data analysis (mean, medium, mode, range) and accompanied by a written explanation
Conclusion:	briefly answers the question asked in the beginning; states the hypothesis to be supported or not supported, and makes suggestions for further research



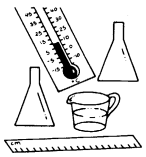
STEM FAIR DISPLAY CHECKLIST

After you have completed your backboard, take time to complete this checklist yourself to be sure you have everything included on your display board. Then add or revise any areas that you did not check off as being complete. After you have made any changes to your board, have your parent complete the checklist as a final review of your work before turning it in at school.

	Assessment	
	Self	**Parent**
1. Overall appearance is neat and attractive.	_____	_____
2. All necessary parts are included and labeled **(Question, Hypothesis, Materials, Procedure, Results, and Conclusion)**	_____	_____
3. I used no more than three colors when doing my backboard.	_____	_____
4. My backboard has a short and catchy title.	_____	_____
5. All of the words on my backboard are spelled correctly.	_____	_____
6. I have used proper grammar and punctuation.	_____	_____
7. My procedures are written in clear sequential order.	_____	_____
8. My procedure shows that I conducted repeated trials **(at least 3)** and used an adequate sample size, if necessary.	_____	_____
9. I have identified my independent, dependent and control variables.	_____	_____
10. All necessary parts are included on my chart **(title, labels, and units)** and it is neatly drawn and filled in with appropriate data.	_____	_____
11. I have the correct type of graph that displays my data from my chart and the graph includes all the necessary parts **(title, axes, increments, labels, and scale).** A key is present if necessary.	_____	_____
12. I included a written explanation of my chart, graph and any other observations I made.	_____	_____
13. My conclusion includes the answer to the original question, accuracy of my prediction, what I learned - **supported with data**, any problems and real world applications.	_____	_____
14. My research paper follows the guidelines listed in the journal.	_____	_____

SAMPLE EXPERIMENT WRITE-UP

Use the spaces provided to record information about your project. If you need more room, use the back of this sheet.



QUESTION:

MATERIALS: (List specific amounts)

PREDICTION:

PROCEDURE:

Independent variable:

Dependent variable:

Controlled variables:

Steps:

JUDGING CRITERIA

RESULTS: (Charts, Graphs, Diagrams

WRITTEN RESULTS:

CONCLUSION:

JUDGING CRITERIA

A. Overall Appearance and Organization of the Backboard **5 points**

- All parts of project are included, clearly labeled, and in sequential order (question, prediction, materials, procedure, results, conclusion)
- Backboard is neat and attractive.

B. Question **5 points**

- Question led to an investigation, not a report, demonstration, or model.
- A creative approach to problem solving was used to formulate the question.

C. Prediction **5 points**

- Prediction must state a possible outcome of the experiment with an accompanying explanation.
- Background information is present showing research was done prior to predicting.

D. Materials and Procedure - (10 points total)

Written Procedure **5 points**

- Materials and equipment are listed with specific amounts using metric units.
- All steps to conduct the experiment are described and in order.

Experimental Design **5 points**

- Independent, dependent, and controlled variables are correctly identified and listed.
- Adequate data were collected through repeated trials to justify the conclusion.
- Sufficient sample size was used to support a conclusion (as necessitated by project).

E. Results - (10 points total)

Graphic Representation **5 points**

- Data are present in the form of a table with appropriate labels and title.
- An appropriate type of graph is accurately constructed (scale, labels, and title) from the data on the data table.

Written Explanation **5 points**

- Explanation analyzes and summarizes the data to note patterns and trends.
- Explanation interprets the graph.

F. Conclusion **5 points**

- Conclusion answers original question being investigated.
- A statement reflecting whether the prediction was supported or not is included.
- Supporting data are referenced.
- Additional questions to investigate are presented.

G. Interview - (10 points total)

Understanding **5 points**

- Student is able to explain the investigation in a way that demonstrates clear understanding.

Application **5 points**

- Student is able to relate findings of project to a real world situation.
- Student is able to identify career connections.
- Student is able to generate ideas for future research.

TOTAL **50 points**

Teacher Signature _____ **Total Score** _____

STEM Fair Project Ideas

Physical Science:

What variables affect the swing of a pendulum (length of string or mass of pendulum)?
Is there a relationship between the size and strength of a magnet?
What types of surfaces produce the greatest or least amount of friction?
What variables determine the strength of an electromagnet (number of wire wraps, wire gauge, diameter of a nail)?
What variables affect the flight of an airplane (materials, weight, shape, angle of launch)?
How is the bounce height of a ball related to the drop height?
What variables affect the efficiency of parachutes (size, shape, materials)?
Which shape of windmill blade is most efficient?
Does the length of a ramp (inclined plane) affect the amount of force needed to pull a load up a ramp?
What effect does air pressure have on the bounce of a ball?
Does mass affect how fast objects of equal volume will fall through a liquid?
How does the size of a wheel affect the rate at which it lifts a load?
What is the effect of mass on rocket trajectory?
How does temperature affect the bounce height of a ball?
Does the angle of launching affect how far a paper airplane flies?
What variables affect the distance a balloon rocket will travel (amount of air, nozzle shape, angle of ascent, different pathways)?
Which type of material conducts sound the best?
Do different types of string or string lengths affect the efficiency of a paper cup or tin can telephone?
Do different watt light bulbs produce different amounts of heat?
What effect does temperature have on buoyancy?
Does color affect the rate in which an ice cube melts?
What effect does color have on temperature?
What material makes the best heat insulator?
Which type of container keeps liquids hotter longer?
What effect does temperature have on the elasticity of a rubber band?
Do suction cups stick equally well to different surfaces?
Does the amount of stretch of a rubber band affect the distance a rubber band will travel?
What design shape supports a bridge the best?
Which container shape allows for greater rates of evaporation?
Does salt water or lemon juice have any effect on the rate of dehydration of different types of apples?
How is the strength of a magnet affected by glass, cardboard and plastic?
What is the relationship between temperature and amount of carbonation in soft drinks?
Does the density of a liquid affect its droplet shape?
Do basketballs that are fully inflated bounce better than flatter ones?
Does viscosity (thickness) of a liquid have an effect on the rate of evaporation or the boiling/freezing point?
What coating inhibits rust formation the best?
Which will food coloring mix into faster - hot, medium, or cold water?
Which chemicals slow the browning of apples or other fruits?
What food dry cells (tomato, potato, or apple) will produce the highest amount of energy measured in voltage?
What effect does temperature/packaging have on the ripening of bananas?
Does temperature have an effect on solubility? Does the color of water have an effect on evaporation rate?
Does temperature affect the growth of sugar or salt crystals?
What materials melt an ice cube most efficiently?
How does temperature affect the reaction rate of Alka Seltzer?
Do heavier objects fall faster than lighter ones?
Does the density of wood affect how much weight different pieces of wood will hold in water?
How well do different types of wood absorb water?
What type of metal, steel, copper, or bronze, will rust faster?
What liquid works best in making invisible ink?
Do watches keep the same time?

Mathematics:

What are the most common sums of two dice when rolled?
What is the probability of reaching into a bin and selecting a particular color of M&M candy? Can statistics be used to predict the contents of edible consumer products such as fruit snacks, a bag of jelly beans or M&Ms?
Which juice box manufacturer has the largest volume of juice and uses the least amount of packaging material?
How do the dimensions of a rectangular prism change with respect to each other?
Does the probability of drawing a particular card from a deck depend upon the number of that type of card in the deck?

Computer Science:

Does the font style of the letters (or characters) in a file change the size of the file?
How does the file size change as more letters (or characters) are added to a file?
What search terms give the best results?
Which search engine gives the best results?

STEM Fair Project Ideas

Life Science/Environmental:

What effect do different colors of light have on the growth of plants?
What type of seeds will germinate fastest?
Does the direction a seed is planted affect the growth of the seed?
Do vitamins or fertilizers affect the growth of plants?
Do mirrors have an effect on plant growth?
Does acid rain have an effect on the germination of seeds?
Which direction will a vine grow around its support object?
What medium works best for growing seeds or plants?
Does temperature affect the growth of seeds or plants?
Is there a relationship between seed size and fruit size?
Which fruits or orange drinks have the most vitamin C?
Do potato cubes gain or lose mass in salt water solutions?
What kind of soil is best for water retention?
How does a garden mist spray affect plant growth?
Which plants and vegetables make the best dye?
Which type of wildflower grows best under artificial light?
How does temperature affect the water uptake in celery plants?
Does the type of water affect the growth of plants?
Is soil necessary for plant growth? (hydroponics study)
How does rotation affect plant growth?
Does music affect plant growth?
Does a plant grow best in sunlight or artificial light?
Can plants deprived of sunlight recover?
What is the relationship between root and stem growth?
Which color of light causes green beans to grow best?
Can potatoes be grown without soil?
How do worms affect plant growth?
What affect do Epsom salts have on plant growth?
How does mint extract affect bean growth?
Can recycled newspaper be used to fertilize plants?
How does the concentration of salt in water affect seed germination?
Do beans grow better in clay, sand or potting soil?
What kind of light do plants grow under best? Sunlight, grow light or regular light bulb?
Do detergents affect plant growth?
How does the clarity of a body of water change over time?
What difference is there in the tree species found in high and low areas of a forest?
Does recycled paper break down faster than new paper?
How well does charcoal filter water?
What percentage of an orange is water?
Do magnets affect plant growth?
Are there differences in the amount of air pollution inside vs. outside a building?

Earth Science:

Are there differences in temperature in shaded versus non-shaded areas during the day and at night?
How accurate are local forecasters?
Do weather conditions affect the broadcasting of AM radio stations?
Are there differences or patterns in wind speed or direction over a period of time?
What materials or methods work best for cleaning up oil spills?
How are different depths and shapes of craters made?
Are different sizes and shapes of sand dunes formed at different wind speeds?
How quickly does a creek change water temperature in comparison with air temperature?
What effect does freezing or boiling have on rocks?
Which material absorbs heat most efficiently, sand, soil, or rocks?
Do different types of soils have different percolation rates?
How wet should sand be to build a sandcastle?
How accurate are Web-based weather forecasting services?
What effects do the changes in the length of day and night have on household plants?
Is air in your house the same temperature at floor level and near the ceiling?
Will the size of a crater be greater when the impact object is bigger? faster?
How accurate are long-range weather forecasts?
Is rainwater absorbed at the same rate in different kinds of soil?
From which direction does the wind blow most frequently?
How warm is it under the snow?
How accurate are homemade weather instruments?

Engineering:

What factors affect the top speed of a radio-controlled car?
What brand of matchbox car rolls more freely?
Does the material of a parachute affect how fast it drops?
What levee construction will hold the most water?
Which folded paper structure will support the most stress?
Which truss design will withstand the most weight?
Will the amount of material eroded change as the slope angle increases?
Does the area of a parachute affect how fast it falls?
Which file card bridge hold the most pennies?
Which paper hoop plane will fly the longest distance?
Which building design best withstands an earthquake?