Elementary Science Fair Project Guide (Student Packet)

TABLE OF CONTENTS

TIPS FOR PARENTS

1. Be positive about your child's work.
2. Be honest with your student. If you don't know the answer, tell your child that you don't know, but offer to help locate a source of information that may help.
3. Help your child look around for ideas. Investigate, libraries, Internet, etc.,
4. Help seek out people to help – other adults, teachers, other professionals
5. Help your child collect and save materials. Inexpensive materials found around the home often work the best.
6. Allow your student to "mess around" with materials without your intervention.
7. Allow your student time for thinking, exploring, and doing the experiment.
8. Stress "how-to" skills – e.g., observing, rather than memorizing facts.
9. Examine issues with moral consequences – e.g., animals used for experimentation.
10. Help your student keep a daily log of their research activities.
11. Go to the Science Fair and take pictures of experiments for future ideas.
12. Assist as needed, but let your student do the work.

MY SCIENCE FAIR EXPERIMENT

What do I do?

Choose your topic. Get ideas from your teacher, parents, friends, science books, newspaper articles, television, Internet, etc. *You are not to experiment on any human or animal without the prior permission of your teacher. Collect* and put together your ideas and materials you will need. Follow the *Scientific Method* as much as possible.

What is the Scientific Method?

Scientific Method refers to the process that scientists go through when solving a problem. See page 5 for more a more detailed description. It involves the following steps:

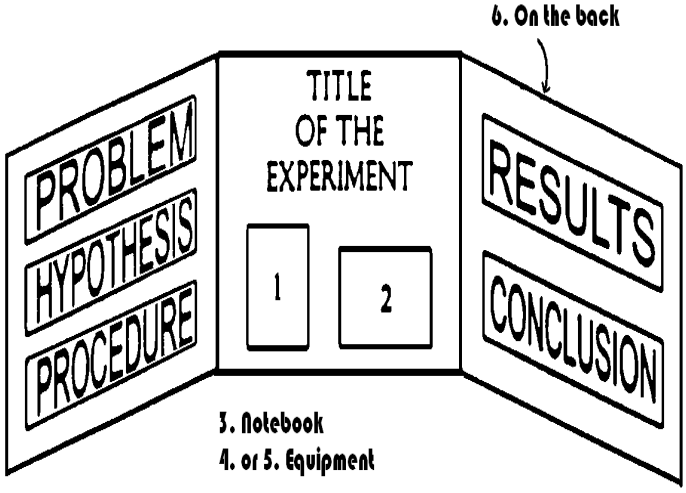
1. State the Problem: Write the problem clearly, perhaps in the form of a question.
2. Present a Hypothesis: Describe your educated guess of the possible solution (your prediction of the outcome of your experiment) and justify your reasoning.
3. Present a Procedure: Describe how you will go about solving the problem. Include a list of all the materials needed. Do the experiment.
4. Present the Results: Tell what happened in words. Show what you have found out using tools like charts, tables, graphs, diagrams and pictures.
5. State your conclusions: Write a paragraph that tells whether the experiment solved your problem. Did it prove or disprove your hypothesis? If your hypothesis was incorrect, what might be some of the reasons?

How do I display my experiment?

Your experiment should be placed on a display board that stands by itself, such as on a three-sided display, as shown below. It should not be over 48 inches wide when open.

Example of display layout:

1. Graphs and Charts
2. Photographs or drawings and diagrams of your work.
3. Notebooks may be placed in front of the project.
4. K-3 only: Equipment may be placed on table in front of display. Do not include liquids or smelly items.
5. Grades 4-6: No equipment or apparatus.
6. Student's and teacher's names should be written **only** ON THE BACK of the display.



Summary:

- Choose an experiment.
- Have the experiment approved by your teacher.
- Follow the guidelines and safety rules set forth by your teacher or as described in this packet.
- Gather all materials needed and do the experiment, following the scientific method as closely as possible.
- Illustrate the experiment and organize your results.
- Keep an observation log (if needed).

MY SCIENCE FAIR PROJECT TIMELINE

Task	Date Due
1. Choose a problem to investigate.	
2. Do some background research and get advice.	
3. Develop a hypothesis.	
4. Decide on the procedures you will use.	
5. Make a list of materials you will need and gather materials.	
6. Conduct your investigation and collect data.	
7. Organize your data or results.	
8. Draw your conclusions.	
9. Keep a project notebook (log).	
10. Proofread your work.	
11. Design your exhibit.	
12. Construct your visual aids and exhibit backdrop.	
13. Turn in your project.	
14. Present your project.	

COMPONENTS OF A SCIENCE FAIR PROJECT: THE "SCIENTIFIC METHOD"

1. Title/Problem

- Put it into a question format.
- Draw on ideas and wonderings you have had or written down during discussions of classroom experiments.

2. Introduction (Optional, as needed)

- What gave you the idea?
- Who helped you?
- What kind of research did you do?
- Include background information needed to understand the problem (this can also be part of the hypothesis – see examples below).

3. Hypothesis

- It is a prediction (educated guess) about the possible outcome.
- It must be written BEFORE doing your experiment.
- It helps you refine your ideas and shows your thought process.
- **If…then** statements can be a helpful way to phrase a hypothesis.

Examples:

a) "I think that plants need sunlight because I noticed that plants on the sunny side of my house are larger than the plants on the shady side. If this is true, then if I place one plant in a sunny spot and one plant in a dark closet, I predict the one in the dark will not grow." (Early elem.)

b) "When we were doing an experiment with electromagnets, we discovered that wrapping more wire around the nail made the magnet stronger. This made me wonder if there were other ways to increase the strength of an electromagnet. Besides wire coils, an electromagnet needs an iron core. I think that if I wrap 25 coils around a larger nail, then it will attract more paperclips than 25 coils on a smaller nail." (4th grade)

Notice that these hypotheses have the variable and the idea for how to do the experiment already built into them. It is important to understand that the point of the experiment is NOT to prove you are right. It is fine if the results of your experiment do not support what you thought. Many important science discoveries and advances have been made because scientists were forced to rethink their predictions when things did not turn out the way they had expected. Scientific inquiry is a process more than a method.

4. Materials

List of all materials needed (including things like scissors, containers, tape, etc.) and include the amount of each item.

5. Procedures

- Should be written as detailed step-by-step instructions.
- Should include control when applicable (provides comparison, shows that outcome was a result of changing one variable and not a random occurrence that would have happened regardless.)

Example: *If you are trying to prove chemical reactions happen more quickly if the temperature is higher, you need to run the experiment with room temperature and cold temperature ingredients as well. (5th grade)*

6. Results

- Charts
- Tables
- Graphs
- Diagrams or photographs

7. Conclusion

- Refer back to your original question and examine the actual outcome compared to your hypothesis.
- Discuss any problems you had.
- Offer an explanation or further research or investigations that might be done if your hypothesis turned out to be incorrect.
- Suggest possible real world application for the results of your test.

SCIENCE DIVISIONS

Biological Science: includes all living things and how they are affected by the environment. Examples of topics:

Ecology	Adaptation of Plants	Plants
Conservation	Balance of Nature	Human Body

Physical Science/Earth Science: includes the areas of physics and chemistry. Earth Science includes topics related to the land, sea, atmosphere, and space surrounding the earth. Mathematics is the language used to discuss these sciences.
Examples of topics:

Machines	Heat and Temperature	Molecular Motion and Forces
Engines	Magnetism	Matter
Levers	Light and Color	Astronomy
Photography	Number Systems	Metals
Electricity	Rockets	Elements and Components
Electronics	Sound and Music	Crystals
Synthetic Materials	Molecular Structure	Rocks / Minerals
Aerodynamics	Solutions	Air Currents
Air Pollution	Solar Energy	Conservation

SOME SUGGESTIONS FOR SCIENCE FAIR INVESTIGATIONS:

1. What is the effect of wind on the amount of water that a plant needs? (Biological Science)
2. How can you get kidney beans to grow fastest? (Biological Science)
3. How can you affect the shape of a magnetic field? (Physical Science)
4. How high do you have to raise a smooth board to get a block to slide down it? How does covering the block with felt or sandpaper or other materials affect that height? How does changing the weight of the block affect height? (Physical Science)
5. What affects how fast an ice cube melts in air? How many ways can you get it to melt faster than it does in air at room temperature? (Physical Science)
6. What are the effects of detergent on water? (Physical Science)
7. Which magnifies newsprint more – clear water drop or a soapy water drop? (Physical Science)
8. What is the biggest shadow you can make with a piece of paper 8 ½ inches by 11 inches? What is the smallest shadow you can make with the same piece of paper? (Physical Science)
9. What is the effect of turning young plants upside down as they grow? (Biological Science)
10. How can you get seeds to germinate fastest? (Biological Science)
11. Which seeds germinate fastest? Do little seeds germinate faster than big seeds? (Biological Science)
12. What species of seedling can survive longest in just damp cotton wool in the dark? (Biological Science)
13. Does a water-pick clean your teeth better than a standard toothbrush? (Biological Science)
14. How do different deodorants affect skin and clothes? (Biological Science or Physical Science)
15. What is the fastest way to cool a cup of hot water? (Physical Science)
16. How can you grow the biggest crystals of alum? (Physical Science)
17. How does light affect plants?
18. Do sweet, salt, and bitter substances taste the same to everyone?
19. How can you affect the time it takes for bread to rise?
20. What happens when you soak egg shells in vinegar? What about when you soak them in lemon juice or other kitchen chemicals? (Physical Science)
21. What kind of fruit rots fastest?
22. Do plants grow faster if you talk (or sing) to them regularly? (Biological Science)
23. Do people who play sports regularly have the same heart rate as people who don't? Do sports people recover from exercise more quickly than less active people? (Biological Science)

24. Will seeds sprout faster in soil or in a plastic bag with damp cotton wool? (Biological Science)

25. What is the fastest way to get food to rot? Warm or cool places? Damp or dry? Light or dark? In the presence of other moldy things? (Biological Science)

26. Do preservatives in manufactured foods really work? Try different ways to get “Twinkies” to rot!

27. Which gum keeps its flavor the longest? Which blows the best bubbles? What is most stretchy? Which loses the most weight after you chew it? (The weight lost is the sugar your saliva dissolved away.)

28. How can you make suds last longest? Compare shampoo to dishwashing detergent. Compare different brands of shampoo to each other and different brands of dishwashing detergent to each other. (Physical Science)

29. Investigate all the different effects of static electricity. What is the effect of static electricity on paper, plastic, different kinds of breakfast cereal? (Physical Science)

30. Which brand of paper towel stays strongest when wet? (Physical Science)

31. Which freezes fastest - Coke, Kool-Aid, strong salt water, or weak salt water? (Physical Science)

32. How can you stop cut apples from going brown? (Biological Science)

33. What mixtures will a filter separate? (Physical Science)

34. How can you make the best cup phones? (Physical Science)

35. How do lenses and pieces of glass bend light? What else can bend light? (Physical Science)

36. What is the best way to keep steel from rusting? (Physical Science)

37. Which filtering systems work best to clean dirty water? (Physical Science)

38. How does the color of light affect plant growth? (Biological Science)

39. What conditions affect the growth of mold? (Biological Science)

40. How does temperature influence yeast cell reproduction? (Biological Science)

41. How does the angle of an inclined plane affect the work to lift an object? (Physical Science)

42. Which surfaces provide the least amount of friction? (Physical Science)

43. Which fruit and vegetable juices make good indicators for acids and bases? (Physical Science)

44. How does water depth affect water pressure? (Physical Science)

45. Which materials insulate best against the cold? (Physical Science)

46. Which mouthwashes retard the growth of bacteria? (Biological Science)

47. Do bacteria grow better in the light or dark? (Biological Science)

48. Compare two parts of your body to see which normally harbors more bacteria. (Biological Science)

49. Find the best way to wash a finger and remove the most bacteria. You could try paper towel drying compared to air drying. You could try the effect of soap compared to air drying. You could try the effect of soap compared to no soap. (Biological Science)

50. Compare the amount of bacteria in soil samples from two different places.

51. Does toilet paper stop bacteria getting through? Try touching agar with a naked finger and then with a finger wrapped in one layer of toilet paper. (Biological Science)

52. Which materials conduct electricity? Try different kinds of liquids too. (Physical Science)

53. How does the shape of a reflective surface affect the reflection of light? (Physical Science)

54. What is the relationship between magnification and the focal point of a lens? (Physical Science)

55. Does the color of a container affect the amount of light energy absorbed? (Physical Science)

56. How do offspring reflect parents' traits? (Biological Science)

57. What part(s) of a plant can be used to propagate a plant? (Biological Science)

58. Which design of paper plane will fly the furthest? (Physical Science)

59. Who can react faster to a bell - children or adults? (Biological Science)

60. Can people identify different kinds of Kool-Aid by taste alone? (Biological Science)

61. What is the effect of detergent on the life in pond water? (Use containers of pond water – don't pollute a pond.) (Biological Science)

62. What effect does salt have on the properties of water? (Example: Acidity lathering ability with soap, dissolving ability of sugar, freezing and boiling points.) (Physical Science)

63. What affects the success of making sponge cake? (Physical Science)

64. What affects the rate of the baking soda and vinegar reaction? (Physical Science)

What will judges be looking for?

A sample judging form is included on the next 2 pages to give you an idea of the questions they will ask themselves as they look at projects.

Example of Science Fair Judging Form

Project No._____

General Instructions

Award a number from 1 to 10 to each category, 1 being the lowest points possible, and 10 being the highest points possible. The questions listed under each category are there to help you determine the number of points to award, but be flexible.

Ideally, all children could receive a perfect score. It is quite possible for a number of projects to be equally good. Don't try to determine the best project. Award points as merited. Be kind, but don't give all 100's.

Scientific Method

1. Is the problem clearly stated in the form of a question?
   Is there a reasonable hypothesis offered?
   Is the reason for the hypothesis explained, if appropriate?
   Remember that K-3 projects may be demonstrations, while 4-6 projects must involve problem solving. ____/10

2. Is the procedure explained in terms the child and you can understand? ____/10

3. Are the graphs and charts labeled properly?
   (If there is no possible way to use graphs or charts, give a 10. If there is no way to quantify things, they should have a graphic display of results – look to that and award points accordingly.) ____/10

4. Is the conclusion supported by the results?
   Did the child compare the hypothesis with the conclusions?
   Is there an attempt to establish a relationship between cause and effect? ____/10

5. Was the experiment controlled? Were there comparisons that proved that the cause of the result was not accidental or it was not what would have happened under any conditions, not just the experimental ones? Be aware some types of experiments are more difficult to control than ones dealing with batteries or freezing points. Do not downgrade children if there was a reasonable attempt at controls for such experiments. Were enough trials made to verify results? ____/10

Scientific Accuracy

1. Did the student give credit to sources of information obtained, if any?
2. Is the factual information correct and are the figures calculated accurately?
3. Is the spelling correct? ____/10

Knowledge

1. Is it obvious that the student understands the material and has learned something?
2. Does the overall project show logical development? ____/10

Neatness and Attractiveness

1. Are the labels and title neat and legible?
2. Is the handwriting in the report as neat and legible as you could expect for this age level? (Do not downgrade a K-2 child who may have motor coordination to develop for writing this paper imperfectly in comparison to a child who prints easily or one who had a parent do it (e.g., a kindergarten child who prints backward letters or numbers should not be penalized.)
3. Is the project as attractive as might be expected of this age child? (Do not downgrade if it is acceptable – e.g., a beautiful, extraordinary project should not necessarily get more points than an acceptable one. Only downgrade unacceptable attempts.) ____/10

Time and Effort, Level of Difficulty

Award the child from 1 to 10 based on apparent time and effort he/she spent on this project. ____/10

Overall Impression

Award the child form 1 to 10 based on your overall impression of the project. ____/10

Total Score ____ /100

Judge Sign-off: _____

Comments: _____

_____

REFERENCE SCIENCE FAIR BOOKS AND PERIODICALS

Barr, George	Research Ideas for Young Scientists, McGraw Hill Book Company, 1958.
Barr, George	More Research Ideas for Young Scientists, McGraw, Hill Book Company, 1961.
Barr, George	Research Adventures for Young Scientists, New York, McGraw Hill Book Company, 1964
Benre, Ronald	Ideas for Science Fair Projects, Arco Publishing Company, Inc., 1963.
DeBruin, Jerry	Cardboard Carpentry, Carthage 11, Good Apple, Inc., 1979
DeBruin, Jerry	Creative Hands-On Science Experiments, Carthage 11, Good Apple, Inc., 1980 (Chapters 8 and 9).
Lafferty, Peter	Burning and Melting Hands-On Science, Gloucester Press, 1990.
Lafferty, Peter	Magnets to Generate Hands-On Science, Gloucester Press, 1990.
Markle, Sandra	Science Mini-Mysteries, Atheneum, New York 1988.
Stone, George K.	More Science Projects You Can Do, Englewood Cliffs, New Jersey, Prentice-Hall, 1981
VanDeman, Barry A. and Ed McDonald	Nuts and Bolts: A Matter of Fact Guide to Science Fair Projects, Harwood Heights, Illinois, The Science Man Press, 1980.
Science and Children, January, 1983	(Science Fairs are highlighted in this issue.)

These are older references. You will find more up-to-date books at your favorite bookstore or online – the internet can be a valuable source of information.