

Guide to the Science & Engineering Fair in Elementary Grades



Frederick County Public Schools



Table of Contents

Page 3	Getting Started and Project Types
Page 4	Experiment Based and Research Based
Page 5	Technology and Engineering Process
Page 6	Life/Environmental Science Ideas
Page 7	Earth/Space Science Ideas
Page 8	Chemistry/Physics Science Ideas
Page 9	Planning Your Science Fair Project Checklist
Page 10	Displaying a Science Fair Project- Experiment Based
Page 11	Rough Draft for Your Project Display - Experiment
Page 13	Displaying a Science Fair Project - Research Based
Page 14	Rough Draft for Your Project Display - Research
Page 16	Displaying a Science Fair Project - Tech. & Engineering
Page 17	Rough Draft for Your Project Display Tech. and Engineering
Page 18	Websites for Project Ideas

Getting Started

Many times the hardest part of doing a science fair project is getting started. Consider what you like to do or learn and start there. The possibilities are endless and many ideas can come from just observing the world around you and exploring your interests.

Parents, please work with your child to select a project idea they can get excited about! Even young students can participate in the fair. Make it simple! A collection of objects from nature is a great project for beginners. The important thing is getting into the spirit of science and having fun while learning.

Project Types for Grades Pre-Kindergarten - 5th Grade

Research-Based

By creating a research-based project, students can explore a variety of scientific topics according to their varied interests. The research-based project can be as basic as a collection, display, or demonstration, but always includes some level of research appropriate to the student's grade level.

For example, a student may have an interest in sharks. A younger student might create a display of different kinds of sharks and present basic information about each. An older student could research the different kinds of sharks and explain how some are better suited to live in certain oceans, while others would not be able to survive. Or they could research the environmental impact pollution has had on the shark population.

Any elementary student can enjoy the process of researching a topic interesting to them or exploring a question they have long wondered about.

Experiment-Based

By creating a project based on the scientific method, students can become familiar with a useful strategy that will assist them in solving problems.

For example, a student may want to determine which boat shape is least likely to tip over. This project could begin with the student designing several different boat shapes, then testing them with weight placed in several different positions.

After conducting the experiment, it then could be related to a real-life application. For instance, when purchasing a kayak for an inexperienced person, what design would be best for stability?

Not only is it important to design an experiment that can follow the scientific method, but it is also important to link the experiment to being useful in real life.

EXPERIMENT-BASED

State the problem you want to solve

Hypothesize - What do think will happen?

Design your experiment

- Tested variable
- Controlled variables
- Measured variable
- Data to be collected
- Materials needed

Conduct your experiment

- Observe
- Collect data
- Organize data

What did I learn? - Write your Conclusion(s)

Real-life application/research

- Why would I want to know this?
- How can this be used in the real world?
- What else can I learn about this by doing some research?

Prepare your display (may include...)

- Pictures/photographs
- Data tables
- Graphs
- Charts
- Written real-life application/research

RESEARCH-BASED

State the question you want to research

Why do you want to learn about this?

Design your research

- Potential sources of information
- Observations to be made
- Field notes to be taken
- Display materials needed
 - Photos
 - Descriptions
 - Artifacts
 - Models

Conduct and organize your research

- Observe
- Research your sources
- Organize your information

What did I learn? - A written summary of your findings.

Reflection

- How is what I learned useful to me?
- What else does this make me want to know?

Prepare your display (may include...)

- Pictures/photographs
- collection or display
- demonstration
- written summary

Technology and Engineering

Technology is anything created or used to solve a problem or fulfill a desire. For example, a mouse trap is a form of technology developed to solve a problem. An I-Pod is a form of technology developed to fulfill a desire to have a convenient way to store and listen to music.

Engineering is solving problems by developing or improving a technology. Engineers are designers of technology. Students wishing to create a project in this category become inventors or designers. For example, a student could decide to design a lunch box alarm to protect their valuable snack cakes. What a great way to put science into action!

Use the following steps to create a new technology or improve an old one.

TECHNOLOGY AND ENGINEERING

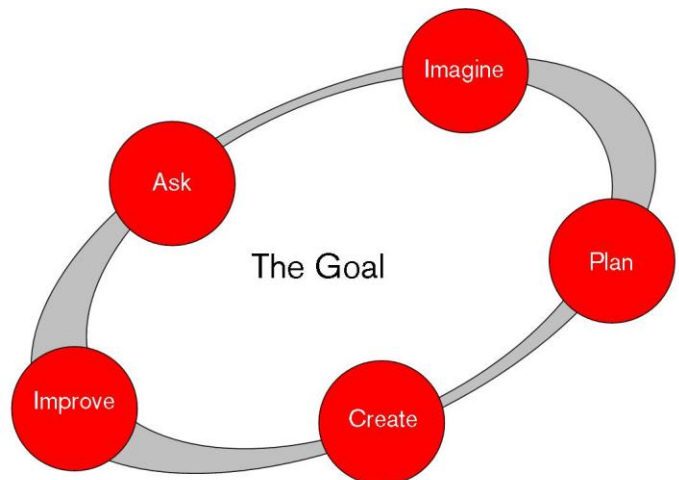
Ask: What's the problem?
What have others done?
What are the constraints?

Imagine: What could be some solutions?
Brainstorm ideas.
Choose the best one.

Plan: Draw a diagram
Make a list of materials you'll need

Create: Follow your plan and create it.
Test it out!

Improve: Make your design even better.
Test it out!



(Created by Engineering is Elementary, Museum of Science, Boston. Used with permission.)

<http://www.mos.org/eie>

Life/Environmental Science Ideas



Learning about nature and the environment is just the beginning with Life/Environmental Science. Think about these questions...

- How do animals in an environment cause changes to the environment to make it easier for them to survive?
- How do single-celled organisms behave and survive?
- How is the white tail deer population beneficial and harmful to the environment?
- How are sharks well-suited to the environment in which they live?
- How do organisms change at each stage in their life cycle?
- Why are certain habitats better than others for meeting the basic needs of organisms?
- What are the consequences when Earth's natural resources are used?
- How are people in Maryland affected by the environment?
- Why do some organisms need others in order to survive and reproduce?
- Can you invent a way to pollinate a flower?

Great ideas for life/environmental sciences are just outside your door. Take a walk through your neighborhood or a local park. Make observations about what you encounter along the way. Some great places to visit locally in the Frederick area include:

- The Great Frederick Fair
- Fountain Rock Nature Center
- Catoctin Mountain Park
- Sugarloaf Mountain
- Landfill



Life Science Units

Kindergarten: Alive
First Grade: Organisms
Second Grade: Life Cycles
Third Grade: Aquarium Habitats
Fourth Grade: Classification
Fifth Grade: Terrarium Habitats

Earth/Space Science Ideas



From the skies above to the land below, Earth/Space science is fascinating. To explore this topic you could:

- Create a model of Earth and identify why life can survive.
- Describe how events such as hurricanes change the Earth's surface and design a plan to reduce flooding.
- Research fossils and describe the environment in which the plant or animal lived.
- Design an experiment to test the evaporation rate of water and how to best conserve this resource.
- Observe and describe the pattern of stars in the sky and how they appear to change with the seasons.
- Compare Earth to another planet in our solar system.
- Research farming practices that limit erosion, and how the Chesapeake watershed is impacted by runoff.
- Create a model to show how physical weathering changes the Earth's surface.
- Observe and collect data on weather patterns in your community and compare them to another area.
- Invent a new way to purify water.

The Earth and Space Science Lab is located at 210 Madison Street, Frederick, Maryland, 21701 (adjacent to Lincoln Elementary). This state-of-the-art facility is a great resource for learning more about Earth and Space Science. They provide evening shows available to the whole family. Visit the FCPS website <http://essl.sites.fcps.org/> or call (240) 236-2694 for current dates and times.

Earth/Space Science Units

Kindergarten:	Earth
First Grade:	Weather
Second Grade:	Finding the Moon
Third Grade:	Rocks, Soil, and Fossils
Fourth Grade:	Space
Fifth Grade:	Rocks, Erosion, and Weathering



Chemistry/Physics Science Ideas



Chemistry and physics are part of our everyday life. It can inspire you to learn about the way things work, or make something work even better. To explore this topic you might consider:

- Experimenting with vehicle and ramp properties to learn about force, mass and motion.
- Exploring periodic motion using a pendulum.
- Observing, describing, and comparing different types of motion. Then, find some real-life examples.
- Exploring heat conductors and measuring heat loss to design a better insulated cup.
- Researching an alternative source of energy production.
- Exploring magnets and how they act with objects.
- Demonstrating how an electromagnet works and how to alter its strength.
- Experimenting to show how heating and cooling can cause changes to an object's observable properties.
- Learning about chemicals in your household.
- Designing a new kind of fire alarm.

The Maryland Science Center in Baltimore is a fabulous place to investigate the physical sciences, but you really don't have to travel far to find some really fun places to visit. Try taking a bridge tour around Frederick and look at the different construction techniques or just look around the house at the variety of machines we use everyday to make our lives easier.

Chemistry/Physics Science Units

Kindergarten: Matter and Heat / Magnets

First Grade: Solids and Liquids

Second Grade: Changes

Third Grade: Chemical Tests

Fourth Grade: Motion and Design and Light

Fifth Grade: Electricity, Magnets and Electromagnetism



Planning Your Science Fair Project

Checklist

Planning your project is a critical factor in having enough time to do a thorough job. You should start brainstorming at least 1 to 2 months ahead of time and try to allow 2-4 weeks to complete your project depending on the project itself.

- Brainstorm ideas
- Choose a topic
- Narrow your topic
- Write a problem
- Form a hypothesis (experiment-based)
- Design the project
- Think of a title
- Gather materials and/or resources
- Do the experiment or research / Plan the engineering design
 - Observe
 - Collect data or research your sources
 - Organize data or information (charts, graphs, pictures, journal)
- What did I learn?
 - Write a conclusion (experiment-based)
 - Write a summary of your findings (research-based / technology and engineering)
- Real-life application (experiment-based) or Reflection (research-based / technology and engineering)
 - Why would I want to know this?
 - How can this be used in the real world?
 - What else can I learn about this by doing some research?
 - How is what I learned useful to me?
 - What else does this make me want to know?
- Prepare your display
- Practice your presentation

DISPLAYING A SCIENCE FAIR PROJECT

EXPERIMENT-BASED

Title

Procedure

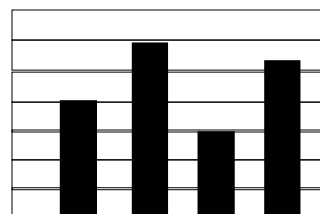
Problem

Results

Data Table

Trial 1 Trial 2 Trial 3 Average

Graph



Purpose

Materials

Hypothesis

Conclusion /

**Real-Life
Application**

Rough Draft for Your Project Display



Experiment-Based Design

Use the space provided to plan your project and what you will include on your project display. Once you have completed this rough draft, have a parent or teacher look it over for you. Then you are ready to make your display. If you need more room, attach another sheet.

Title: _____

Problem: _____

Hypothesis: _____

Purpose: _____

Materials: _____

Procedure: _____

Results (graph, observations, chart, tables):

Conclusion (What did I learn? Be sure to relate back to your problem and include data to support your findings.)

Real-Life Application/Research (Why would I want to know this? How can this be used in the real world? What else can I learn about this by doing some research?)

DISPLAYING A SCIENCE FAIR PROJECT

RESEARCH-BASED

Title

Observations

Research

Question

Purpose

**Pictures /
Photographs**

**Materials /
Resources**

**What Did I
Learn? /
Reflection**

Rough Draft for Your Project Display



Research-Based Design

Use the space provided to plan your project and what you will include on your project display. Once you have completed this rough draft, have a parent or teacher look it over for you. Then you are ready to make your display. If you need more room, attach another sheet.

Title: _____

Question: _____

Purpose: _____

Materials/Resources: _____

Observations: _____

Research: _____

What did I learn? (Summary of your findings)

Reflection (How is what I learned useful to me? What else does this make me want to know?)

DISPLAYING A SCIENCE FAIR PROJECT

TECHNOLOGY AND ENGINEERING

Title

Possible Solutions

What's the Problem?

Design

Purpose

Improvements

Materials / Resources

**Pictures / Photographs/
Design Diagrams**

What Did I Learn? / Reflection

Rough Draft for Your Project Display



Technology and Engineering Design

Use the space provided to plan your project and what you will include on your project display. Once you have completed this rough draft, have a parent or teacher look it over for you. Then you are ready to make your display. If you need more room, attach another sheet.

Title: _____

What's the problem?: _____

Purpose: _____

Materials/Resources: _____

Possible Solutions: _____

Design/Improvements: _____

What did I learn? (Summary of your work)

Reflection (How is what I learned useful to me? What else does this make me want to know?)
