2016
Science Fair Handbook

Fairlands Elementary School

This book belongs to:

Full-size handbook available online on the PTA Science Fair page at

www.fairlandspta.com

and Mrs. Holder's Website www.tinyurl.com/FairSciLab

Science Fair Vision

The purpose of the Fairlands Elementary School Science Fair is...

- To demonstrate that 'Science can be fun'.
- To stimulate and nourish personal interests in science.
- To promote understanding of and creativity in the Scientific Method of Investigation.
- To promote self-discipline necessary to accomplish the project.
- To give the students a sense of pride and accomplishment derived from participation.
- To foster a lifelong appreciation of scientific processes in preparation for life in an increasingly technological society.
- To promote educational links among parents, school, community, and the world.

Support Provided By:
Fairlands School PTA

This is a school-site supported program that only exists due to the financial and physical support of our very own parents, families and staff here at Fairlands. We work hard to ensure that Fairlands kids love science, and this Fair is a great celebration of all that enthusiasm! A heartfelt "Thank You" goes out to all the people who make it possible.

If you'd like to be a part of the crew who helps...from selling display boards after school to helping type certificates, to helping monitor classes coming in to view the projects, please contact volunteers@fairlandspta.com .

2016 Science Fair Coordinator:

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Handbook written by Stacey Holder

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Questions about
the 2016 Fairlands Science Fair

Fairlands' Science Fair is on THURSDAY, JUNE 2 from 6:30-8pm

What is the Science Fair?

The Science Fair is a non-competitive exhibition of student-developed science inquiries open to all students: pre-kindergarten through fifth grade. The event involves choosing one of the five types of projects and completing the preparation (at home), the presentation (to the class) and a static display of the project board (to set up in the MPR).

Is my student required to do a science project at the Science Fair:

5th Graders: YES, all 5th graders are required to do an EXPERIMENT.

K-4th graders: No, the Science Fair is open to all K-4 students on a voluntary basis, unless required by the classroom teacher. Projects are to be done at home. No registration is necessary, just inform your child's teacher of your intent two weeks prior and bring the project to school when it is due.

What do I need to know as a parent?

Science projects should be done at home with family support, but should be student-driven. 5th graders must do individual projects, and it must be an experiment. K-4th grade students may work alone or in groups of 2-3 students. K-4th grade projects can be one of any of the five project types. Siblings may work together, but be sure students share the work and that all are as involved as age allows. If your student wants to use plants, it is suggested to allow at least 6-8 weeks and use quick growing seeds such as radishes or fast-growing annuals from the nursery. Encourage your student to do a unique investigation, not just a repeat of something they saw on the internet. The best project ideas come from brains...based on observations and interests!

What does my student bring to school and when?

5th graders should expect projects due in class the week of May 16 (classroom teachers will give you due dates). All K-4 projects will be turned in to the MPR on Tuesday May 31. K-4th grade parents may help students bring their project to the MPR after school 2:50-4:00 May 31. A "project" means a free-standing, standard size display board. (Not a poster.) The project board should be bright, colorful and clearly show what was learned. It should be labeled on the top of the right flap (when closed) with student name, grade, teacher and room number. *If desired, practical and safe, students may bring parts of their experiment as well AT YOUR OWN RISK. Nothing fragile, valuable, toxic or a known allergen is allowed. If it will be tempting for little hands to touch the materials, perhaps it should be left at home. Keep in mind it will be on display in the MPR.* **LABEL ALL PARTS WITH YOUR NAME AND ROOM #.**

Where can I get a display board? What size should it be?

The PTA will generously provide white three-panel cardboard display boards to any student who wants one. They will be distributed directly to students who come by after school in the hall behind the science lab in April (usually after Spring Break) through May 20. These boards are 27" tall and approximately 20" wide (when folded closed). Donations of any amount up to $1.00 per board are appreciated, but not necessary. Alternatively, taller and wider boards of different colors and composition can be purchased at local office stores or craft stores. The standard-sized boards are usually 32-36" tall and 24" wide when closed. Three-panel display boards can also be crafted out of any thick cardboard ("poster board" usually doesn't work, though). Please make sure all displays are free-standing. Please ask your teacher if you need help getting materials.

What if a student wants to enter a competition?

The Alameda County Fair, held in June-July at the Pleasanton Fairgrounds, has a division for science fair projects. Entering the Alameda County Fair is completely separate from our school's science fair. It is a judged competition. Check their website for guidelines.

Types of Science Fair Projects

5th Grade Projects must be EXPERIMENTS, all other grades can choose one of five categories: Experiment, Collection, Observation, Model, or Invention

. *(HOT TIP: For plant experiments or observations, please choose fast-growing plants. Radish plants go from seed to full-grown radish in 1 month, making them great for experiments!)*

1. EXPERIMENT (K-5th)

An experiment starts with an interesting observation and then answers a question using the scientific method. Questions should be based on fact, not opinion, should be open ended (not yes/no) and should seek to measure something rather than answering a “How does this work or happen…?” type of question.

Examples of observations that could lead to experiment ideas might include: that mold seems to grow differently on bread, cheese or fruit, that you can roll really far on some surfaces but not others, the ocean is full of salt water but rain isn’t salty or that fertilizer is supposed to make plants grown fast. The key is to take an idea and then turn it into a MEASURABLE, open-ended question.

An experiment occurs when one variable (the independent variable) is changed. Another variable (the dependent variable) responds to the first and is watched. Other variables (constant variables) remain the same, or are unchanged, throughout the experiment.

Once again....in “PLAIN English”:

- DO something (Bounce a ball)
- CHANGE one thing about what you did. (Use a different kind of ball...the INDEPENDENT variable)
- DO it again, but keep everything else the same (Same height from the ground, same surface...these are the CONSTANT variables)
- MEASURE something (the height it bounced....the DEPENDENT variable)

2. COLLECTION (K-4th)

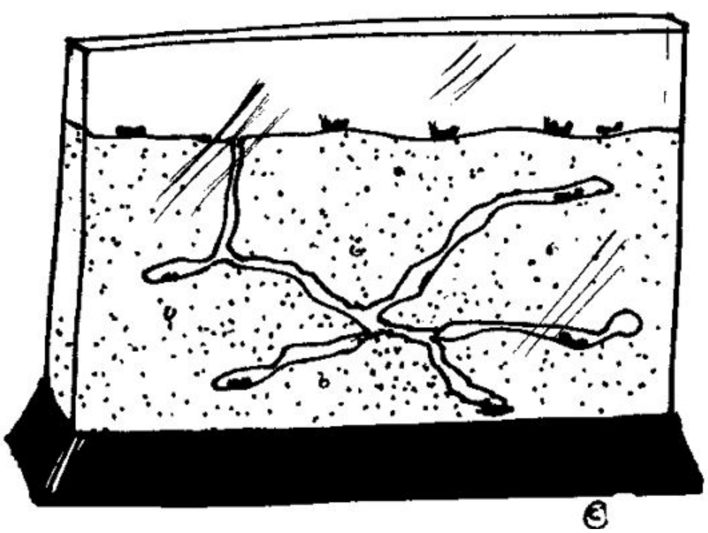
A collection study is a fun way to learn the proper names of objects that interest you. It involves collecting the objects, describing them, grouping them, and identifying them by their proper name.

The five senses may be used to describe objects:

Eyes	color, shape, sheen
Hands	texture, weight, temperature
Ears	pitch, rhythm, loudness
Nose	odor, strength
Tongue	sweet, sour, salty, bitter

Examples of a collection might be leaves, insects (which are found dead...no harming live animals!), sea shells, fossils, rocks, coins, or simple machines. Your display board should have labels, explanations and/or background information.

3. OBSERVATION (over time) (K-4th)



An observation study begins with the selection of a topic and a question that can be investigated by observing. Specific movements, behaviors, changes or actions in nature might be observed over a period of time, and once the observations are gathered, they are studied for patterns that will answer the question.

Examples of an observation project might be ants' eating habits, pollination process, moon phases, family pet behavior or insect life cycles.

Display boards should have drawings, photographs, explanation of how you gathered information and/or background information.

4. MODEL (K-4th)

A model study may begin with a curiosity about how something works. It is a way to display the parts of something and how what each part does to carry out a particular function. Examples of functional models may include building an electromagnet, showing how lungs work, making a solar cooker, or connecting wires to show the difference between parallel and series circuits. Another type of model is an enlargement or reduction as a scaled version of an object. Examples of enlarged-scaled models include building a flower model, a model of the human eye, or a cross-section of an apple. Examples of reduced scale models include making craters on the moon, the solar system, a dinosaur, or a space shuttle. It is important for the student to make a comparison between the real item and the model…what is "good/bad" about the model? Display boards should include information on how it works, diagrams of parts and/or other interesting information.

5. INVENTION (K-4th)

An invention can be one of two things. First, it can be some thing or some process that has never been made or done before (for example, the first spaceship made from a cereal box that actually flies or a way to purify water using only a Ziploc bag). The other type of invention is one in which a thing or process is modified in some way (for example, a better television, a better brake system in a car, or the classic "better mousetrap", but DON'T HARM ANY ANIMALS TO DO YOUR PROJECT!). Such a changed thing or process is still considered an invention. Examples of an invention for the Science Fair might be – design a new toy, make a lunchbox that will keep food fresh for 12 hours, design a new pot for growing plants, make an electromagnet that will pick up 10 nails, or build a bird feeder that will attract only a certain bird (but not squirrels!!!).

The Scientific Method

Use this guideline for an EXPERIMENT project.
Other project types may or may not be able to follow this format; it depends on the individual project.
Underlined words should be used on a display board if possible.

1. MAKE AN OBSERVATION

Notice the world around you. Listen when people talk. Read books. When you hear an interesting idea that makes you think, "I wonder what would happen if……" or "I wonder why…" use it! An observation is simply a factual statement such as, "Sometimes my hair dries quickly and sometimes it takes a long time to dry." "A ball rolling on the playground stops quickly when it reaches the grass."

2. SELECT A QUESTION , DEFINE A PROBLEM

The best science project comes from a question that YOU want to answer. You may also include an explanation as to why you selected the project. Your question should be asked in such a way that it couldn't be answered with a simple yes or no. For example, "At which temperature does salt water freeze?" is a better question than "Does salt affect the freezing point of water?" The question should be based on fact, not opinion. Instead of, "Which fertilizer works best?" try "Which fertilizer produces more blooms?" The question should include "measuring" (with a tool or at least "counting") something. Be careful of questions that begin with "Why" or "How". Usually these questions aren't measurable. In other words, there's usually no data for the student to collect! In other words, **if you can find the answer by reading it on the internet or in a book, it's not a science fair project.**

3. FORM A HYPOTHESIS

This is a guess or prediction about what will happen as a result of your experiment. Forming a **hypothesis will help you design your procedure**, and the experiment will prove or disprove your hypothesis. "I think…" or "I predict…" Doing some research first helps you to add an explanation of WHY you think that will happen.

3. PERFORM THE PROCEDURE, LIST THE MATERIALS

Plan the details of your experiment. Select the independent (manipulated) and dependent (responding) variables. Decide which things you must keep the same – these are your controlled variables. FOR EXAMPLE: **independent variable (what is being changed)**: hours of sunlight a plant receives daily, **dependent variable (what is being measured)**: height of the plant, **controlled variables (things that are kept the same)**: amount of water, type of plant, amount of fertilizer, etc.

1. Determine what you will be measuring and what instrument or tool you will use.
2. Plan how the tests will be done. If applicable, do a "small scale" test to see if things will work as you are hoping. Which test will you do first?, How many tests will you do?, What will be recorded?, How many times?
3. Assemble the equipment to be used in the experiment. (Sometimes you have to invent something!)
4. Prepare data sheets for recording measurements and for your comments.
5. **As you perform the tests, take notes on your procedure to formally write up later**. Enter all measurements on your data sheets. It is important that you repeat each test several times. Take photos as additional records if desired.

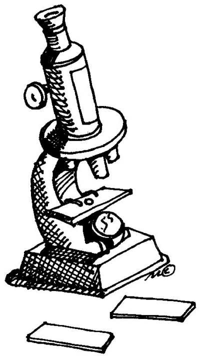
4. PREPARE AND EXPLAIN THE RESULTS

Group and organize the measurements and observations you have made. Make charts, graphs, and/or tables to show what happened. It is best if you show your results in more than one way. A table and a graph, photos and an observation log, etc.

5. DRAW A CONCLUSION

Answer your question. Try to explain "how" and "why" the results are what they are. What was the cause? Do the results agree with your hypothesis? What can you say about your experiment in general? What can you count on happening again if someone else does a similar experiment? If possible, try to describe how your results might apply to everyday experiences. Use the following format for a very thorough, powerful conclusion:

CLAIM: (What is your question's answer? What are you saying you discovered?)
EVIDENCE: (Restate some of your results, especially those which relate to your claim)
REASONING: (This almost feels like "stating the obvious" at this point, but you connect the evidence to the claim. "Because B happened when I did A, that means A caused B " (the plant to grow faster, for example))



Getting Started...

The first step in getting started on your project is choosing a topic. Think about the fun projects, experiments and questions that come up in science lab. What are some topics you are interested in? Here are some suggestions. The world is full of hundreds of ideas from A to Z!

A amphibians, animals, archaeology, astronomy
B bats, biology, birds, boats, bones, brain
C chemistry, color, computers, conservation, constellations, caves
D dew, digestive system, dinosaurs, disease, drugs, decomposition
E ear, ecology, electricity, enamel, energy, eye, earthquakes
F fingerprints, fish, flowers, fossils, friction, fruits
G gardening, geology, giraffes, glass, glaciers, gravity
H habitats, heart, herbs, hot-air balloons, human body, heat
I insects, instinct, insulation, invertebrates, ice
J jellyfish, jet propulsion, jet stream, joints
K kaleidoscope, kangaroos, kelp, kidney, knee
L lava, life cycle, lightening, lizards, lung
M machines, magnets, matter, minerals, molecules, motors
N natural resources, nervous system, nutrition
O oceanography, optical illusion, osmosis, ozone, oxygen
P paleontology, petroleum, plants, pollution, plate tectonics
Q quail, quartz, quasar, queen bee, quicksand
R rainforest, reptiles, respiratory system, robots, rocks
S soap, solar power, sound, spiders, springs, sundial
T teeth, telescope, terrarium, turtles, tsunami
U ulcers, unicycles, Uranus, umbrellas
V vertebrates, vitamins, vocal cords, velocity, viscosity
W water, weather, work, worms
X x-rays, xylophone
Y yams, yeast, yogurt
Z zebras, zinnias, zucchini

Let the ideas on this list be just a beginning...and see what kinds of questions they lead you to!

Use the scientific method if at all possible (mandatory with an experiment, with other projects it depends on exactly what you are doing). Using the scientific method will help guide your discoveries and prepare you for future scientific studies.

Your project does not have to be complicated or use expensive materials. In fact, the best projects are simple and based on something the student is interested about. Students may use books or the internet to find an idea, but are encouraged to modify the experiment to make it original. Adults should help with your project as little as possible. **Your work should be your own so that you understand your project.**

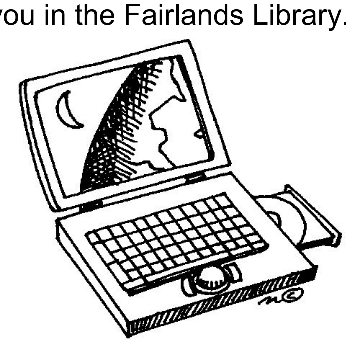
Science Fair Project Research

Once you have a general topic or area of interest, it's time to learn something about it to narrow down exactly what you want to find out in your project. Research can take many forms. It can help you to learn background information, help explain the "hows and whys" of their project. You can research ingredients in the soaps you are using, research the paper-making process if you do an experiment about paper towel absorbency, or find out what's inside a battery and how it works if doing an experiment using batteries.

IDEA BOOKS AND WEBSITES:
Be cautious of repeating an experiment that your child has seen, read about or heard about. Just repeating something someone else has done won't allow your child to truly get involved with the scientific process, just as copying other school work doesn't allow for learning. Instead, use websites and project books to spark an idea that is original…a question that your student comes up with on their own. Think about what could be changed about an experiment that you've read about. What can be measured? What other materials could be used?

THE "SMALL-SCALE TEST":
The TV show The Mythbusters uses a technique in a lot of their investigations in which they build a model or otherwise perform a smaller, less expensive or simpler version of the "big" idea they want to test out. In some cases, it's a good idea for a student to perform a small scale test to be sure his or her idea is going to work before devoting a lot of time and effort on a project just to find out with two weeks left to go that you have no results! In this way, performing the small scale test is actually a form of research which might even lead you to a different project altogether.

FINDING THINGS AT THE SCHOOL OR PUBLIC LIBRARY:
Science books, including books about science fair projects, are generally on shelves found in the 500's and 600's. You can use the Pleasanton Public Library or Mr. Mutzl has pulled out a great collection for you in the Fairlands Library.



WEBSITES:

- **http://www.fairlandspta.com/science.html Mrs. Holder's collection of favorite science resources…plus, an electronic version of this packet….just in case it gets misplaced.**

- https://sites.google.com/a/pleasantonusd.net/fairlandsscience/ **Mrs. Holder's site with all kinds of science lab information and a tab on the left for "Science Fair Central"**

- http://school.discoveryeducation.com/sciencefaircentral/Getting-Started/idea-finder.html As the URL implies, this is an Idea Finder...an interactive way to get your idea narrowed down. ...***Highly recommended!***

- http://www.sciencebuddies.org/ Also highly recommended! Ideas, advice, mentors, more!

- http://www.ipl.org/div/projectguide/   A librarians' index to the Internet; a pre-screened selection of thousands of websites: all resources they list have "good" information.

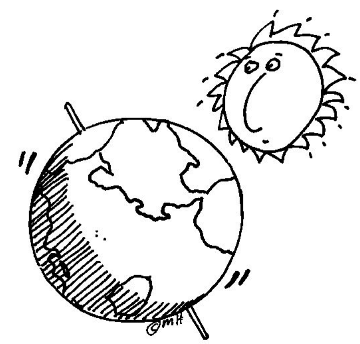
QUESTIONS TO GET YOU THINKING

*Please note: **The ideas below are NOT "science fair-ready"**. In other words, they aren't worded properly to be an "open-ended, measurable, testable experiment". These are only ideas from which the student should state THEIR actual question that they will explore.*
Many of these are "yes or no" questions which are not appropriate for a science fair project.
Be sure to come up with a way to do a FAIR TEST (keeping all variables constant except the one you are testing.)

SAFETY:

- Always use proper safety equipment and adult supervision.
- Be cautious around chemicals, heat, sharp objects, etc.
- You may not harm any animal, big or small, in any way.

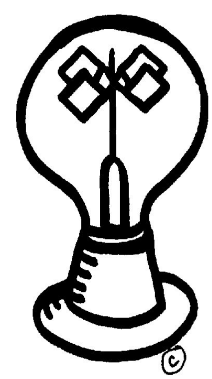
EARTH SCIENCE:



1. Can I predict the weather?
2. What effect does surface color have on heat absorption?
3. How does a bend in a river affect erosion?
4. What effect does temperature have on crystal growth?
5. What surface retains the most heat, land or water?

PHYSICAL SCIENCE:

1. Which materials conduct heat efficiently?
2. Do all liquids have the same density?
3. What type of work can each simple machine help with?
4. What affect does speeding up evaporation have on temperature?
5. What affects the way a pendulum swings?



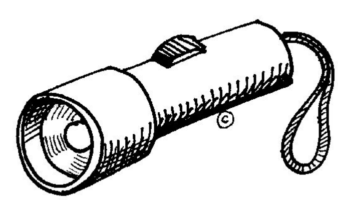
LIFE SCIENCE:

1. Does temperature affect plant growth?
2. Is memory improved if more than one sense is used?
3. Can you identify a spider by it's web?
4. Do hummingbirds have a color preference?
5. Does weight affect lung capacity?

ENVIRONMENTAL SCIENCE:

1. How long will litter last? Is it ok to litter with things that are "biodegradable?"
2. Where does our water come from? Where does it go?
3. What are some sources of renewable energy?
4. What uses less water, a shower or a bath?
5. What are the effects of different types of pollution on plant growth?

CONSUMER SCIENCE:

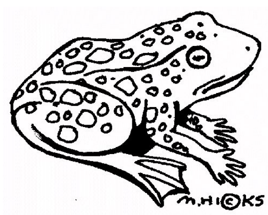


1. Which shampoo and conditioner stops tangles?
2. Which detergent cleans the most efficiently?
3. Which paper towel picks up the most water?
4. Which brand of nail polish lasts the longest?
5. Does cost affect the length of time a battery lasts?

Special Note to Younger Students

Doing a science fair project does not require technical expertise or fancy equipment. Here are some examples of experiments that can be done by young children. They are easy to do and use materials you already have in your home.

If a student is interested in a certain topic, explore that idea but be open to new ideas that show up "out of the blue". In science, one thing almost always leads to another! For example...
Starting with ...AMPHIBIANS.

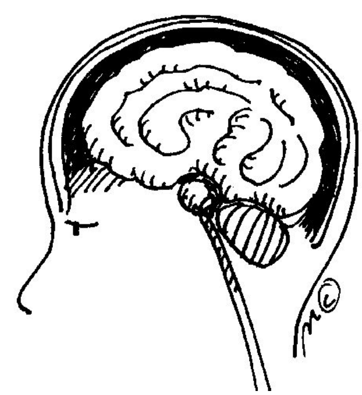


Amphibians have MOIST SKIN...In learning why, you might find that they can BREATHE THROUGH THEIR SKIN....Then you learn about the PORES or "HOLES" in the skin....That reminds you of something else that might have tiny holes in a seemingly smooth surface like PLASTIC WRAP....Then you start to wonder about different types of wraps and products to KEEP FOOD FRESH. To have a variable you can actually test and measure, ("freshness" isn't necessarily easily measured) you decide to test HOW FAR AWAY SOMEONE CAN SMELL AN ODIFEROUS FOOD SOURCE wrapped in different brands of plastic wrap...To control variables, subjects will be blindfolded and not told which food item nor which brand of plastic wrap is being tested at that time.

EXPERIMENT Question: Which is the longest-flying paper airplane design?

Get several sheets of paper and make different types of paper airplanes. Be sure to keep the type of paper and size of paper constant. Only change the design.
Then assign each plane a number and consistently toss each airplane. (How can you be sure you are tossing them with the same force and motion?) (Maybe a family member can help invent a launcher?) Mark where each lands. Then measure out the distance each plane flew. Continue tossing the airplanes several times each. Write all your measurements on a graph in a notebook. Which plane design went the farthest?

MODEL Question: How does a human ear work?



You will need a balloon, toilet paper or paper towel tube, cardboard (from cereal boxes?), and some other things like string or small tubing to represent other parts of the ear. After researching the parts of the ear and how we hear, student can assemble the model. On the display board be sure to label the parts of a REAL ear and compare it to a labeled drawing of the MODEL ear.

OBSERVATION Question: Which direction does the wind blow during different times of the day?

Make a wind vane and hold it in the same spot outside at different times of the day. it will point to the direction the wind is blowing to. Use a compass to find what direction the wind is coming from. Make a table showing the direction the wind was at different times for several days. Are there any patterns?

Planning your Science Project

Use this page as you'd like… it doesn't need to be turned in at school.

Three interesting topics, questions or things I want to learn more about are:

1.

2.

3.

Out of these ideas, imagine how you might do a project on them. Is there something to figure out? Is there something to learn? Circle the best idea that seems it will make an interesting project.

An Experiment will have all the parts listed below. A different project type might not.

My question is: ____

My hypothesis is: ____

Research I might do: ____

Materials I might need: ____

Experiment or activity I plan: ____

How I will record results: ____

Imagine what your display board will look like. Draw a picture of it and label the parts.
A display board should: Make sense (parts should generally follow in order from left to right), look good (neat, organized, eye-catching, easy to read) and have an attention-grabbing, interesting title.