**Science Fair Handbook**

**Albert Lea Area Schools**

**Grades 3 – 6**

**Project Limitations and Safety Requirements**

1. NO LIVING ORGANISMS WILL BE EXHIMBETED AT THE FAIR
2. The exhibitions of human and animal parts are prohibited except: teeth, nails, animal bones, histological sections and liquid tissue slides properly acquired. Sealed insect collections will be permitted.
3. Photographs and other visual presentations of surgical techniques, dissections, necropsies and /or other laboratory techniques depicting vertebrate animals in other than normal conditions may not be displayed on the student’s exhibit, but may be contained in an accompanying notebook to be shown only during judging. Photographs of special needs human subjects require signed consent, as per federal regulations.
4. Exhibiting spoiled foods, molds, bacteria, microorganisms or any other type of cultured growth is not permitted, unless they are in a sealed plastic container.
5. Plants may be exhibited
6. Liquids may be exhibited, as longs as they are in sealed plastic containers. This liquid may not be harmful in any way, should it accidentally be opened.
7. Exhibits are allowed a 36” x 36” wide space.

**Safety**

Anything which could be hazardous to public display is PROHIBITED. This includes:

1. Syringes, pipettes and similar devices.
2. Any flames open or concealed.
3. Highly flammable/combustible gases, liquids or solids.
4. Dangerous chemicals including caustics and acids.
5. Poisons, toxic and hazardous chemicals, drugs and other controlled substances.
6. Dry ice or other sublimating solids.
7. Tanks which have contained combustible liquids or gases, unless they have been purged with carbon dioxide.
8. Operation of a Class III or IV laser.
9. Projects with unshielded belts, pulleys, chains and moving parts with tension or pinch points that pose a potential hazard to observers.

Proper attention to safety is expected of all science fair participants, including compliance with the following requirements for all operating exhibits.

1. Any apparatus producing temperatures that will cause physical burns must be adequately insulated.
2. Batteries with open top cells are not permitted; other types of batteries may be used for electrical power.
3. High voltage equipment MUST be shielded with a grounded metal box or cage to prevent accidental contact.
4. Large vacuum tubes or dangerous ray-generating devices MUST be properly shielded.
5. High voltage wiring switches and metal parts MUST be located out of reach of observers and designed with an adequate overload safety factor.
6. Electrical circuits for 125-volt AC must have and Underwriters Laboratories-approved cord of proper load-carrying capacity, which is equipped with a standard grounded or polarized plug.
7. All wiring MUST be properly insulated. Nails, tacks or insulated staples MUST not be used to fasten wiring.
8. Bare wire and exposed knife switches may be used only in circuits of 12 volts or less; otherwise standard enclosed switches are required.
9. Electrical connections in 125-volt circuits MUST be soldered or attached with approved connectors and connecting wire properly insulated.

General Notes: Projects will be inspected for rules violations during the judging process at the Elementary Fair. Projects found to be in violation will receive only a ribbon and not be eligible for any special or grand awards.

**SCIENCE FAIR PROJECT CATEGORIES**

**ELEMENTARY DIVISION GRADES 3 – 6**

**Project Descriptions:**

This list of category descriptions, followed by examples of types of projects belonging to each, is designed to help students think of possible project ideas. All elementary projects are registered into one of these categories.

Keep in mind that all projects must be EXPERIEMENTS and follow scientific inquiry method. Demonstrations are NOT accepted into the fair.

**Botany**: agriculture, plant growth, plant diseases, plant behavior, plant cells, bacteria, fungi, etc.

**Consumer Product Testing**: testing of products; i.e. soaps, paper towels, batteries, bubble gum, etc.

**Earth and Space Science**: geology, geography, meteorology, astronomy, rocks, minerals, soils, volcanoes, weather, fossils, gravity, atmosphere

**Engineering, Technology, and Math**: applications of scientific principles to practical ends as design, construction and operations of structures, equipment, and systems, probability, mathematics

**Environmental Science**: pollutions (air, water, land, noise…) waste disposal, environmental change (heat, light, irrigations, and erosion), and ecology

**Medicine and Health**: medicine, dentistry, pathology, ophthalmology, nutrition, sanitation, disease, pediatrics, dermatology, allergies, speech and hearing, biochemistry, food additives, human genetics, cells.

**Physical Science**: optics, acoustics, electricity, magnets, simple machines, plastics, fuels, crystals, chemistry

**Zoology and Humans**: animal genetics, mammals, birds, reptiles, amphibians, fish, insects, anatomy, physiology, behavior, veterinary medicine, psychology, sociology, learning, public opinion, surveys.

**K-3 Level Projects**

Experiments:

Magnetic and nonmagnetic materials

Which magnet is strongest?

Which materials conduct electricity best?

Which materials conduct heat best?

Sounds from different rubber bands (or glasses of water)

Which toy car rolls furthest?

Which materials dissolve in water?

Which paper towel absorbs the most water?

Will an ice cube melt faster when crushed up?

Do coins corrode more in salt or fresh water?

How vinegar affects egg shells?

How a shadow changes throughout the day

Measuring rainfall with a rain gauge

Depth of snow at ten different locations

Testing a sundial with a clock

Which brand of raisin bran has the most raisings?

What a plant needs to grow

Do plants give off waters?

In which soil do plants grow best?

Growing potatoes at different locations

How fast do kidney beans grow?

Do large apples have more seeds than small ones?

Do different kinds of apples have different amounts of seeds?

What conditions do pill bugs prefer (light or dark, moist or dry)?

Can an earthworm detect light and darkness?

How far does a mealworm (or snail) travel in one minute?

What is the best condition for the growth of mold?

Which bread molds most quickly?

Which color liquid do hummingbirds prefer?

What food does a hamster prefer?

Can people identify flavors of Kool-Aid when blindfolded?

**4 – 6/Junior High Level Projects**

**Engineering**

\*Do oil additives reduce friction on engine parts?

\*A frictionless magnetic bearing

\*How many rotor blades give maximum lift for a helicopter?

Paper airplane performance

\*Robots

\*Using electromagnets to power a car

\*Battle of the Bridges

\*Computer projects

\*Testing a car headlight as a satellite dish antenna

\*Storing the sun’s energy

\*Power from rising air

\*Power from the waves

\*Testing different water turbine blades

**Earth Science**

\*Charting the apparent motion of Polaris

Composition of Hawaiian sand

Water retention of different soils

Using a computer for mineral identification

How much dust falls on your lawn in a month?

How clean is our air?

How acid is our rain??

Speed of clouds using photography

The effect of wave action on different rocks (using a rock tumbler)

Wave barriers

Using feathers to clean up oil spills

Terracing and how it affects erosion

\*The effects of water on different types of wood

Consumer

Which firewood gives the most heat per dollar?

\*Which solar panel is most efficient?

Can a roof overhang cut summer cooling costs?

A comparative study of various packing materials

How much money can a pool cover save?

Which candle is the best buy?

\*Which light bulb is most efficient?

Are TV commercials louder than regular programming?

Think up your own special project

The frequency and length of TV commercials during a one-hour program

Which battery is the best buy?

How much does it really cost to run a refrigerator?

Which stain remover works best?

Which detergent removes grass stains best?

Which detergent cuts grease the best?

Which detergent has the longest-lasting suds?

The effectiveness of pre-wash products

Waterproofing agents- which are best?

The effects of deodorants on clothes

Which paint protects wood the best?

The effectiveness of different wood preservatives

\*Shampoo evaluation

\*Water solubility of suntan lotions

\*Meat, Fat and moisture content of hot dogs

\*Do sausages vary in fat and water content?

Which popcorn pops the most?

Up to bat – wood or aluminum?

Fishing lines take the strength test

\*Sole traction – which sole is best?

\*Skateboard wheels – which are best?

Leaky faucets – how much do they cost us?

Which uses more water, a shower or a bath?

Which container (or wrapping) preserves food best?

Which paper towel is most absorbent?

Which diaper is best?

Which lighter has the most fuel?

Comparison of locks – which is best?

Which nails have the best holding power?

\*The best air pressure of an A.T.C. (3-wheeler)

How long are yellow lights at various intersections?

Do parking meters give us the right time?

**Life Science**

Does a magnetic field affect the growth of beans?

Does electricity affect the growth of beans?

Does temperature affect the growth of plants?

How do plants react to different kinds of music?

\*How detergents affect the growth of plants

Do plants grow better with tap water or distilled water?

The effects of rootbounding on plant growth

Do roots always grow down?

Do mirrors affect the way plants grow?

\*Does leaf surface area affect plant growth?

Leaf size vs. location

Effects of artificial vs. natural light on plants

Under which color cellophane do plants grow best?

Can you give a plant too much fertilizer?

Testing different potting soils

Which mulch covering works best?

\*Does the phase of the moon affect the germination of seeds?

Do seeds sprout better in cold or hot climates?

\*How does gravity affect the growth of seeds?

\*Does acid rain affect the germination of seeds?

Under which thickness of plastic do radishes grow best?

How the amount of light affects the growth of marigolds

Do avocados ripen more evenly with the stems left on?

\*Which banana has the most sugar – green, yellow or brown?

\*Comparing the moisture content of five varieties of apples

Effects of the environment on popcorn (heat, cold, moisture, time, etc.)

Does aspirin prolong the life of cut carnations?

\*How detergents affect the growth of algae in pond water

\*A study of marine growth on various surfaces

How fast does a mealworm (or snail) travel?

The speed of snails on different surfaces

\*Horsepower of snails

The effect of different metals on snails

Effects of household pesticides on earthworms

Do earthworms help plants to grow?

\*Can insects pull more than their own body weight?

\*Ant control – natural vs. chemical repellants

Do goldfish grow larger in a lager tank?

Fish feeding – the effect of light

\*Can mice see colors?

\*Can mice distinguish shapes (squares, circles, triangles – associate one with food)

\*Hamster activity and the phases of the moon

\*Can the color of unborn rabbits be predicted?

How many grams of food does a rabbit eat per day?

Chickens and colored corn – which will they eat?

\*Will a chicken lay more eggs with rock music playing?

Do pyramids preserve food?

Under which thickness of plastic do radishes grow best?

How the amount of light affects the growth of marigolds

Do avocados ripen more evenly with the stems left on?

\*Which banana has the most sugar-green, yellow or brown?

\*Comparing the moisture content of five varieties of apples

Effects of the environments on popcorn (heat, cold, moisture, time, etc.)

Does aspirin prolong the life of cut carnations?

\*How detergents affect the growth of algae in pond water

\*A study of marine growth on various surfaces

How fast does a mealworm (or snail) travel?

The speed of snails on different surfaces

\*Horsepower of snails

The effect of different metals on snails

Effects of household pesticides on earthworms

Do earthworms help plants to grow?

\*Can insects pull more than their own body weight?

\*Ant control – natural vs. chemical repellants

Do goldfish grow larger in a larger tank?

Fish feeding – the effects of light

\*Can mice see colors?

\*Can mice distinguish shapes (squares, circles, triangles – associate one with food?)

\*Hamster activity and the phases of the moon

\*Can the color of unborn rabbits be predicted?

How many grams of food does a rabbit eat per day?

Chickens and colored corn – which will they eat?

\*Will a chicken lay more eggs with rock music playing?

Do pyramids preserve food?

\*How does our vision affect our taste?

Light vs. vision – which color is best?

Night vision and the effects of colored objects

\*The effect of color on depth perception

Does a blindfolded person walk in a circle?

The relationship between age and response time

\*Can you recognize your own profile?

Left-hand, right-hand transference using a “mirror tracing”

Reading and remembering with different colored paper – which works best?

Flexibility: boys vs. girls

Do adults know U.S. geography? (or math skills, science concepts, etc.)

\*How teeth react to different liquids

\*Do taste buds grow weaker as you get older?

\*Effects of coffee on persons’ steady hand

\*Effects of caffeine on blood pressure

Hot tubs and their effect on blood pressure

\*Effects of foul smells on blood pressure

\*Tar and nicotine in five brands of cigarettes

Smoking and lung capacity

Lung power of different age groups

**Physical Science**

Which metals conduct heat best?

\*Measuring the calories in a peanut

Which material makes the best heat insulator?

\*The efficiency of airspace as an insulator

Which color of liquid absorbs the most heat?

Which color container absorbs the most heat?

Which color container cools off the quickest?

How temperature affects the height at which different balls bounce

&how heat affects recording tape

How constant is the temperature in my refrigerator?

How accurate is the temperature knob on my oven?

The effects of temperature on the strength of dry cells

The effect of light on dyed materials

\*Calculating liquid density using light refraction

Materials that absorb sound

String telephones: what materials work best in conducting sound?

Conductivity of various liquids

\*How temperature affects the amount of electricity given off by a solar cell

How increasing the number of batteries affects the speed of a motor

What is the voltage range of the GE-14 bulb?

\*The strength of a magnet vs. distance

\*Do magnetic fields affect the sound quality on a recording tape?

The effects of washing on dyed materials

\*Which fabrics are most fire-resistant?

\*Which toothpaste is most abrasive?

\*The amount of dissolved salt in drinking water

Can saltwater be desalted by freezing?

Popcorn: A graphical analysis of pops per second

\*Strength of different woods

Ink evaluation with paper chromatography

Splat – a study in droplet patterns

\*Chlorine levels in our drinking water

The effects of swimming pool water (chlorine) on hair

\*Testing sugar in soft drinks

\*Comparison of vitamin A content in frozen, canned and fresh peas

\*Which foods have starch (or sugar, fat, protein, etc.)?

\*Testing various orange drinks for vitamin C

\*How fire affects roofing materials

How well to various fabrics absorb dye?

\*How strong is a spider web thread?

\*How does the tail affect the flight of a kite?

\*What shutter speed is needed to photograph a moving fan?

The velocity of water through different tubes (same size, different materials)

The velocity of different liquids through the same size tube

\*Density of various liquids

**\* Denotes more difficult projects**

**SCIENCE EXPERIMENT WORKSHEET**

Project Title (Should be a question): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Hypothesis (What I think will happen):

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Equipment and Materials I will use:

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Procedure (What I plan to do):

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Results (What happened. Keep measurements, graphs, pictures, etc.):

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Conclusion (What I found out by doing this experiment):

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**HELP FOR STEP 5: EXPERIMENT**

\*Design an experiment to answer your question

When planning your experiment, remember to keep everything the same except for the single variable you are testing.

A variable is something that can be changed in the experiment

A control group should be used when conducting an experiment. The control is very important because it shows the normal results from your experiment if you don’t try to change anything.

***HERE IS AN EXAMPLE:***

Hypothesis: An increase of fertilize will cause greater growth in tomato plants.

Equipment/Materials: 4 pots, soil, water, fertilizer, tomato seeds

Procedure: The test variable will be the amount of fertilizer used. All other conditions will stay the same.

1. The seeds will come from the same package and randomly selected.
2. All seeds will be planted in the same size pots with the same soil.
3. 4 seeds will be planted in each pot.
4. All plants will receive exactly the same amount of light and water.
5. The temperature for all plants will be the same
6. One pot will be the control group. This pot will not receive fertilizer.
7. One pot will receive the recommended amount of fertilizer each week.
8. Once pot will receive twice as much fertilizer each week.
9. The last pot will receive three times as much fertilizer each week.
10. I will observe the pots daily and record my results. I will measure the plants as they grow and make a chart/graph. I will describe how the plants look.

*See the next two pages for help on recording observations and making graphs.*



**RECORDING OBSERVATIONS AND DATA**

Use a separate notebook for recording all measurement and observations. Record information on a daily basis and consider the following:

* Make sure that in your data you have accurate metric measurements. Give masses in grams, volumes in millimeters, and linear measurements in millimeters or centimeters.
* It is better to have too much data than not enough. KEEP LOTS OF NOTES!
* When making observations, record the date and time.
* Consider taking photographs to be used in your research paper or as part of your display.



**HELP FOR STEP 6: WRITING A REPORT**

It is important to be able to share your project with others. One way to share information is in written form. Here are some guidelines for writing the report.

1. TITLE PAGE

Include your project title, your name, school’s name, grade, city and state

1. BODY OF REPORT:

(Use your experiment worksheet to help you complete this section)

My question is….this should be the same as your title

What I have read or know about my topic before I began experimenting…

My hypothesis…what you think will happen

My experiment…materials I used, what I did step-by-step

My results…remember to attach your record of observations, and any charts or graphs of data you may have

My conclusions…Was your hypothesis correct? What variables were important? Did you collect proper data? Did you collect enough data? Could you improve your experiment in any way? Include any other final thoughts about your project that you may have.

1. BIBLIOGRAPHY: A list of sources used, including people that helped you.

**GRAPHS AND CHARTS**

Your daily log of observations will be the best means for sharing the data and information collected during the experiment. Charts and graphs will provide a fine way to share data in an easy to read and understand fashion. There are different kinds of charts and graphs. Here are some examples:

**Bar Graph**

(Use with comparison questions when the independent variable is not continuous)

**Line Graph**

**(Use with “How does X affect Y?” type questions – independent variable is continuous like time or distance)**

**PROJECT DISPLAY**

Make your project NEAT. It should be a display of your work, your ability, and your talents.

1. Your instructor/advisor will supply you with a 3-sided display board that is 3 feet by 4 feet in size.
2. Make letters large, clear, and neat. Make your project explain itself by using pictures, diagrams and other data. DO NOT put your name on the display board.
3. Use charts, graphs, photos, pictures, and or objects.
4. You will need to supply your own card table the day of the fair on which to put your project.

**Example of an Experimental Project (grades 4- 6)**

|  |  |  |
| --- | --- | --- |
| 1. Purpose 2. Method (experiment) 3. Materials Used | TOPIC  (diagrams)  (charts) | 1. Data 2. Results 3. Conclusion |

**Example of a Demonstration Project (grade 3)**

|  |  |  |
| --- | --- | --- |
| What I plan to do or show | TOPIC  (photos, pictures, drawings, etc.) | What I found out from this project |

**HELP FOR STEP 7: EXHIBIT**

This is a visual way to communicate to others so take your time and do a good job.

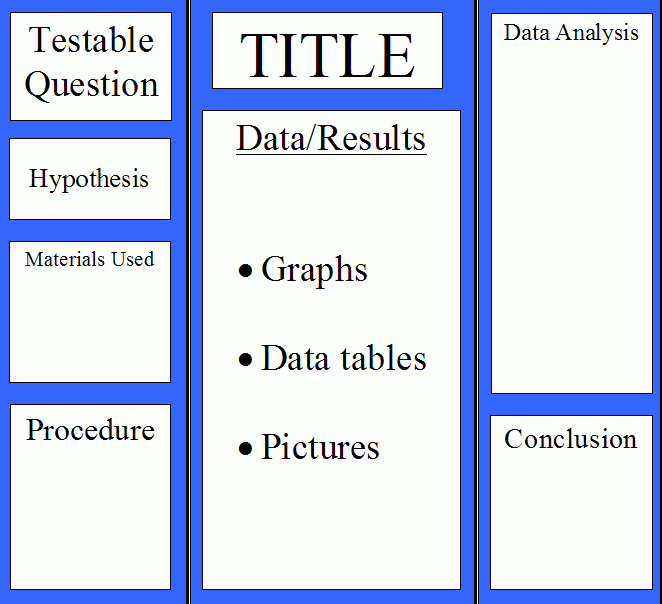
Make your project NEAT. It should be a display of your work, your ability, and your talents.

Your science fair instructor will give you a display board after you have completed your experiment.

Use charts, graphs, photographs, and clear bold lettering to highlight your display.

DO NOT put your name on the display board.

You will need to supply your own card table the day of the fair on which to put your display board.



DEVELOPING A BIBLIOGRAPHY

A bibliography is a listing of the resources and references used during the research of your project.

This information is organized so that interested readers could seek out and find the books.

Here are examples:

**Bibliography Key Examples**

**Books with one author:**

Author’s last name, first. *Title of Book*. (in italics) City of publication: publisher, date of publication.

Example:

Simon, Seymour. *Hurricanes*. New York: McGraw-Hill, 1996.

**Books with multiple authors:**

Authors in order they are listed on the title page. *Title of Book. (in italics)* City of publication: publisher, date of publication.

Example:

Buffet, Jimmy and Tom Chapin. *Songs for Kids*. New York: Harper, 1999.

**Magazines or newspaper**

Author of article. (if available) Title of article. *Magazine or newspaper title. (in italics)* Date: Page.

Example:

Schrock, Rockwell. New card games for kids. *The New York Times*. 22 December 1999:p. 34.

**Encyclopedia article:**

Author of article. (if available) Title of article. *Title of encyclopedia. (in italics)* Volume number. Date of edition, page number(s).

Example:

Smith, Mort. Gemstones. *World Book Encyclopedia*. V.6. 1999, p. 340-345.

**Internet source:**

Author (it is not recommended to use info off of the web if an author is not mentioned). Title of article. *Title of complete work (in italics)*. Date of visit. Full URL (internet address in angle brackets)

Example:

Smith, Terry. *Exhibits at the fair.* Terry’s 1904 World’s Fair Page. 21 December 1999.<http://www.inlink.com/~terryl/exhibits.html/>

Adapted from <http://www.successlink.org/great3/g2277.html>

**HELP FOR STEP 8:JUDGING**

This is an important part of your project so take time to plan and practice this presentation you will make to the judges.

Here is an approach you may wish to use for making your oral presentation:

1. Greet the judges and introduce yourself
2. Give them a copy of your abstract and research paper
3. Give the title of project, your grade, and your school
4. Tell how you became interested in the topic
5. Give some background information on your topic
6. State your hypothesis
7. Discuss what you found in your research
8. Describe the step-by-step procedures you followed. Refer to any equipment you brought and/or photographs.
9. Explain the results of your experiment and be sure to discuss the control group and variable tested. Refer to any charts or graphs you may have made.
10. State your conclusions
11. Ask the judges if they have any questions
12. Thank the judges for their time and any suggestions they may have offered to improve your project.

Good manners, nice clothes, and enthusiasm for what you’re doing will help impress the judges. Here are some tips:

1. Make good eye contact with your judges
2. Stand up straight
3. Speak clearly with confidence
4. Relax, smile, and have fun!