NWO REGIONAL SCIENCE FAIR

A PLACE FOR BRIGHT IDEAS!

Northwestern Ontario Regional Science Fair

Elementary Science Fair Kit

Version 1.0
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Purpose of this Kit

1. We aim to show you how student science projects can help you meet curriculum outcomes in science and technology.

2. We want to assist you in walking your students through the process of a science fair project, examining all of the steps that it involves.

3. We will explain how to run a school science fair.

4. We want to help you make science fun!!!

The contents of this kit will provide you, the school science fair facilitator, with background information, student handouts, and planning guidelines to help make your school science fair a great success. Planning a school (or class) fair can seem daunting, yet with a little assistance it will be a fun and rewarding experience for students, teachers, school staff, and volunteers.

Please feel free to take any of the materials presented within this resource and adapt them to your specific situation. It is our hope that the contents of this kit will make it much easier to put on a successful science fair, and enrich the science foundations of all who participate.

If you have questions, comments or concerns about the contents of this document, contact information has been provided in the appendices.

The Benefits of Science Projects

Science Fair projects:

★ help students appreciate and understand the role of engineers, scientists, etc.

★ further the students' understanding on a topic of personal interest.

★ assist students in developing problem solving skills.

★ allow the development of organizational skills.

★ facilitate students in developing language and communication skills.

★ present situations where students can apply their scientific skills.

Projects and Curriculum Expectations

Asking a question/making a hypothesis:

"Students will......

formulate questions and identify needs and problems.

explore possible answers to questions and ways of meeting needs.

formulate questions about and identify needs related to the strength of structures (gr. 7) / efficient operation of mechanical systems (gr.8), and explore possible answers and solutions."

Planning the experiment/procedure:

"Students will....

plan investigations for some answers and solutions identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions.

follow safe work procedures and use appropriate tools, materials, and equipment (Gr. 8)

use the most appropriate items from a selection of tools, equipment, and materials to perform a specific task. (Gr. 8)

produce technical drawings and layout diagrams of a structure or a mechanical system that they are designing, using a variety of resources. (Gr.8)

select and use appropriate materials and strategies to make a product. (gr. 8)"

Presenting results:

"Students will...

communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, charts, graphs, drawings, and oral presentations.

use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures, and results.

identify the personal and social factors that determine whether a product is used."

Cross-Curricular Connections:

The following are some curriculum areas that can be examined in a science fair project:

Language Arts:
-journal writing, recording raw data, writing reports, research skills, using nonfiction material, library/internet skills, making speeches, answering questions, sharing ideas.

Mathematics:
-measurement, units, decimals, fractions, percents, data management, organization, computation skills, comparing of data, tables, graphs, using data management software

Art:
-using colour/texture, balance, organization, neatness, building display models

Science:
-various topics, recording data, experiments and validating data, using controls, keeping accurate records, work safety, errors, Scientific Method, scientists from the community

Social Science/History/Geography:
-research skills

Physical Education, Music:
-depends upon type of project

Overall:
-organizational skills, completing own work, time management, self-advocacy skills, group-work skills, responsibility

Types of Projects:

There are three types of projects that are recognized at regional, provincial, and national science fairs. They are common to any topic, depending on the approach taken by the student.

Experiment:

An experiment uses controlled variables to answer a question. The students thinks of a question about a topic, makes a hypothesis, and then performs their experiments. The experiments should be repeated. All observations should be noted, and analyzed. An experiment examines cause and effect relationships, and it is important to identify and control the variables.

Stages of an experiment:
1. Ask a question
2. Form a hypothesis
3. Plan the experiment
4. Perform the experiment
5. Observe and record data
6. Organize and analyze results
7. Present results

Innovation:

An innovation is when a student designs a product that solves a particular problem or issue. Students experiment with the materials to design a solution. Through trial and error students make adjustments to their designs. The outcome of an innovation should be the design of a useful product or technique or process.

Stages of an innovation:
1. Identify a problem
2. Select the best alternative
3. Plan the prototype
4. Build the prototype
5. Test and evaluate the prototype
6. Organize and analyze results
7. Present results

Study:

A study is when a student makes observations about an existing issue. Although they should be able to identify any variables, the student does not control or change these naturally occurring variables in a study. The student should focus on finding a new explanation for their recorded observations. A study could also be a research project in which the student compares the results and observations of others in a field of interest. It is a collection or analysis of data (e.g. survey) to reveal evidence of a fact, situation or pattern of scientific interest.

Stages of a study:

1. Ask a question
2. Form a hypothesis
3. Plan the study
4. Carry out the study
5. Observe and record data
6. Organize and analyze results
7. Present results

NOTE:

High-level science fair projects are often difficult to identify as an experiment, innovation or study, as they combine elements from each.

For example, a student wishes to examine which type of water filter best removes organic solids from waste water. In order to accomplish this task, they research what organic solids are, and how they are removed from water (study), they then construct their own filters (innovation), and compare their effectiveness using controls (experiment).

At the elementary level, students should be encouraged to chose one type of project at the outset, but if their exploration of their topic area expands beyond a single project type, and the student seems capable of working with a multi-faced project, they should not be discouraged from pursuing their investigation to its conclusion.

Safety and Ethics

Students must think about safety issues before beginning their projects. It is also the teacher's responsibility to check that the project is following safety and ethics guidelines.

These guidelines are in place to protect students and others from danger while undertaking science and technology research. Three main areas of concern are hazardous materials, vertebrate animals, and human participants.

The list of prohibited materials is quite lengthy. If you have questions, you can access the list either off of the NWORSF website, or by contacting someone on the committee directly.

Vertebrate animals are not permitted in science fair projects, **except** as part of a *study* in a natural setting. If animal subjects are involved students must speak to the supervising science teacher BEFORE beginning their work.

If there is an expectation of competing beyond the school level, the student must have permission from the NWORSF Safety and Ethics committee BEFORE they begin the project.

Choosing A Science Fair Topic:

The biggest challenge is in choosing a topic for a project. The best projects are those that are in an area of interest to the student. If a student is struggling with choosing a topic, ask questions about their personal interests, or refer them to school resources. Most libraries and certainly the internet have examples of possible projects. Also included in this kit are some sample project ideas. Allow students **time** to choose their topic.

You can also encourage students to write down topics and questions following a field trip. You can also ask them to bring in newspaper/internet articles about recent science discoveries or inventions.

It is important to remind students that their project does not need to be an experiment. As long as the child is pursuing the answer to a question that is scientifically relevant, and follows the scientific method, their project could also be a study, or an innovation.

The following topic-choice exercise may be photocopied and handed out to potential science fair participants to help them chose a topic of interest to them.

Student Handout - Scientific Method

When scientists design and carry out experiments to study or test an idea, they need to follow an organized plan in order to ensure that they have accurate results. This plan is otherwise known as the **Scientific Method**. It includes each of the following steps:

1) **Problem** – clearly identifies the problem you intend to research.

2) **Hypothesis** – this statement reflects what you believe the outcome of your experiment will be, or what the results will prove.

3) **Materials/Diagrams** – lists all of the materials necessary to perform the experiment, including a labelled diagram of the experiment set-up if necessary.

4) **Procedure** – lists each of the steps in the proper order to carry out the entire experiment.

5) **Observations/data** – this is where you keep track of any observations (i.e.: changes, measurements, etc.) during your experiment, and record any significant data in an appropriate table or graph.

6) **Conclusion** – this includes a summary of your experiment, including whether or not your hypothesis was correct, whether or not your experiment was an accurate test and why, and any questions that accompany the experiment.

You will be required to complete each of the sections outlined above through the design and completion of your own Science Fair project. When you perform any experiment, you must carefully write out a report which details the way you carried out your investigation and what your results were. In order to be successful throughout the scientific method it is also imperative that you follow the guidelines outlined below:

- Include a neat, title and headings
- Use neatly drawn labelled, and coloured diagrams and graphs where necessary
- Your lab report may be either done on computer or neatly hand-written
- A lab journal/log that clearly delineates your science adventure from start to finish

Student Handout - Choosing a Topic

Choosing a topic for your science fair project doesn't need to be a difficult process. The most important thing is to pick something that ***YOU*** are interested in. Don't pick a topic just because someone says it will be a good project. The best projects are the ones where the person who researched them was fascinated by the topic.

<u>Here are three starting points:</u>

1. One of the ideas from your science fair group meeting brainstorming sessions may be really interesting for you.
2. Book titles from the reference, resource or science sections of your school library may lead you to a science fair project idea.
3. You may know of a project done by another student in another year that interested you.

Remember, the above three points are just to get you thinking about topics of interest. They are not meant to provide specific projects for you to re-do. Your project should be your own idea!

Student Name: ____

Date: ________________________

What am I <u>**REALLY**</u> interested in?

Was there a science subject I studied in school that I really liked? What is it?

What have I read about or seen on TV that made me interested in how it worked?

Can I think a problem that nobody has solved yet? If so, what is it?

At this point in your topic search, it is OK to have more than one idea. Once you find several ideas that really interest you, start crossing out those that would be too difficult for you to research with your available resources.

When you come to the point where you have chosen your topic and you need a question to answer, or "hypothesis", the following examples can *help* you create one. We have included one example for each of the three types of science fair project - experiment, innovation and study:

Experiment:
"How does ___________________ affect ______________________?"

Innovation:
"In what way could ________________ improve the performance or operation of ________________?"

Study:
"What relationship exists between ___________________ and ________________ ?"

Write down all of the questions about your topic that interest you. What do you know or not know that you would like to investigate further?

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Sample Science Fair Project Ideas:

Earth and Environmental Science:

- Does acid rain affect the growth of aquatic plants?
- What is the best way to keep cut flowers fresh the longest?
- Does the colour of light used on plants affect how well they grow?
- What plant fertilizer works best?
- Does the type of potting soil used in planting affect how fast a plant grows?
- Does having worms in soil help plants grow faster?
- Can plants grow in pots if they are sideways or upside down?
- What light brightness makes plants grow best?
- Does the colour of birdseed affect how much birds will eat it?
- Do natural or chemical fertilizers work best?
- What type of grass seed grows the fastest?
- What are the effects of snow depth on temperature?
- How do weather conditions affect evaporation?
- How do robins build nests in your backyard?
- What kind of spiders live in your area? Where do they spin webs?
- Which plants grow well in your neighbourhood?
- Do all seeds in a package germinate?
- Observe mold growth on different types of bread (wheat, white, rye).
- Observe the growth of grasses in different soils.
- Study the reactions of seeds to different chemicals.
- Study the effects of salt versus sugar on plant growth.
- How much water do different soils hold?
- Observe the effects of light direction on plant growth.
- Observe cloud patterns and try to predict the weather.

Life Science:

- Make a model showing how the muscles in your arm work.
- Can the food we eat affect our heart rate?
- Can background noise levels affect how well we concentrate?
- Does the colour of a room affect human behaviour?
- Do athletic students have better lung capacity?
- Can people tell artificial smells from real ones?
- Can animals see in the dark better than humans?
- Does age affect human reaction times?
- Does shoe design really affect an athlete's jumping height?
- Can some people really read someone else's thoughts?
- Can mice learn? (you pick the animal)
- Study/observe the effect of temperature on insect activity.
- How does your dog respond to strangers coming into your home?
- What are some behaviours of earthworms?
- What kinds of food do certain types of birds prefer?
- Study animal features relating to adaptation.

Physical Science:

- Make a model showing expansion and contraction.
- Why can't you sink a Rice Krispie?
- Where does the "white" go when snow melts?
- Why can you boil water in a paper lunch bag without burning it?
- Does the colour of hair affect how much static electricity it holds?
- What is the effect of salt on the boiling temperature of water?
- How much weight can the surface tension of water hold?
- How can water be purified?
- What kind of line carries sound waves best?
- What are the best hear conductors?
- Do all liquids boil at the same temperature?
- Which metal rusts the fastest?
- Observe how heating water affects the rate at which materials dissolve.
- What factors affect how fast liquids will mix?
- In which liquids will an ice cube float?
- Observe the freezing points of different liquid substances.
- How does the colour of an object affect how warm it gets?
- Are there solid particles in the air we breathe?
- What effect does the colour of an item have on the amount of solar energy it absorbs?

Math, Engineering and Computers:

- Make a balloon rocket travel the farthest along a string.
- Make a pendulum that will swing a preset number of cycles in a set amount of time.
- Make a paper airplane that will stay in the air the longest.
- Make an Electromagnet.
- Build a container that will keep an ice cube solid the longest.
- Make a Barometer.
- Make a sand timer that will run a determined amount of minutes.
- Build the tallest possible freestanding structure using toothpicks and soaked peas.
- Construct a musical instrument that can play several different notes.
- Which paper towel brand is the strongest?
- How effective are childproof containers and locks?
- What brand of battery lasts the longest?
- What brands of bubble gum produce the biggest bubbles?
- Make a rain detector that will set off an alarm when it starts to rain.
- Build an automated greenhouse.

The above list of projects represent samples from each of the four areas of scientific enquiry. This is not a comprehensive list, and should not be considered to be examples of the "best" projects. For further project sample ideas, we also recommend using the Science Project "Topic Wizard" at:

http://www.sciencebuddies.org/science-fair-projects/recommender_register.php

*Special thanks to C.R. Price for contributing to the list of project ideas.

Name: ____________________ **Date:** __________________________

Student Handout - How to Write a Purpose and Hypothesis:

Problem/Purpose/Question:
This step involves narrowing possible topics and then choosing the question to be the focus of your experiment. Your question should be specific. You may need to gather more information before you decide on your final question. Ask yourself:

> Specifically, what do I want to know? What is the purpose of asking this question? What will the answer tell me? Can this question be answered through research? (Can I describe how I might answer it?)

Examples:

Question: Where do the flies at the butcher shop really come from? Does rotting meat turn into or produce the flies?

Question: Is there indeed a "life force" present in air (or oxygen) that can cause bacteria to develop by spontaneous generation? Is there a means of allowing air (and thus any life force, if such does exist) to enter a container, but not the bacteria that are present in that air?

Forming a Hypothesis/Hypotheses:
This step helps you answer the question:

This is a tentative answer to the question: a testable explanation for what was observed. The scientist tries to explain what caused what was observed

Hypothesis: Rotten meat does not turn into flies. Only flies can make more flies.

Hypothesis: There is no such life force in air, and a container of sterilized broth will remain sterile, even if exposed to the air, as long as bacteria cannot enter the flask.

Science Fair Purpose/Problem List

First & Last Name	Title of Project	Purpose	Grade / Teacher

Note: This list should be filled out at each science fair project meeting to track changes to student projects as they are made, in addition to following student attendance.

Name: ____________________ **Date:** __________________________

Student Handout - How to Make Scientific Observations:

EXPERIMENTAL EVIDENCE

Experimental evidence is what makes all of the **observations** and answers in science **valid** (truthful or confirmed). The history of evidence and validations show that the original statements were correct and accurate. It sounds like a simple idea, but it is the basis of all science. Statements must be confirmed with loads of evidence. Enough said.

Scientists start with observations and then make a **hypothesis** (a guess), and then the fun begins. They must then prove their hypothesis wright or wrong with trials and tests that show why their data and results are correct. They must use controls, which are **quantitative** (based on values and figures, not emotions). Science needs both ideas (the hypothesis) and facts (the quantitative results) to move forward. Scientists can then examine their **data** and develop newer ideas. This process will lead to more observation and refinement of hypotheses.

How to Make Basic Observations in Science:

- Record <u>everything</u> that come to mind and sight
    - Group members – if applicable
    - Date
    - Time of day – i.e. 14:30 or 09:20
    - Environment – location (classroom)
    - Temperature – i.e. room temperature 20°C
    - Weather – i.e. partly cloudy
    - Colour
    - Shapes
    - Texture
    - Draw a diagram
    - Take photos
    - Odour – NOTE: only waft samples never directly smell a sample
    - Record what is happening (changes) – i.e. chemical changes and/or physical changes.
    - Physical details – what it originally looked like and what it looked like throughout the process and upon completion

Science Fair Timeline

Steps	Recommended Number of Weeks to Start Prior to School Fair Date	Your Deadline Date
Choosing A Topic	10 weeks	
Select method of investigation: experimental, study, innovation	10 weeks	
Making a Plan: -Scientific Method -Doing Research	9-8 weeks	
Carrying out your plan	7 - 5 weeks	
Begin designing charts, graphs and/or taking photographs for your display	7 - 3 weeks	
Drawing conclusions	3 weeks	
Writing a summary	3 weeks	
Making the display	2 weeks	
Preparing your oral presentation	1 week	
Science Fair Day	Week of	

Log Books

Introducing students to writing science notebooks/logs can be achieved through writing workshops. You could read informational texts as examples of how one can write detailed descriptions of what is being observed.

Students benefit from linking their writing to their actual science experiments. Connections help children remember and understand the big ideas of science as they explore the world around them.

Children learn to redefine their ideas of scientists, viewing scientists as learners, explorers and writers.

Questions to address could include:
Why would a scientist keep a notebook?
Why would scientists write about their experiences and thinking?
What would entries look like?
What are the writing features and forms used by scientists?
How will I use a science log book?
How will the logbook help me as a learner?
Are logbook pages finished products or will they be used to write your final product?

Some useful mentor texts include:
"Crawdad Creek", author: Scott Russell Sanders, illustrator: Robert Hynes
- describes with illustrations and great detail about elements and living creatures discovered by siblings while hiking along a creek

"Salamander Rain", written and illustrated by Kristin Joy Pratt-Serafini
-a boy belongs to an environmental club and he tracks his learning in a journal and scrapbook format. It is full of information, scientific drawings, and ideas for outdoor learning.

It is important that students understand that a log book can be a tool to gather information or collect questions.

Some classroom ideas:
★ Show anecdotal notes from zookeepers or veterinarians
★ Anecdotal notes about a classroom pet, recording the pet's actions, sounds, and behaviours
★ A list of plants, organisms, and other organic matter observed in a pond, such as at Kingfisher Lake Outdoor Centre or Hazelwood Lake Conservation Area
★ Show observation notes obtained from the Thunder Cape Bird Observatory

Things that should/could be included in a logbook:
• sketches
• questions
• date of entry
• anecdotal observations
• graphs and tables of gathered information
• notes of video clips
• expected timelines

Logbook entries can be messy, they are not a work of art or a final product. It is useful to let your students understand that a logbook entry is a valid form of writing, holding the inspiration for future writing. The gathering of ideas is imperative to their learning. It helps them become effective scientists.

Points to remember:
Be sure to show how a logbook is different from the project workbook and abstract. Logbooks are rough notes, and should probably be handwritten at the time any thoughts occur, as opposed to the formatted, typewritten summaries of all project work in the project workbook.

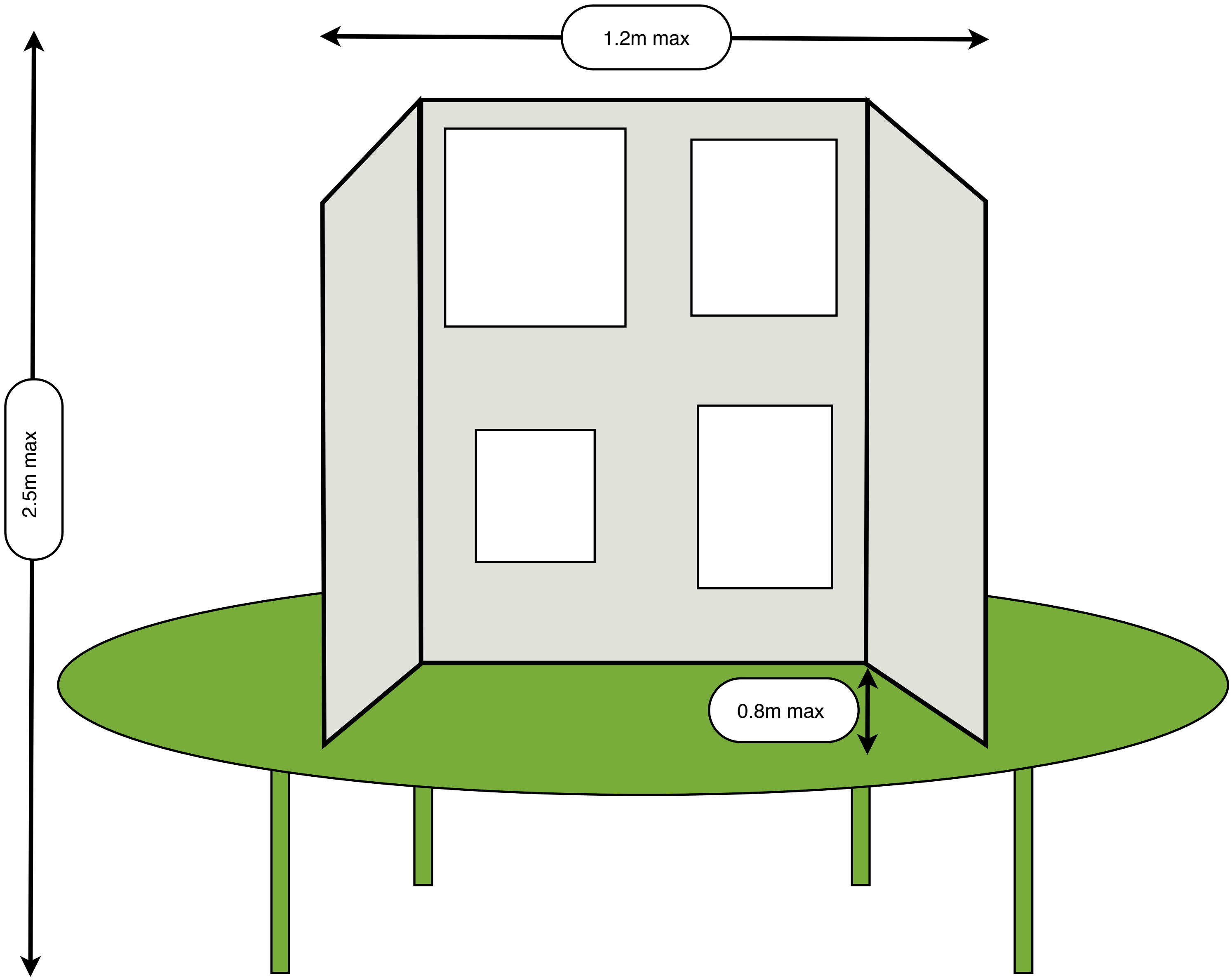
Resource used:

www.choiceliteracy.com/public/964.cfm 11-08-20, 8:59 a.m.

Project Size

Projects must be self-supporting, and be no more than:

1.2 metres wide
0.8 metres deep, and
2.5 metres above the floor



Parent/Guardian Involvement

The following represent general guidelines for parents regarding appropriate levels and types of involvement in their children's project.

* Parents **should** ensure the safety of their child during their project

* Remember, the science fair project is the student's work. Parents may provide advice and guidance. They **should not** carry out project work on behalf of your child, unless it involves operation of equipment that would be unsafe for a student (such as power tools for construction of experimental apparatus, or transportation of students to research locations).

* **Students will be asked if they had any assistance with their project**, and what that assistance entailed.

* Be positive, offer encouragement, support and advise.

* Take your child to the library to help find research material.

* Guide your child in gathering inexpensive, everyday household material for use in experiments.

* Encourage your child by asking questions and discussing progress in the project.

* See that deadlines are met.

* Proofread all written work, but projects should be in the students' own words.

* Visit the School Science Fair to see what your child and their fellow students have done.

Planning A School Science Fair

One of the benefits of science fair projects is student ownership of the work. A school science fair is a great opportunity for students to “show off” their work. It is also a great opportunity for promoting science throughout the school. Students get to see different approaches to science, and older students can inspire younger students for future projects.

Planning a fair does not need to be difficult or a lengthy process. We have included some planning resources to assist you in this.

Consider offering prizes for your projects. This of course is determined by how much money you have to spend, and/or on what donations you are able to get from community sponsors. Ideally, it is recommended that a certificate of recognition should be given to every participating student. The acquisition of prizes is an excellent parent volunteer project.

Physical Project Set-up:
The set-up for your fair is dependent on how many projects are entered, and space available.

Try to plan on 1.25 meters of free space in front of each project to allow for judges, students, and viewing guests to move freely. It is a good idea to draw a floor plan and assign numbered spaces to each project.

Safety:
* Aisles and exits must be kept clear.
* There should be no trip hazards (ie. all electrical cords should be taped securely)
* There should be no sharp edges on displays or materials
* All exhibits should be self-supporting and sturdy
* No toxic, flammable, or dangerous chemicals are permitted
* No exposed electrical parts or lasers
* Be aware and follow school allergen guidelines

Students should be made aware of safety expectations prior to the day of the fair. This should streamline the time taken on safety checks. An adult should do a safety check of each project. This means checking for allergens, unsafe chemicals/hazardous materials, electrical hazards, dangerous experimental apparatus, etc. as listed above and added to/modified by the school science fair chairperson. If any of these factors are found during the safety check, the student will be asked to remove the items in question from the fair area.

School Fair Judging:
Judges can be recruited from school staff, school council, parents, or general volunteers. In order for projects to be judged objectively, a short judging workshop

should be presented to ALL judges prior to the school fair. This workshop should present judging forms and criteria, suggest comments, provide a timeline and answer any questions coming from judge volunteers. An effort should be made to provide judges with sample questions for oral interviews as well. The ultimate goal of the judging workshop is to make judges comfortable and familiar with the judging process, project assessment criteria, and fair expectations.

If possible, judges should be assigned to projects matching an area of expertise. This can either be done during the workshop itself, or by getting a list of judges' interests and areas of expertise prior to the fair date.

Sample Comments For Judges

(for student comment sheets)

Please adjust your comments according to the grade level of the student presenting their project. Some of these students are only in grade three, and this is their first year doing a science fair project!

These are only sample comments, to help you out. Please feel free to expand on them, and use your own ideas.

Bibliography Comment:

"Include a bibliography, you should do some background research on this topic."

Acknowledgements Comment:

"Include acknowledgements of anyone who helped you with your project."

Abstract Comment:

"Include an abstract. This should be separate from your logbook, and preferably not on your backboard."

Display/Backboard Comments:

★"Your pictures and diagrams were very good."

★"Your charts and graphs were well designed and easy to understand."

★"Your public speaking skills were excellent, and you really taught us lots about your project."

★"Great job at organizing and constructing your display."

★"Your display board was well done - well organized and clear."

★"Great job at organizing and constructing your display."

★"Use more colour in your display, to help capture attention."

★"Use bigger print for your text on your backboard."

★"Provide more detail on your backboard, using the scientific method."

★" A few more pictures on your display would add visual impact."

Research Comment:

"Include all your notes in a logbook."

Presentation Comments:

★"Your speaking was very clear."

★"Your public speaking skills were excellent, and you really taught us lots about your project."

★"You did an excellent job at presenting your topic during your interview."

★"Your presentation during the interview was excellent. You spoke clearly, and communicated your ideas clearly."

★"Practice your presentation."

★"Talk slower and louder."

★"Include your logbook."

★"Your logbook was amazing!"

Hypothesis Omission Comment:

"You should write a hypothesis predicting how your experiment will turn out, before you actually do the experiment."

General Comments:

★"Your project idea was very original, and practical in your life."

★"We were impressed with how you thought about what you would do next time to improve your project."

★"Your topic choice was both interesting and relevant to a lot of people."

★"You could suggest how the results of your experiment could be helpful to the general public."

★"You were interested in your topic, and your excitement made the judges excited for your work."

Class Activity Samples:

Magnetic Tricks

Problem:
What materials are attracted to a magnet?

Materials:
bar magnet
testing materials: aluminum foil, copper wire, glass marble, iron nail, paper, steel ball bearings, toothpick

Procedure:
1. Lay the testing materials on a wooden surface.
2. Touch the magnet to, and slowly move the magnet away from, each material.
3. Observe and record which materials cling to the magnet.

Results:
The iron nail and the ball bearings are the only materials that cling to the magnet.

Why?:
The only two testing materials with magnetic properties were the iron nail and the ball bearings, so they were the only materials to cling to the magnet.

Expansion:
Allow students to experiment using other testing materials of their own choice. Have them record their results.
Does the magnet have to touch the testing material to attract it? Repeat the original experiment, holding the magnet very near, but not touching the materials. Have students record a measurement of the height the material moved to reach the magnet. Which materials have the strongest magnetic properties?

Class Activity:
Spinner

Problem: How can wheels be made to spin faster?

Materials:
1large paint can (one that has never been opened)
6 marbles
4 heavy books

Procedure:
1. Place the can on a table.
2. Space the marbles evenly around the rim of the can.
3. Balance a stack of books on top of the marbles.
4. Use your hand to push gently against one corner of the stack of books.
5. Observe the movement of the books.

Results:
The books spin around easily on top of the marbles.

Why?:
Wheels allow you to move things more easily, and ball bearings within wheels allow them to rotate faster. The balls reduce the friction between the surfaces of the wheel and the axle. The marble bearings in this experiment rotate as the book pushes against them, and only the tops of the balls touch the book. Since only a small part of the surface of the marbles touch the book, there is less friction.

Expansion:
Would increasing the number of ball bearings reduce friction? Repeat the experiment using more marbles around the rim of the can.
How effective are the marble bearings? Repeat the original experiment without the marbles.

Class Activity:
Colour Fun

Problem: Is green really green?

Materials:
strip of paper towel or newspaper
green felt-tipped pen or a drop of green food dye
a jar or glass with 2.5 cm of water

Procedure:
1. Make a spot of colour about 5 cm from one end of the strip of paper towel.
2. Hang the strip in the jar so that the spot is above the water and the end of the strip is in the water.
3. Let it stand for 15 to 20 minutes.
4. Observe.

Results:
The green spot is gone - but above the original spot the paper has turned blue, and above that the paper is yellow.

Why?:
Most dyes and inks are combinations of colouring substances which can be taken apart by adding water or alcohol. Water moves up the paper in the same way that sap rises in trees. As the water moves up, it dissolves the green spot and gradually moves the colour up the strip of paper. But since the colours that make up green - blue and yellow - do not move at the same rate, they separate.

Expansion:
Try using different colours and compare the results.

Class Activity:
The Egg in the Bottle Trick

Problem: Can you really put an egg into a bottle - if the bottle has a neck that's slightly smaller than the egg - without mashing the egg?

Materials:
1 hard boiled egg, peeled
1 small-necked jar or bottle
hot water

Procedure:
1. Pour boiling water into the bottle.
2. Shake it around and then pour it out.
3. Quickly place the egg over the mouth of the bottle.

Result:
Even though the egg is larger than the opening, the egg drops into the bottle.

Why?:
The hot water leaves steam in the bottle, which forces out some of the air. As the steam in the bottle cools, it changes into droplets of water and requires less space. This reduces the amount of air pressure in the bottle, and so the pressure of the outside air pushes the egg inside the bottle.

Expansion:
Try to remove the egg. (Hold the bottle upside down, place your mouth on the opening of the bottle, and blow into it for 30 seconds. The pressure inside will be greater than outside - and so the egg will be forced out).

Class Activity:
Soapy Shipwreck

Problem:
What does soap do to water that makes washing easier?

Materials:
1 teaspoon of liquid soap
1 pin or needle
250 mL of water
tweezers

Procedure:
1. Float a pin on a cup of water. Place the pin on the water using the tweezers.
2. Add liquid soap drop by drop.
3. Observe.

Results:
As you add soap, the pin sinks.

Why?:
The pin isn't actually floating. It is resting on the water's "skin." (surface). Water molecules are strongly attracted to one another and stick close together, especially on the surface of the water. Surface tension also prevents water from surrounding the particles of dirt, etc. on clothes.
When dissolved in water, soap separates the water molecules, reducing the surface tension.

Class Activity:
Paper Airplane Activity:

Make a paper airplane that will soar

8 1/2 x 11 inch piece of paper
ruler
scissors
pencil
timer

Make paper airplanes, compete to see which plane can soar the farthest and longest.

Class Activity:
Hygrometer

Problem: Can you make a hygrometer?

Materials:
clear, widemouthed jar
a single strand of hair a few inches longer than the jar
red marker
toothpick
glue
pipe cleaner
black marker

Procedure:
1. Colour one end of the toothpick red. Wrap one end of the hair around the center of the toothpick. Place a drop of glue on the toothpick to keep the hair in place. Let it dry.
2. Bend the ends of the pipe cleaner so that it sits on top of the jar as shown.
3. Place the toothpick in the jar by holding the end of the hair. The toothpick should be in the center of the jar, just above but not touching the bottom. Glue the hair to the pipe cleaner to keep it in place.
4. When the weather is sunny, notice which way the red end of the toothpick is pointing. Draw a sun with a black marker on that side of the jar When it is raining notice which way the red end of the toothpick is pointing. Draw rain clouds on that side of the jar.

Expansion:
Try using different sized jars, or different textured hair.

Class Activity:
Make a Rainbow

Problem: Can you make your own rainbow even when it's not raining?

Materials:
plastic tray/bowl
piece of paper
mirror
water

Procedure:
1. Put the tray of water in a sunny place, such as on a windowsill, or outside.
2. Stand the mirror in the tray so the sun can shine through the water onto the mirror.
3. Hold the paper above the tray. Tilt the mirror until you see a rainbow on the paper.

Expansion:
Can this experiment also be accomplished using an artificial light source?

Class Activity:
Make a Gas

Problem: Can you make carbon dioxide and blow up a balloon with it?

Materials:
narrow-necked jar
baking soda
vinegar
balloon
teaspoon

Procedure:
1. Fill a quarter of the jar with vinegar. Put the baking soda into the balloon, using the teaspoon.
2. Stretch the neck of the balloon over the top of the jar. Don't let any of the baking soda spill into the jar.
3. Quickly lift the balloon up to tip all of the baking soda into the jar. The vinegar will react with the baking soda, making bubbles.

Why?:
When the vinegar and baking soda react, they make carbon dioxide gas which fills the balloon, blowing it up a little.

Expansion:
Try using different kinds and sizes of balloons, and altering the amounts of vinegar and baking soda used.

Class Activity:
Testing Gravity

Problem: Does gravity move objects at the same speed, even if they have different weights?

Materials:
tissue paper
a coin
two identical boxes
two student chosen identical objects that can fit in their boxes

Procedure:
1. Carefully tear a piece of tissue paper the same size as a the coin. It will be lighter than the coin.
2. Drop the paper and the coin from the same height. (The paper falls more slowly because air gets in the way).
3. Put the coin in one box and the paper in the other. Put the lids on and drop both boxes together.

Observation:
The boxes have the same air resistance and land at the same time, even though they are different weights. Why?

Curriculum Link:
grade six space: gravity

Class Activity:
Impact Craters

A lesson designed to assist with writing a conclusion

Purpose: To determine factors affecting the appearance of impact craters and ejecta on Earth's moon

Materials:
1 pan filled with flour
dry tempera paint
3 impactors (marbles, balls, etc)
meter stick
plastic ruler
newspaper
safety goggles

Procedure:
1. Create an hypothesis as a class or as individuals.
1. spread newspaper evenly on the floor.
2. Put on your safety goggles.
3. Tap the pan to make sure the flour is settled evenly. Sprinkle a thin layer of dry tempera paint over the flour.
4. Drop the first impactor from a height of 30 cm into the pan of flour.
5. Write down your observations of what the resulting crater looks like.
6. Repeat the above steps for impactor #1, increasing the drop heights to 60 cm, and one meter.
7. Repeat the steps for two more impactors.

Results:
Is your hypothesis about what affects the appearance and size of craters supported by your experiment data? Why or why not?

What do the results of your experiment reveal about the relationship between crater size and velocity of impact?

What do the results reveal about the relationship between ejecta (ray) length and velocity of impactor?

Expansion:
What would happen if the impactor was dropped from different heights?
What would happen if you change the angle of impact?

Curriculum Link:
grade 6: space

Class Activity:
Barefoot Touch

Purpose: Allows students to express and understand the importance of detailed observations.

Materials:
sandpaper
cellophane
bath towel
jacks
chalkboard
chalk eraser
inflated balloon
wet sponge
dry sponge
baseball
paintbrush

Procedure:
1. Show the children the materials.
2. Have a child remove his/her shoes and socks.
3. Choose three items from the collection.
4. Have the child close his/her eyes.
5. Let the child touch an object from the three objects chosen with his/her barefeet and then try to guess which object is being touched.
6. Have the child describe how the object feels.
7. Develop a class list of different words describing each object.
8. Discuss how an object can be described by different people using different words.

Class Activity:
Knocking on Hard and Soft Surfaces

Materials:
soft item (pillow/sweater)

Procedure:
1. Have the children knock on the floor or a desk with their firsts.
2. Have the children knock on the same surface, but this time have them place a soft item between their fist and the surface.

Observations:
Do both knocks sound the same? If not, why not?
What does the soft item do to the sound? (It absorbs the sound vibrations. The hard surface allows sounds to bounce and echo).

Expansion:
Discuss: Is it quieter to walk across a floor that has a rug than one that does not have a rug? Why?
What are some other things in the classroom that help absorb sounds?
What are some of the things in the classroom that bounce sound off?

Curriculum Link: grade 4: sound

Class Activity:
Seeing through a Balloon

Materials:
a large balloon

Procedure:
1. Hold the uninflated balloon up to a light. Have the children see if they can look through it. Ask: *What needs to happen to the ballon for it to become thinner so you can see through it?* (It needs to be blown up or inflated with air).
2. Blow the balloon up with air. have the children look through it. (They will be able to see things that are close up, but things that are farther away will look hazy and blurry).

Expansion:
let child explore looking through assorted opaque and translucent materials. Ask them to look around their home to find materials to look through to bring in to share with their classmates.
Discuss: can light pass through all materials?
Are translucent materials always translucent?

Curriculum Link: grade 4: light

Class Activity:
Air Pressure: Plunger Power

Materials:
bathroom plunger
feather
pieces of paper
spoon or screwdriver

Procedure:

1. Place the plunger on a smooth surface like a desk or a floor. Do not press down on it. Ask one of the children to lift the plunger up.

2. Place a feather or small pieces of paper near the suction cup of the plunger. have a child press down on plunger.

3. Observe what has happened to the feather. (It has moved) What caused the feather to move? (Air under the suction cup was pushed out due to a difference in air pressure.)

4. Ask a child to lift the plunger up. It will be difficult to do unless the suction seal of air has been broken. (To do this, slide a spoon or screwdriver under the plunger's suction cup to break the air seal or suction.)

5. Discuss why it is so difficult to lift the plunger. (Air pressure on the outside of the suction cup is greater than the air pressure on the inside of the plunger's suction cup.)

6. Discuss how air pressure holds things in place.

Class Activity:
Making Frost

Materials:
empty soup can with label removed
7-8 ice cubes
magnifying glass
2 teaspoons of salt
spoon
half a cup of cold water

Procedure:
1. Put the ice cubes, water, and salt into the can.
2. Stir the mixture with the spoon for one minute. Warn that this will make the can very cold.
3. Let the can sit on a table by itself. Watch the outside of the can. (Frost crystals will soon begin to form there.)
4. Use the magnifying glass to have a closer look.

Discussion Questions & Class Activities:
Have students draw some of the frost crystals they saw.
Where did the crystals come from?
What would eventually happen to the frost if you left the can there for one hour?
Where did the water come from that froze into frost on the outside of the can?

Class Activity:
Eye of the Potato

Materials:
potatoes
drinking straws

Procedure:
1. Challenge students to make a straw go through a raw potato.
2. For this experiment to work, you need to cover the top of the straw with your thumb, then thrust the straw firmly, at an angle, downward through the potato. (The pressure from the air trapped inside the straw will strengthen the straw so it pierces the potato.)

* Choose potatoes that are not too green. Try this a few times beforehand so that you are familiar with how to thrust the straw through the potato.

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SCIENCE FAIR FAQ'S

1. **At what grade can students start doing science fair projects?**

   The answer to this depends on the level of the fair:

   School Fair – Any teacher or school can choose to have their students working on science fair projects at any grade. Some schools choose to wait until the students are eligible to participate at a higher level of fair. Some schools start a year or 2 before that in order to give the students practice before they're eligible for the more competitive fairs. Some start as early as grade 1 or even kindergarten and have the whole school involved in a science 'fair' or science-is-fun event in order to tap into the normal excitement kids have in exploring their world. We know of at least one pre-school that had their students involved in inquiry-based science throughout the year and produced a display-only science fair project as a group.

   Regional Fair – Each regional committee makes their own decisions. Many choose to begin in grade 7 to match the CWSF, but many have a pre-Junior fair of some description. The Northwestern Ontario Regional Science Fair committee runs a basically non-competitive Beginner Fair which is currently open to grades 4-6, and a fully competitive regional fair for grades 7-12.

   Canada-Wide Science Fair – The CWSF is open to students from grades 7-12.

2. **Are pairs of students allowed to work on science fair projects together?**

   Again, this depends on the level of the fair:
   School Fair – Teachers and schools can run their fairs as they choose. However, they will need to be aware of the regulations for the higher levels of fairs in order for their students to progress and participate in those fairs. Some schools allow their students to work in groups in the younger grades who cannot participate at the regional level, just to allow them to learn how to do science fair projects before they are eligible to participate in the more competitive fairs.

   Regional Fair – Again, each regional committee will make its own decision. Part of the decision may be dependent on funding and display space; some allow no pairs, some allow pairs in all participating grades. The Northwestern Ontario Regional Fair allows pairs for secondary school projects only, and if a pair is one of the top projects and wins a trip to the CWSF, the pair is responsible for finding funding for the second person.

   Canada-Wide Science Fair – The CWSF allows pairs projects for all participating grades

   (i.e. grades 7-12).

3. Can an Intermediate student and a Senior student do a pairs project together?

Yes, but if so, the project would then be classified as Senior for judging.

4. Are groups larger than 2 allowed?

School and regional fairs can again make their own rules, but … not at the CWSF, and therefore not any projects participating at lower levels of fair which hope to participate at the CWSF. The Northwestern Ontario Regional Fair does not allow groups greater than 2. Again, working in larger groups in the younger grades, not eligible to participate in the regional fair, is allowed in some schools as a familiarization tool.

5. Can only one of a pair present their project at a science fair (or 2 out of 3, etc.)?

No, this is not regarded as a fair representation of the project for the purposes of judging. If 2 (or more) people work on a project, both (or all) must be there to be judged.

6. How do my students participate in the Regional Science Fair?

Each regional fair makes their own regulations, but for the Northwestern Ontario Regional Science Fair, each school in the region will be asked if they are interested in participating in any given year and then allocated a certain number of project spots, based on the number of students participating at the school level. It will be up to each school to pick their top projects to go on to the NWORSF.

7. How do my students participate in the Canada-Wide Science Fair?

The only way for students to participate at the CWSF is to be chosen by their regional science fair.

8. What if our school is not organizing a school fair this year, but we have 1 or 2 students who want to work on science fair projects independently?

Contact the Northwestern Ontario Regional Science Fair through www.nwosciencefair.ca.