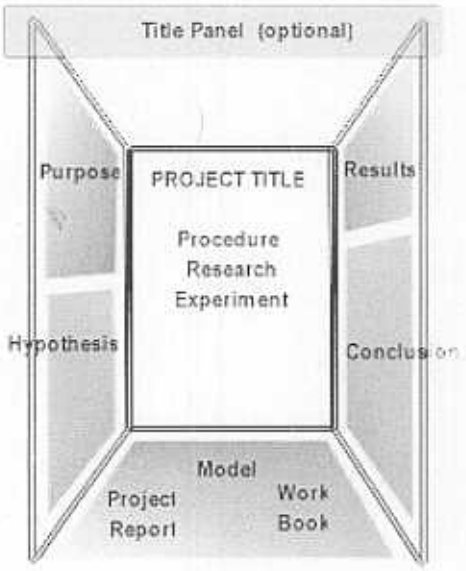
DISPLAY OF PROJECTS

The projects must be displayed in free-standing fashion. Cardboard is the most appropriate material, but those students who plan to go on to the Regional and Canada Wide Science Fair, should consider something sturdier (e.g. plywood). See the linked page on size of display as an example of layout size.

Students requiring electricity must supply their own extension cords.

Students are responsible for displaying their project (and being in attendance at the fair) on Monday evening (for judging) and Tuesday and Wednesday for the public and student visitors.

Display Size Example



Maximum Size Restrictions

height 3.5 m from floor

width 1.2 m

depth 0.8 m

JUDGING (Summary of Marks)

	Marks
A. SCIENTIFIC THOUGHT: (see next section for detailed explanation)	45
B. Presentation:	
Original Creativity	25
Skill:	10
Dramatic Value:	10
Project Summary:	10
Total:	100

NOTE	Teachers must identify Type and Level of scientific thought on the student registration form. This will assist the judges. (e.g. EXPERIMENT, Level 2; STUDY, Level 3; etc.)

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A GUIDELINE FOR SCIENTIFIC THOUGHT JUDGING (MAXIMUM 45 MARKS)

STUDY TYPE OF PROJECT	EXPERIMENT TYPE OF PROJECT	INNOVATION TYPE OF PROJECT
DEFINITION: A collection and analysis of data to reveal evidence of a fact, situation or pattern of scientific interest. It could include a study of cause and effect relationships or theoretical investigations of scientific data. Variables, if identified, are by their nature not feasible to control, but an effort to make meaningful correlations is encouraged.	DEFINITION: An investigation undertaken to test a specific hypothesis using experiments. Experimental variables, if identified, are controlled to some extent.	DEFINITION: Involving the development and evaluation of innovative devices, models or techniques or approaches in fields such as technology, engineering, or computers (both hardware and software).
STUDY Level 1 Study of existing printed material related to the basic issue.	EXPERIMENT Level 1 Duplicating of a known experiment to confirm the hypothesis. Hypothesis is	INNOVATION Level 1 Building models (devices) to duplicate existing technology. 5 + 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10

5 + 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10	totally predictable. 5 + 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10	
STUDY Level 2 Study of material collected through compilation of existing data and through personal observations. Display attempts to address a specific issue. 15 + 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10	EXPERIMENT Level 2 Extend a known experiment through modification of procedures, data gathering and application. 15 + 1, 2, 3, 4, 5, 6, 7, 8 , 9, or 10	INNOVATION Level 2 Make improvements to, or demonstrate new applications for existing technological systems or equipment and be able to justify them. 15 + 1, 2, 3, 4, 5, 6,7, 8, 9, or 10
STUDY Level 3 Study based on observations and literary research illustrating various options for dealing with a relevant issue. Appropriate arithmetic, graphical or statistical analysis in relation to some significant variable(s). 25+ 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10	EXPERIMENT Level 3 Devise and carry out an original experiment with controls. Variables are identified. Some significant variables are controlled. Data analysis includes graphic presentation with simple statistics. 25 + 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10	INNOVATION Level 3 Design and build innovative technology or provide adaptations to existing technology that will have economic applications and/or human benefit. 25 + 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10
STUDY Level 4 Study correlating information from a variety of significant sources which may illustrate cause and effect or original solutions to current problems through synthesis. Significant variable(s) identified with in-depth statistical analysis of data. 35 + 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10	EXPERIMENT Level 4 Devise and carry out original experimental research which attempts to control or investigate most significant variables. Data analysis includes statistical analysis. 35 + 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10	INNOVATION Level 4 Integrate several technologies, inventions or designs and construct an innovative technological system that will have commercial and/or human benefit. 35 + 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10

GUIDELINES FOR PROJECT DIVISIONS
Life Sciences

A life science project attends to some aspect of the life or life-style of an organism. Projects that solve problems related to biology are included, as are projects in the behavioral sciences.

Those projects which are derived from a life science topic, but have as their major focus a problem in another discipline, are better placed in a different category.

Example 1	Example 2
An acid rain project that investigates the effect of acid precipitation on potted geraniums would be a life science project, while another that examined precipitation from varying weather patterns would be a physical science project.	The effect of microwaves on germinating mung beans would be a life science project, while cooking the mung beans using microwaves would not.

Digestion is both a life process and a chemical process, so what should be done with a biochemistry project? What about a kinesiology project that tracks the centre of mass of a gymnast doing round-off? If a student solves a problem that legitimately belongs in life science and another division as well, the student needs to ascertain if the motivation for solving the problem was primarily to understand how something lives, or how something happens.

Physical Sciences

A physical science project is one that has as its primary objective a consideration of the cause and effect of some abiotic process or activity. Although living things may bear the consequences of some phenomenon under study, if the focus is on the phenomenon itself, and not on its effect on the organism(s), then the study is a physical science project.

Example 1	Example 2
The meteorological characteristics of a Chinook would be physical science, while the effects of a Chinook on living organisms would be life science.	The factor affecting the size of a bubble gum bubble (time, brands, etc.) would be a physical science project, although factors to be considered would include the effect of digestion enzymes and saliva and the action of chewing, both of which are life science.

It is possible that some physical science studies may overlap into engineering. The student may need some guidance to focus on one area while perhaps maintaining the other as background work or as a related extension.

Computer Science

A computer science project is one in which the computer is the focus of the project. Projects in this division will be of two distinct types. One will be some sort of programming project where a student has written an original piece of software applicable to a particular problem. The second type of project will involve some hardware innovation, either to the computer itself or to a peripheral piece of equipment. The latter case may also require a complementary software innovation.

There are at least two considerations to be made when placing projects in this division. The first is to beware of projects that use a computer as a tool to store and manipulate data from some other work. If the computing activity is not the focus of the project, perhaps with the data gathered only for demonstration purposes, such a project should be placed in the division suggested by the data.

The second problem pertains to the distinction between computer science projects and engineering projects. For the purposes of science fair project designations, a project that has the attributes of an engineering project, but with a prime focus on a computer-related idea, is best registered as computer science.

Environmental

Projects dealing with the study of earth and space science, along with the impact of environmental factors on biological systems. Projects in this category would include the fields of ecology and oceanography.

Engineering

An engineering project involves the design and/or physical construction of some device, appliance, machine, process, etc. that has an application. Whereas a physical science project looks at the relationship of factors or variables, an engineering project applies the relationships.

Example 1 Finding out what keeps an airfoil up is physical science; designing a better airfoil is engineering.	Example 2 Measuring solar energy coming to a given place is physical science; catching it for use is engineering.
Example 3 Determining the optimum conditions for raising worms would be life science; designing the vermicarium that would operationalize these conditions would be engineering.	Example 4 Investigating the variables involved in the removal of oil from tar sands (temp., solvents etc.) is physical science; developing a process for extraction is engineering.

For the purpose of science fairs, computer-related projects are considered a separate division.

SAFETY REGULATIONS FOR SCIENCE FAIR PROJECTS

General Safety

1. Safety to the public is a prime consideration. Suitable precautions must be taken to prevent the possibility of personal injury, property damage, and the legal action that could result from a lack of concern for safety.
2. Exhibits must be sturdy with moving parts firmly attached and approved for safety. Each exhibit must be self-supporting. Electricity (AC 110 volt 60 cycle) will be supplied but no gas or water outlets will be provided. Switches and cords must be of the approved variety and circuits must be protected by fuses. Cell or battery-fed circuits should be both safe in design and operation.
3. All sharp edges or corners on prisms, mirrors, enclosures, and glass and metal plates must be removed or otherwise protected.
4. The length of hoses or extension cords is to be kept to a minimum and out of the way to eliminate tripping hazards. Use tape for securing..
5. Aisles and exits should not be obstructed.
6. Moving exhibits (e.g. radio-controlled vehicles, robots) should be restricted to the regulation display space.
7. In addition to the regulations noted here, there may be local municipal or provincial regulations which must be followed. The Host Committee shall share any such restrictions with RSFs in September preceding the fair.
8. The exhibits must comply with all YSF Canada animal and safety regulations as outlined under the headings Regulations, Display of animals and animal parts.

Fire Safety

Certain restrictions have been defined on the construction of displays to reduce the possibility of accidental fire during the fair.

1. All backboards must be constructed from a material at least 1/8" thick. Acceptable products are plywood, Masonite (6 mm, 1/4"), peg-board, chipboard, particleboard or panelboard. Any other material able to withstand the standard flame test is also acceptable.

   Therefore, corrugated cardboard, free-standing Bristol board, foam-core art board, styrofoam or similar insulative materials and other flammable or toxic gas producing materials are unacceptable.

2. Panels can be decorated by paper that is applied with wallpaper past, rubber cement, glue, tacks, pins, or staples so that no air pockets are left behind the paper. This includes lettering, experimental write-up sheets, borders, and backgrounds. Panels can be painted with any water-based

latex paint. No proof of source is required. All other coating materials must be Underwriter Lab approved and proof of such approval is needed, i.e. the can and its label.

3. **All chemicals used for the actual experiment must be left at home or school and simulated by safe substitutes**, such as colored water. All experimentation should have been completed before the fair and the challenge is to describe the processes followed. No project will be penalized because the key (but potentially dangerous components) were not on display.
4. Fire extinguishers of proper size and rating will be available in the exhibition area.
5. Combustible material should not be used near a heat source.
6. Open flames should not be used unless protected and approved by the safety committee.

Chemical Safety

1. No containers of toxic or flammable chemicals are allowed.
2. Dangerous chemicals are not allowed - this includes prescription drugs and over-the-counter medication.
3. Substitutes for toxic and corrosive chemicals must be used. Common salt, for example, can be used to simulate chemicals such as ammonium nitrate. Water may be used instead of alcohol, ether, and other highly flammable liquids. Molasses can be used to represent petroleum products. When chemicals are simulated, they should be labeled with the names of the substance they represent preceded by the work "simulated." No project will be penalized because the key (but potentially dangerous) components were not on display.

Electric Safety

1. Use voltage as low as possible.
2. Use a ground fault interrupter for electrical leaks and faults. Such units should be installed on the main electrical control panel serving the entire exhibit area.
3. Disconnect all electrical exhibits at the end of the day or the viewing period.
4. Use only extension cords in good repair and with CSA approval. Cords with defects in insulation or connections should be discarded.
5. Where practical and necessary, it is recommended that pilot lights be used to indicate that the voltage is on.
6. Cord-connected electrical appliances should have a 3-wire conductor with ground or be CSA approved.

7. An insulating grommet is required at the point where the service enters the enclosure.
8. Electrical devices must be protectively enclosed as far as it is practical.
9. The enclosure must be non-combustible. All non-current carrying metal parts must be grounded.
10. No exposed live parts over 36 volts are allowed. Current (amperage) must be low so as not to cause any discomfort or danger if touched.
11. Wet cells shall not be used because of the hazardous chemicals involved.

Structural And Mechanical Safety

1. Construction of exhibits must be of a safe design with adequate stability to keep from tipping.
2. Dangerous moving parts such as belts, gears, pulleys and propeller blades must be suitably guarded.
3. Pressurized vessels should have a safety valve.
4. Compressed gas cylinders are not allowed.

Use Of X-Rays Or Radiation-Producing Equipment

If an exhibit uses x-ray equipment or any other equipment capable of emitting high energy radiation, registration of ownership with your provincial government is required. You must submit plans for structural protection to the provincial government and request approval, for which both the owner of the device and the owner of the building are responsible. You must identify an individual formally trained and qualified to exercise supervision of the operation and to take responsibility for safe performance. It will be an obligation of this individual to satisfy the Chief Inspector by exposure rate measurements or other suitable documentation that the operation is safe. Project involving voltages above 10kv should be considered to pose a potential x-ray hazard.

Lasers and x-ray or radiation-producing equipment may not be operated during public viewing periods.

Microorganism Safety And Bio-Hazards

1. The following hazardous biological materials may not be displayed:

   - Radio-isotopes or compounds containing radio-isotopes at activities above normal background.

- Biological toxins.

- Microorganisms pathogenic to animals. (The use of mixed cultures obtained from the environment, e.g. soils, mouth swabs, etc. are acceptable for experimentation and display.)

- Cells or tissues infected with animal viruses.

2. No cultures are allowed for exhibition. Photographs or simulated cultures may be used.
3. Experimentation involving hazardous materials must be carried out under controlled laboratory conditions and supervision. The name and qualifications of the supervisor should be specified.
4. Experimental manipulations of recombinant DNA molecules or animal viruses are prohibited.
5. No plant tissue, soil or material which could decompose shall be exhibited.

ANIMAL CARE - REGULATIONS

Animal Care - General

Regulations pertaining to projects involving animals and the display of those projects reflect different standards. While student investigations of biological processes are to be encouraged, they are subject to the same laws, ethics, and regulations as any other research. In the Criminal Code of Canada, the Animals for Research Act of Ontario, and similar legislation in other provinces, all vertebrates are afforded protection. Also, schools and science fairs are explicitly included in the definition of "research facility" in Ontario. The regulations described here are written in view of these laws.

The display of a project is further restricted by the YSF Canada in view of the need to maintain a positive public image towards science fairs. The restriction is due in part to a lack of essential expertise and experience on the part of the student investigators and their immediate supervisors. There is also a desire (on the part of the general public and research community) to maximize the efficiency of animal use and to impress this on the students, especially regarding scientific merit and value.

RSFs should adhere to the following regulations and take steps to ensure that schools within their region are thoroughly familiar with them and conform to them in school fairs. The regulations must certainly be adhered to for the CWSF, so it would be in the best

interests of all concerned if the guidelines are followed faithfully from the outset.

Visiting projects from other countries should be informed of these regulations sufficiently before the fair so that they do not display projects contradictory to the Canadian regulations and milieu. Biological experimentation is subject to legal restrictions including, among others:

- Criminal code of Canada, Section 446, Cruelty to Animals;
- Convention for International Trade on Endangered Species;
- Canadian Wildlife Service;
- Health of Animals Act, Bill C-66
- Guidelines of the Canadian Council on Animal Care;
- Animals for Research Act (Ontario); and
- Regulations for Housing, Care and Treatment of Animals Used for Biological & Medical Purposes (Alberta).

Regulations

Any experiments involving human beings and other vertebrate animals should be passed through the YSF Canada Ethics Review Committee to ensure compliance with the above mentioned regulations and restrictions. If necessary, the YSF Canada will refer the project to appropriate authorities cognisant of current regulations and relevant aspects regarding scientific merit, for guidance and suggestions for performing the work.

Lower orders of life (bacteria, fungi, protozoa, insects, plants and invertebrate animals) can be used in experimentation to reveal valuable biological information relevant to higher orders.

Vertebrate animals (birds, fish, mammals, reptiles, amphibians) are not to be used in any active experiments which may in any way be deleterious to the health, comfort or physical integrity of the animals.

Observation of wild animals, animals in zoological parks, farm animals and pets is permitted. Observation of wild animals falls within the definition of hunting (or fishing) in some jurisdictions. Students should also obtain advice and permission from

conservation authorities to ensure that they are not interfering with the animals' normal lifestyle and well-being, and to ensure that their project is permissible. A permit may be required.

For example, behavioral experiments with positive rewards are permissible only if the animal is not placed in a stress situation. Training an animal to travel through a maze to receive a food reward is stressful, particularly if the animal is hungry, and is therefore not permissible. However, allowing an animal to make a free choice (of food, for example) is permissible, as long as the animal is not stressed before offering the choice (e.g. by withholding food).

Studies of chick embryos are similarly restricted to observation, without intervention with drugs or other chemicals, or manipulation of physical conditions to test the resiliency of the animal. If eggs are hatched, the chicks must be reared normally. Otherwise all embryos must be destroyed by freezing by the 18th day of incubation.

Cells and animals parts (including organs, tissues, plasma or serum) purchased or acquired from biological supply houses or research facilities may be used in science fair projects, but should not be displayed at the fair. Evidence of the source of the materials (e.g. bill of sale) must be available at the display.

The acquisition of animal parts should involve either the service of biological supply houses or research facilities, or involve salvage from other sources. Salvage from found carcasses (e.g. road kills) is discouraged due to serious health risks and other constraints.

If the acquisition involves salvage from a research project, where the animal has been killed for other legitimate purposes in a legal and humane manner, then the disposition to the science fair project must be part of the original research proposal, and such disposition must have been approved by the Research Committee or the Animal Care Committee of the institution involved. Reference to the original project should be made on the science project display.

If the acquisition involves salvage from the food industry, then the source must be acknowledged.

If the acquisition involves hunting, fishing or trapping, then those activities must be done in accordance with prevailing regulations, and precautions must be taken to ensure the safety of the student(s). The taking of animals other than for food, without

explicit approval, can constitute cruelty. Permits for research are available from conservation authorities, and should be displayed at the project.

Research involving human beings must involve the principles of informed consent. No human tissues or fluids are to be exhibited in a science fair project due to the associated ethics and possible health hazards. A proposal for an "experiment" of any kind involving humans must be submitted through the YSF Canada Safety, Animal Care and Ethics Policy Committee for advice from competent authorities and to ensure compliance with all applicable regulations and restrictions.

Display Of Animals And Animal Parts

Students working on biological projects may involve animals as outlined above. The display of the project is to be a report of completed work, and thus further restrictions are imposed. Also, science fair organizers should try to reduce the potential for adverse reaction from visitors and other exhibitors.

Live microorganisms and vertebrate or non-vertebrate animals shall not be included in the display, although appropriate photographs may be available in the report.

The only parts of vertebrate animals that may be displayed are those that are either naturally shed by an animal or parts properly prepared and preserved. Soft tissue specimens are not acceptable if they are preserved in formaldehyde, a dangerous chemical excluded under the chemical safety section of these guidelines. Sealed tissue samples on microscope slides are permissible.

Thus, porcupine quills (safely contained), shed snake skin, feathers, tanned pelts and hides, antlers, hair samples, skeletons and skeletal parts are permissible, while organ and tissue samples are not. However, photos, videos or slides of organ and tissue samples may be available for viewing upon request, but may not be obviously displayed.

Scientific Merit

A science project should strive to have true scientific value and originality.