**Science Fair**

**1. Criteria to Consider when Choosing Science Fair Projects:** pg.2

The project must fit into one of the science 9 units:

 -Atoms and Elements (chemistry)

 -Characteristics of Electricity (physics)

 -Reproduction and Human Development (biology)

 -Exploring our Universe (astronomy)

The project must fit into one of the Science Fair categories:

 A. Automotive pg.2

 B. Computing and Information Technology pg.2

 C. Life Sciences pg.2

 D. Biotechnology and Pharmaceutical Sciences pg.2

 E. Earth and Environmental Sciences pg.3

 F. Engineering pg.3

 G. Environmental Innovations pg.3

 H. Health Sciences pg.3

 I. Physical & Mathematical Sciences pg.4

**2. Choosing Project Format:** pg.5

The project will must follow one of these formats (although it is possible that a project may include elements from more than one of the formats).

A. Experiment pg.5

B. Innovation pg.5

C. Study pg.6

**3. Originality and Creativity:** pg.6

Some project ideas will be taken directly from the Internet, others will be genuinely original. Those that were borrowed will need to be altered to make the project more individualized. Copying an experiment out of a book or from the Internet will not impress the judges.

**4. The project log and report:**  pg.6

The report should be minimum five pages long. It should include references, background information, data collected, and a day to day report on accounting for all the work that was done on the project.

**5. Backboard and display:**  pg.7

The backboard has to be built to specific dimensions and needs to be constructed in such a way the judge can make quick sense of what the project was about and the conclusions that were drawn.

**6. Presentations:**  pg.8

Each project will be marked on their ability to explain their project as well as answer questions that the science fair judge has about their project.

**7. Usage of class time:**  pg.8

Focus on what the student does in class, this includes not only the preparation, but also the removal and cleaning that follows the presentation.

**8. Topic Assistance** pg. 9

**9. Write Up Guidelines** pg. 10

**10. Timeline** pg. 12

**1. Criteria to Consider when Choosing Science Fair Projects:**

The project must be related to one of the science fair categories. Before you begin work on your project it must first be approved by your teacher. Make sure you identify which category your project would fit in (automotive, biotechnology sciences…).

**A. Automotive**

Automotive projects fall into 6 general categories:

 i) **Health, Safety and Injury Prevention** projects focus on making future vehicles safer for both occupants and pedestrians through the application of new technologies to future vehicles or the education of vehicle operators and others. Another important area of research is in making automotive manufacturing plants safer for auto workers.

 ii) **Societal Issues and the Future Automobile** projects focus on social and political issues related to the automotive sector. These projects explore the advantages of a sustainable and healthy Canadian automotive sector, including social benefits, economic prosperity, employment growth and public safety.

 iii) **Materials and Manufacturing** projects focus on traditional and innovative materials and manufacturing methods for the future automobile. The goal is to create future cars that are lighter, stronger, less expensive, and lower in environmental impact.

 iv) **Powertrains, Fuels and Emissions** projects focus on the vehicle powertrain or the fuel that it consumes. This includes fuel efficiency, exhaust emissions and greenhouse gas emissions. The goal is to create vehicles that perform to consumer expectations and have a lower environmental impact.

 v) **Design Processes** projects examine how new technologies can work together and enable engineers to develop better vehicles. These projects include the integration of product manufacture, new materials and manufacturing processes to meet the needs of the vehicle operator or passenger.

 vi) **Intelligent Systems and Sensors** projects explore the ways in which electronic and mechatronic systems and sensors can be used to help make driving safer, easier, more energy efficient and more enjoyable. These projects focus on technologies that enhance driving through remote sensing and assisted navigation.

**B. Computing and Information Technology**

Computing and information technology projects concentrate primarily on the development of computing hardware, software or applications, including programming languages and algorithms, software design and databases as well as the storage, transmission and manipulation of information.

Projects using computers to store and analyze data are normally entered in the division suggested by the focus of the experiment or study. However, if the project's focus is primarily on the application of computing to the problem and the data are of secondary significance, the project should be entered in this division.

**C. Life Sciences**

A Life Science project examines some aspect of the life or lifestyle of a non-human organism. These include botany and zoology, as well as psychology and kinesiology of non-human organisms. Examining plant growth or animal behaviour are examples of life science. Some phenomena, such as digestion, involve both life science and physical science. The selection of division will spend on whether the young scientist’s intent was to study the chemistry of the process, or the role of the process in the life of the animal.

**D. Biotechnology and Pharmaceutical Sciences**

**Biotechnology** projects apply knowledge of biological systems to solve a problem, create a product or provide a service. Biotechnology projects generally fall into one of four fields:

 i) **Crop development** projects focus on plants that are involved in agricultural, horticultural or silvicultural (forestry) production. Projects in this area may investigate problems of herbicide tolerance, spacing, cultivation, irrigation, effect of soil variation, hybridization...

 ii) **Animal science** projects pertain to animals involved in agriculture or aquaculture, sport, or domesticated pets. Also included are projects where humans participate in wild animals’ lives through habitat revitalization, population management, or harvesting. Possible topics include enhanced animal production, reproductive technologies, genetics and transgenics, animal health, housing, training and interactions. Most animal science projects will be of the study type. Experiments on vertebrates demand careful planning, pre-authorization, and must satisfy Science Fair rules that govern the use of animals. For details on use of animals in your project visit: *http://www.ysf.ca/files/PDF/governance/policy/en/4.1.2\_Animals.pdf*

 iii) **Genomics** projects focus on deciphering and understanding the genetic information content of an organism. Genomics differs from classical biological research in its large scale, broad scope and intense reliance on data collection, analysis and information technology (bioinformatics). Proteomics, the study of proteins and their location, structure and function, is part of the wider study of genomics.

 iv) **Microbial** projects consider how microbials affect productivity in agriculture, horticulture and forestry. Possible topics include plant growth-promoting rhizobacteria, biological weed and fungal control, bio-fuel cells, etc.

Projects that focus on acquiring knowledge about how something lives are categorized as Life Science, not Biotechnology.

**Pharmaceutical Sciences** projects study the interaction of chemical substances with living systems. This includes substances with medicinal properties (show the potential to cure or reduce symptoms of an illness or medical condition). Projects could include studies on drug composition and properties, interactions, toxicology, therapy, medicinal applications and antipathogenic capabilities. Experiments on people demand careful planning, pre-authorization, and must satisfy Science Fair rules that govern the use of people. For details on use of people in your project visit: http://www.ysf.ca/files/PDF/governance/policy/en/4.1.1\_Humans.pdf

**E. Earth and Environmental Sciences**

Earth and environmental sciences projects focus on topics relating to how the planet works, how these planetary processes affect living things, or relationships between or among living things. Examples would be the study of pollution, its sources and its control. It can also involve studies of biotic and/or abiotic factors in an environment, where such studies enhance our understanding of biological relationships and abiotic cycles.

These projects fall into the fields of geology, mineralogy, physiography, oceanography, limnology, climatology, seismology, geography, or ecology.

Studies dealing with resource management or sustainable development usually fall into this category. Examples of such studies might include capture/recapture studies estimating population densities, determining bioproductivity in a specific ecosystem or niche, plate tectonics studies or examinations of mineral cycles (e.g., salt mills in the oceans).

**F. Engineering**

An engineering project applies physical knowledge to solve a problem or achieve a purpose. A complete engineering project will include an outline of the need, the development of the innovation and some work on introducing the innovation to the community; however, many engineering projects focus on just the development phase.

The difference between a project in Physical Science and one in Engineering is that Physical Science would pry into the “how does this work,” where Engineering would be concerned with how a modification would change performance.

**G. Environmental Innovations**

An Environmental Innovation looks at how can we improve the environment or create a sustainable future. This includes the invention of an item that leads to a reduction in consumption. Projects might have the student find new uses for items that are currently disposed of, strategies to reduce our current usage of particular items, or find alternative ways of doing things that would lower the amount of oil we use and limit the distance items need to be shipped.

**H. Health Sciences**

The Heath Sciences are concerned with human health and may include the connection between ones health and biological, genetic, psychosocial, economic and environmental factors. Projects may also look into diagnosis, treatment and prevention of disease.

**I. Physical & Mathematical Sciences**

These projects study abiotic phenomenon to understand the relation between identified factors, perhaps including a cause and effect relationship, or the use of mathematical models or mathematics to solve theoretical problems.

**Physical science** projects include fields such as physics, and chemistry and astronomy. Comparison testing of products is included in this division.

**Mathematical science** projects seek to demonstrate applications of mathematics (i.e. the search for a mathematical model) or to solve a theoretical problem. For example, in attempting to predict the shape of cacti, the use of mathematics would be central to the project. The problem provides a context for the exploration of pattern and the search for a mathematical model. Some areas of investigation in this category include algorithms, operational research (applications of mathematical and computing science to solve planning or operational problems), and statistics.

**2. Choosing Project Format:**

 **A. Experiment:** investigation undertaken to test a scientific hypothesis using experiments. Experimental variables, if identified, are controlled to some extent.

An example is the affect of different types of music on a plants growth:

**The independent variable** is the factor that is being tested. In this example it would be the type of music that is played.

**The dependent variable** is the expect outcome that will be measured to determine if your experiment was a success. In our example this would be measuring the height of the plant ten days after it first broke ground.

**The controlled variables** are all other factors that may affect the experiment; the scientist must insure that the only real difference between the different trials is the independent variable. In our example we will want to ensure that no one plant has an advantage over another plant, so they must receive the same amount of light, the decibels of the music (how loud it is) must be the same for each type of music, they all use the same soil, etc…

**A control experiment** does not contain the variable: in our example this would be a test that does not include music, thus testing to see if music has any affect at all.

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| Project Value | Criteria |
| 5-15 points | Duplication of a known experiment to confirm the hypothesis. The hypothesis is totally predictable. |
| 16-30 points | Extend a known experiment through modification of procedures, data gathering, and application. |
| 31-45 points | Devise and carry out an original experiment with controls. Variables identified. Some significant variables are controlled. Analysis such as graphs/simple statistics. |
| 46-55 points | Devise and carry out original experimental research which attempts to control or investigate most significant variables. Data analysis includes statistical analysis and a number of different trials. |

**B. Innovation:** The development and evaluation of innovative devices, models, or techniques or approaches in technology, engineering or computers (hardware or software).

In other words, your project would have you build something and it would either:

- Allow people to do something they have never done before.

- Allow people to do something they already do, but in a different way.

- Find a new way to make a current product.

- Create something new that does the same job as something that is currently being used.

- Create a new way of completing a task that is more efficient.

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| Project Value | Criteria |
| 5-15 points | Build models (devices) to duplicate existing technology |
| 16-30 points | Make improvements to, or demonstrate new applications for existing technological systems or equipment and justify them. |
| 31-45 points | Design and build innovative technology or provide adaptations to existing technology that will have human benefit and /or economic applications. |
| 46-55 points | Integrate several technologies, inventions or designs and construct an innovative technological system that will have human and/or commercial benefit. |

**C. Study:** A collection and analysis of data to reveal evidence of a fact or a situation of scientific interest. It could include a study of cause and affect relationships or theoretical investigations of scientific data.

looks at the state of a system through the production of a research paper or scientific polling. This is something that is often done when someone is curious about a topic that may not be possible to explore in an experiment. Looking into the topic of AIDS is an example, the topic could be researched but there is no way it would be possible to conduct an experiment dealing with AIDS.

These may include things such as:

- testing the water in the river for different materials.

- looking at the link between smoking and educational background.

- determining if there is a link between exercise and mental alertness.

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| Project Value | Criteria |
| 5-15 points | Study of existing printed material related to the basic issue. |
| 16-30 points | Study of material collected through compilation of existing data and through personal observations. Display attempts to address a specific issue. |
| 31-45 points | Study based on observations and literary research illustrating various options for dealing with a relevant issue. Appropriate analysis (arithmetic, statistical, or graphical) of some significant variables. |
| 46-55 points | Devise and carry out original experimental research which attempts to control or investigate most significant variables. Data analysis includes statistical analysis and a number of different trials. |

**3. Originality and Creativity:**

The exhibit should be a creation of the student which either illustrates a novel idea or device or demonstrates an idea or device in an original manner. The contributions made by others must be acknowledged on the exhibit or in the report. The project may not be the same as one you have done before in the past, nor can it be a project one of your classmates has done before unless it shows large improvements and alterations. Many successful participants improve and develop their projects from one year to the next.

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| Project Value | Criteria |
| 5-10 points | Little imagination shown. Project design is simple with minimal student input. A textbook or magazine type project. |
| 11-15 points | Some creativity shown in a project of fair to good design. Standard approach using common resources or equipment. Topic is a current or common one. |
| 16-20 points | Imaginative project. Good use of available resources. Well though out, above ordinary approach. Creativity in design and/or use of materials. |
| 21-25 points | A highly original project or a novel approach. Shows resourcefulness. Creativity in design, use of equipment and/or construction of project. |

**4. The Project Log and Report:**

At the display should be a book that includes the following:

 - A table of contents.

 - Background information that has been photocopied or printed of the Internet. It is not good enough to just fill it with material. Make sure that it is evident that the material was used in the project by highlighting and making notes on these pages.

 - A bibliography at the back of your booklet that lists all the information you have researched. This not only includes books, but also magazines, the Internet, and people.

 - A log book (like a diary). Every time you do something involving your project record the date and what you did in your log book.

The booklet can not be less than 5 pages. In fact, it should be substantially larger. **Do not** print all your material twice putting one copy on your backboard and the other copy in your booklet.

**5. Backboard and Display:**

Exhibits must be confined to an area which does not exceed **0.75 m front to back and 1.20 m** **from side to side**. The overall height of exhibits from the floor is limited to 3.60 m.

All exhibits must be self-supported. Wall space to attach exhibit material to will not be available, only the table will be provided.

In special circumstances, oversized exhibits may be accepted but special permission must be obtained in advance from the Science Fair Committee.

**The typical Backboard Design:**

Title of Project

Conclusion:…

Purpose: …

Discussion: …

Data: …

Hypothesis:…

Materials: …

Procedure: …

Purpose, hypothesis, materials, data, conclusion, and discussion follow the same format as the laboratory write-up outline that is found on page 4.

**Marking Criteria:**

 - Amount of time put into creating the display……………………………………. /15

 - Followed the layout provided……………………………………………………... /5

 - All text is in a font that is easy to read…………………………………………… /5

 - The text is grammatically correctly……………………………………………….. /5

 - Pictures of the project being conducted are present (if possible)…………….. /5

 - The purpose, hypothesis, materials, data, conclusion, and discussion

 were properly written following the format outlined in the duo-tang…………. /30

**\*\*\*The backboard must be cleaned and returned exactly as distributed after Science Fair\*\*\***

**Safety Concerns:**

When assessing the hazards of exhibits, the exhibitors should ask themselves the question, "Could a viewer -- particularly a small child -- touch or spill materials and hurt himself?" If so, additional safety precautions will be required. Construction of frame work, exhibits, displays, etc. must be of a safe design with adequate stability to keep them from tipping.

**Electricity:**

 - A standard electrical outlet of 110V is available but no other service will be available.

 - Extension cord lengths are to be kept to a minimum, and need to be taped down and kept out of the way to eliminate tripping hazards.

 - Electrical cords should be free from breaks, have three prongs, and be CSA approved.

 - Displays must clearly identify if/when electrical current is present.

 - All connections must be insulated or protectively enclosed where practical and the enclosure should be non-combustible.

 - All non-current carrying metal parts of an electrical apparatus must be grounded.

 - Disconnect the power to your apparatus at the end of the day or viewing period.

**Glass and Metal:**

 - Remove/shield edges and corners on prisms, mirrors, enclosures, glass and metal.

**Lasers:**

 - Lasers must have a power of 1 milliwatt or less. Precautions must be taken to ensure that the direct beam never reaches the eye of the observer.

**Heat Sources** (hot plates, light bulbs…):

 - Heat sources must not be used near combustible materials (paper, plastic, cardboard…).

**Projects with Moving Parts:**

 - Dangerous moving parts such as belts, gears, pulleys or fan blades must be suitably guarded. These exhibits must never be left unattended by the exhibitor.

**Chemicals; Corrosive, Toxic, or Highly Flammable Materials:**

 - Any material that could be considered dangerous should be avoided. Substitute items that look like the materials used during your project. The simulated chemicals should be labeled with the names of the substances they represent followed by the word "simulated" in brackets.

**Plants:**

 - All plants must have their soil contained, best to put saran wrap around the base of the plant completely sealing the top of the pot.

**6. Presentations:**

International Blogging Partners will look at all projects and ask questions about what you have done. They will expect you to explain what your project was about and answer the questions they have about your project.

**7. Usage of class time:**

Your ability to use class time efficiently is worth 10 of your marks. A lot needs to be accomplished so I should not have to ask you to get on task or catch you playing games on the computer. The work you put in at home will be reflected in the overall mark you receive when your project is evaluated.

**8. Breakdown of Marks (200 total marks):**

 /10 Usage of class time /10 Presentations

 /55 Satisfying the Criteria of your Project Format /25 Originality and Creativity

 /20 The project log and report /65 Backboard and display

 /10 Extent Linked to Sci9 Curriculum /5 Clean-up/backboard returned

**TOPICS RELATED TO THIS CLASS**

**Life Science – Reproduction and Human Development**

 **-** Examine the process of and influences on the transfer of genetic information.

 **-** Observe and describe the significance of cellular reproductive processes, including mitosis and meiosis.

 **-** Describe the processes and implications of sexual and asexual reproduction in plants and animals.

 **-** Analyze the process of human reproduction, including the influence of reproductive and contraceptive technologies.

**Physical Science – Atoms and Elements**

 - Distinguish between physical and chemical properties of common substances, including those found in household, commercial, industrial, and agricultural applications.

 - Analyze historical explanations of the structure of matter up to and including:

• Dalton model

• Thomson model

• Rutherford model

• Bohr model of the atom

 - Demonstrate an understanding of the classification of pure substances (elements and compounds), including the development and nature of the Periodic Table.

**Physical Science – Characteristics of Electricity**

 - Demonstrate and analyze characteristics of static electric charge and current electricity.

 - Analyze the relationships that exist among voltage, current, and resistance in series and parallel circuits.

 - Assess operating principles, costs, and efficiencies of devices that produce or use electrical energy.

 - Critique impacts of past, current, and possible future methods of small and large scale electrical energy production and distribution in Saskatchewan.

**Earth and Space Science – Exploring our Universe**

 - Inquire into the motion and characteristics of astronomical bodies in our solar system and the universe.

 - Analyze scientific explanations of the formation and evolution of our solar system and the universe.

 - Examine how various cultures, past and present, including First Nations and Métis, understand and represent astronomical phenomenon.

 - Analyze human capabilities for exploring and understanding the universe, including technologies and programs that support such exploration.

**Science 9 – Laboratory Write-up**

 - Formal lab write-ups should follow this order.

 - Use this outline every time you are to do a laboratory write-up and you should do well.

 - Always read your entire laboratory handout before beginning your laboratory, often there is information that you require to make your hypothesis and to answer questions at the end.

The following examples are drawn form a laboratory in which students grew plants under different coloured lights for one week to determine under which coloured bulb the lights grew best.

**Purpose:** The purpose answers why you are conducting the lab and by what means. A purpose could read:

 “To determine which color of light will cause plants to grow best by exposing newly sprouted plants to four different coloured lights, red, green, yellow, and white.”

**Hypothesis:** The hypothesis makes an educated guess as to what your results might be in relation to the purpose of the lab that you have outlined. This tends to be quite difficult and may require you to reflect back on information from past classes or recently covered material. A hypothesis could read:

 “The green light should allow plants to grow best since that is the color that a healthy plant, the red light should be the least effective since red and green are opposite colours.”

**Materials:** Material lists should always be made while you conduct the experiment, write down everything you use and include chemicals and their concentrations. This could be taken from the laboratory handout, but often substitutions must be made based on the supplies available.

**Procedure:** A procedure should always follow the form:

 “The procedure was followed as outlined in the experiment titled “What Light is Needed to Grow Strong Plants” found on pg.22 in the biology 20 duo-tang with the following changes to these steps:

 Step 3) should read: “Put the plants into 20 litre white plastic containers, cut a hole in the top of the lid and put the light bulb through the hole so it can shine on the bean seeds.”

**Data:** All data tables and graphs should be clearly labeled, neat, and include proper units. In many labs it is important to record qualitative data; information that does not have a number associated with it such as color or color change, change in texture, or a noticeable odor being emitted.

**Conclusion:** The conclusion states the results and nothing else.

 “The white light was most effective, followed by the red light. Although the beans had spouted under the green and yellow light, all seedlings had died before the experiment had been completed.”

**Discussion:** The discussion should be written in paragraph form, be at least ten sentences long, and is the only part of the lab that you can use words such as “I, me, we, they,” or “us.” The discussion should address three things which will exemplify your critical thinking skills and understanding of the laboratory, these three things are;

* 1. What are possible sources of error that could have affected your result?
	2. In what way would the identified error have affected your result?
	3. What changes could you make to the lab that would improve the accuracy of your results?

\*Do not include carelessness that should have caused you to start the experiment again such as: “my cat got into the beans sprouts under the yellow light and dug them up, and then urinated on them.”

**Questions/Analysis:** Amended to the end of your laboratory only if issued by your instructor.

**Science 9 – Graphing Rules**

|  |  |  |
| --- | --- | --- |
| **Good Graphing Technique****greedo** |  | **Poor Graphing Technique****jar** |
| 1.Use as much space as possible2. Circled all points3. Line is drawn "best fit" when there is a linear relationship; if the data curves the drawn line smoothly follows the data. |   | 1. Used less than ¼ of the sheet2. Points are not circled and have the potential to loose visibility when the line is drawn on the graph.3. Played connect the dots |
| greed2 | 4. Both x-axis and y-axis properly titled with units included in brackets. The known scale before the experiment is on the x-axis, the unknown before the experiment is on the y-axis.5. All scale values are placed on the lines of the graph paper. |   | jarj2 | 4. The x-axis has a unit but no title and the y-axis is missing units. The known was placed on the y-axis, the unknown was placed on the x-axis.5. Not all scale values have been placed on the lines of the graph paper. |
| 6. The graph has been named in the form unknown vs. known ("y-axis" vs. "x-axis")7. Name is accompanied by the date and lab partner’s name placed in the upper right hand corner. |   | 6. The graph has not been titled at all, or if titled does not follow proper form.7. Either name, date, or partner’s name is missing from the report. |

**SCIENCE FAIR TIMELINE**

Please check in with Miss Thibeault on each of these dates. It is your responsibility to ensure that you are on schedule. All meetings will be at lunch in the Chem Lab.

|  |  |
| --- | --- |
| Date | Complete |
| Thursday, Feb. 28 | * Meet to discuss Science Fair.
 |
| Monday, March 4 | * Choose a topic
* Choose a format
* Have a proposal ready for Miss Thibeault (a short, typed write up explaining **what** you want to do, **how** you want to do it, **why** you chose that topic, and how it **relates** to Science 9).
* This should be posted to your blog. Tag it with your first name and Science Fair.
* Log book is started on your blog (create a page). Tag with your first name and Science Fair.
 |
| Wednesday, March 6 | * Background information all found
* Bibliography for report complete
* Purpose and Hypothesis report complete
* Materials and Procedure for report complete
* All required materials acquired
 |
| Monday, March 11 | * Data Collection for report complete and compiled
 |
| Wednesday, March 13 | * Conclusion for report complete
* Discussion for report complete
* Table of Contents for report complete
 |
| Monday, March 18 | * Backboard display elements complete
 |
| Wednesday, March 20 | * Backboard assembled
 |
| Monday, March 25  | * Be prepared to present to your classmates and me (create a PowerPoint/presentation with highlights from your report).
 |
| Easter Break: One-Two Meetings  | * Work on revisions for regional science fair (in Lumsden), should you be selected
 |
| Tuesday, April 9 | * Regional Science Fair (Lumsden)
 |