4-H Canada Science Fair

2023-24 Handbook

CANADA

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The 4-H Canada Science Fair is an opportunity for you to explore, experiment, and discover! This resource will guide you in creating your own 4-H Canada Science Fair project. It includes information about developing your idea, registering, project requirements, and additional tools for support. Spark your curiosity for science and creativity as you explore a topic you are passionate about with the 4-H Canada Science Fair.

What Can I Expect?

The 4-H Canada Science Fair is an opportunity for you to explore, experiment, and discover! This resource will guide you in creating your 4-H Canada Science Fair project in four steps:

Step 1: Individual or Partner Project

Step 2: Pick a Topic

Step 3: Pick a Project Type

Step 4: Project Components

Either by yourself or with another 4-H member, you'll complete and submit your science project to be judged virtually. Successful projects will move on to our in-person second round, and perhaps even to the Canada-Wide Science Fair.

Judging Criteria

When selecting your topic, note that your project will be judged as follows:

- Part A: Scientific Thought – 50%
- Part B: Originality and Creativity – 30%
- Part C: Communication (PowerPoint, Project Report, Logbook) – 20%

See the detailed rubric in the resources section of this handbook for more information

Round Overview

Round 1 – Virtual Judging

- Here you'll develop and submit your project by the deadline (see our website for key dates). Your project will then be judged virtually in the following week(s) for consideration to move on to Round 2.

Round 2 – In-Person Judging

- Selected participants from Round 1 will be invited to participate and attend the second round. Participants will be made aware of registration fees and logistics for participation. The location varies, however is typically hosted at a partner college or university. At the end of this event, finalists will be determined. These projects will move forward to the Canada-Wide Science Fair!

Round 3 – Canada-Wide Science Fair

- 4-H Canada finalists will attend and present their projects at the Canada-Wide Science Fair which typically takes place at the end of May. Participants will take part in unique, hands-on STEM workshops and compete against the best and the brightest from across Canada for cash prizes and scholarship opportunities!

What are you waiting for? Don’t miss out on the opportunity to travel, connect with 4-H'ers from coast-to-coast, receive one-on-one mentorship, and compete for scholarships and cash prizes! Register today on our website!

Step 1 – Individual or Partner Project

Projects may be completed on your own or with a partner. Please note that groups may not have more than two people per project.

- Partnered projects and individual projects are all judged in the same category and in the same way.
- 4-H Canada Science Fair participants must be 4-H members in good standing.
- 4-H Canada Science Fair participants must be in grades 7-12 or studying in CÉGEP.
- If you choose to do a partner project, only one of you needs to register, and you can share access to the account with your partner.

Registration Steps

1. Once you've decided on either an individual or group project format, visit register.4-h-canada.ca and sign in or create a new account.

2. Select "4-H Canada Science Fair" from the drop-down menu and complete all necessary steps.

3. Questions? Contact the 4-H Canada Youth Programs Manager at program@4-h-canada.ca.

Step 2: Pick a Topic

Getting Started

Many of the world's greatest scientists, inventors, and engineers have asked questions like, "Why are peas either smooth or wrinkled?", "How do burrs stick to me and my dog?", or "What causes some of the stars to move differently in the sky?" In fact, people of all ages and from different backgrounds have asked why, what, or how - which has led to brilliant results like the discovery of genes in agricultural breeding, the invention of Velcro, or an understanding of black holes and supernovas.

Beginning your 4-H Canada Science Fair project by asking similar questions about why things exist, how they can be improved, or what makes them work will help lead you to identifying a project topic. Explore your interests, ask yourself questions about the world around you, and use the 4-H Canada Science Fair to offer solutions to these challenges.

Keep It Simple - Remember, your project doesn't have to be complicated. Some of the best projects explore basic ideas with thorough and precise analysis.

Think about your interests – What are your hobbies and interests? Ask yourself some questions. Is there something you could test, invent, or study that is related to an area you are interested in or passionate about?

Get inspired by your 4-H Club or Project - Look for inspiration from your club or a 4-H project topic. Use your 4-H experiences to inspire your science fair project. Remember to use the resources around you.

Get inspired by our Outreach Initiatives – These free, downloadable activity books include hands-on STEM-related activities on pollination, healthy water ecosystems, food security, electricity, and more. Look for inspiration and ideas you could develop into a science fair project.

Still need inspiration? Check out the Resources section of this handbook for links to online idea generators and previous 4-H Canada Science Fair projects.

Projects to Avoid and Why

- **Product testing asking, "Which is best?"** While many products are easy to use, the science behind them is often complicated. Comparisons (e.g. cleaning products) only have scientific merit if you fully understand the science behind why the product works. Plus, preference testing (e.g. which tastes better) is looking at opinion, not measurable data.
- **Projects that have been done before.** Be creative. Look for new and unique ideas. If you must choose a topic that others have already studied, look for a different approach or aspect to investigate.
- **Results that are obvious or challenging to measure.** For example, the effect of running, music, video games, or any other activity on blood pressure.
- **Any topic that creates risk or pain** (physical or psychological) to a human or animal, or involves tissue samples from living humans or animals. The ethical rules of any science fair strongly prohibit this type of experimentation.
- **You don't have the right equipment, or the results can't be repeated.**

Source: http://www.sciencebuddies.org/science-fairprojects/project_question.shtml#examples

Don't forget to log your thoughts!

Once you choose your topic, start asking questions and record them in your logbook.
See Step 4: Project Components for more details.

Step 3: Pick a Project Type

Mentorship

Need help? You can be paired with a mentor to help as you develop and work on your project. Finding a mentor can help you get access to a lab, guidance on how to properly conduct an experiment, advice the layout of your report, and more. Need help finding a mentor? Email 4-H Canada's Youth Programs Manager at program@4-h-canada.ca.

Now it's time to decide what type of project you would like to create. Choose one of the following:

- Project Type A: Experiment
- Project Type B: Innovation
- Project Type C: Study

Project Type A: Experiment

An experiment involves testing a hypothesis through a specific method. It has one variable that is changed, and the rest stays the same. The best experiments are original and carefully planned so results are as accurate as possible. Read through the following checklist to build a strong experiment project.

1) **Ask a Question**
    - This should be connected to the topic and begin to identify and state what you want to test. For example, "How will different soil types affect a plant?"

2) **Research**
    - Background research is an important step in understanding your topic and learning how to best design your project. A project built on the information you researched will show judges you understand your topic inside and out.
    - Make a research plan using key words to identify other research studies to inform and support your project.
    - All research notes should be written down in your logbook as you do your research. Keep track of what you looked at or referenced. Use sources that are reliable and trustworthy. Information from government, university, or academic sources are likely reliable. Blogs, YouTube, or Wikipedia can be great starting points but should not be used as a primary resource in your bibliography.

3) **Construct a Hypothesis**
   - A hypothesis is an 'educated guess' that can be measured and used to test your experiment. Create a cause-and-effect statement such as: "If [I do this] _____, then [this] _____ will happen." This is the statement you will test in your experiment, so ensure it is something you can measure.
   - Results in an experiment can either support or oppose your hypothesis. If the results oppose your hypothesis, explore why they didn't match. If you change your experiment or do more research to create a new and improved hypothesis, explain your reasoning in your conclusion.

4) **Test Your Variables**
   - Fair tests are experiments where you change one variable at a time while keeping all other variables the same. The variable you change is the independent variable, the variable you want to measure is the dependent variable, and all of the other variables you keep the same are your control variables.
   - Changing more than one variable makes it difficult to identify which variable caused the change.

5) **Map Out Your Project Procedure**
   - After you have developed your hypothesis, map out your experiment (in your logbook!) with a detailed procedure. Describe your independent, dependent, and controlled variables.
   - If you look at examples online, you'll notice that they clearly explain the steps involved in the process, and what is required to do the experiment, so that anyone could follow along and get the same results.
   - After identifying the steps of your experiment, include how you are going to measure your results or collect data. Charts or spreadsheets are helpful approaches for collecting and interpreting data.

6) **Create a Material List**
   - A material list is included before the procedure and is a list of all items needed for the experiment. Anything included in the material list should be mentioned in the procedure. Be specific and precise (e.g. two 9-volt Duracell batteries fully charged.)

7) **Test Experiment and Repeat x3**
   - After completing your experiment, do it again! Repeating an experiment helps identify any mistakes that were made throughout the project, and it helps strengthen your project's validity.

- Include at least three repetitions in your experiment procedure. Consider how long it will take you to repeat your experiment and the resources required. Then come up with an appropriate number of times to repeat your experiment.

8) **Remember to Take Notes!**
   - Your logbook should contain all the information about your project, including ideas, observations, notes, data, and research from beginning to end in detail. If you make a mistake or something goes wrong, it is important to include it in your results analysis and conclusion.
   - Your logbook **does not** need to be made into a 'good copy'.

9) **Analyze Data – Opposing Results? Troubleshoot!**
   - Once you've completed your experiment and repeated it, look at your results. There are different ways of analyzing data but two of the most common ways are with graphs or charts.

10) **Draw Conclusions**
   - So, what do your results mean? In your conclusion explain what your hypothesis was, how you tested it, and the results you've analyzed. Consider your research and the results of your experiment. Decide why your results either support or oppose your hypothesis and why this is important.

11) **Build Your PowerPoint Presentation**
   - Once you've finished your experiment, analyzed your results, and written your conclusion, add these pieces to your PowerPoint project display. Use your logbook to look back on your notes, research, data, and conclusions, and share any relevant information in your display.

Project Type B: Innovation

An innovation involves creating a new product, technique, technology, or scientific method. An innovation needs to be tested – is it better than what already exists? Why? The best innovation projects have a real-world application and will have human or commercial benefit. Read through the following checklist to build a strong innovation.

1. **Define a Need**
   - When designing an innovation, think about a need for the world around you and how your project can offer a solution. Develop an objective statement: the goal or purpose of your project.

2. **S.C.A.M.P.E.R.**
   - This is a process you can use to build ideas for your innovation. Go through each letter and apply it to the world around you (e.g. objects or activities) to help develop new ideas for an innovation.
     - **S** – Substitute – could it be used for something else?
     - **C** – Combine – could it be mixed with another product or activity?
     - **A** – Adapt – could you change or borrow ideas from another object or activity?
     - **M** – Minimize or maximize – what would happen if it was made really small or really big?
     - **P** – Put to other uses – could this object or activity be used for a different purpose?
     - **E** – Eliminate – can you remove parts of the object or activity?
     - **R** – Rearrange – can the object work or the activity happen in a different order?

3. **Map Out Your Project Procedure**
   - Map out how you will design your innovation with a detailed procedure in your logbook. A procedure can be seen as the recipe or instructions for your design process.
   - When looking up other design methods online, you'll notice that other examples clearly explain the steps involved in the process and what is required to do the experiment so that anyone could follow along and get the exact same results.
   - After identifying the steps of your innovation, include how you are going to measure your results or collect data. Charts or spreadsheets are helpful approaches for collecting and interpreting data.

4. **Create a Materials List**
   - A material list is included before the procedure and is a list of all items needed for the experiment. Anything included in the material list should be mentioned in the procedure. Be specific and precise (e.g. two 9-volt Duracell batteries fully charged).

5. **Test Your Design**
   - The first model of a design is a prototype. Test it to see how it works and identify any changes you can make to improve the design.
   - It is unlikely that you will create the perfect design on your first try, so continue this process of creating a prototype and then making improvements until you've created the best possible design.
     When you've found the best possible design, test this final prototype to confirm that it works as you expect. This may mean real-world testing (using it in the actual situation or environment the real innovation would be used in), running a computer model, or having people test it and give you feedback. This process of designing, testing, and redesigning is essential to the innovation process.

6. **Remember to Take Notes**
   - Your logbook should contain all the information about your project, including ideas, observations, notes, data, and research from beginning to end in detail. If you make a mistake or something goes wrong, it is important to include it in your results analysis and conclusion.
   - Your logbook does not need to be made into a 'good copy'.

7. **Prototype Issues? Redesign it!**
   - A prototype is an early version of your project, product, concept, or idea. It's okay if you don't get it right the first time, that's science! Revisit the design and brainstorming process and make modifications or improvements. By doing this in the early stages, it will save you extra work once you get deeper into your project.

8. **Analyze Data and Draw Conclusions**
   - Once you've designed your best prototype and tested your innovation, use the test results to identify how successful your innovation is. There are different ways of analyzing data, but two of the most common ways are with graphs or charts.
   - So, what do your results mean? In your conclusion, explain what your innovation goal was, how you designed and tested it, and the results you've analyzed. This final project component involves considering your entire project and deciding why your innovation was either successful or unsuccessful, and why this is important.

9. **Build Your PowerPoint Presentation**
   - Once you've finished your experiment, analyzed your results, and written your conclusion, add these pieces to your PowerPoint project display. Use your logbook to look back on your notes, research, data, and conclusions, and share any relevant information in your display.

Project Type C: Study

A study involves researching and analyzing data or facts. This involves looking at a variety of scientific studies and yearly records. Looking at all the information and comparing it allows you to draw new conclusions or recommend one study over the others. Read through the following checklist to build a strong research study:

1) **Ask a Question**
   - First, you need to ask a question about the topic you've selected. Making your question specific helps avoid researching too broad of a topic. Figure out what specific question you want to explore and then start narrowing down your research!

2) **Do Your Research**
   - This will be the backbone of your project. In a study, instead of doing an experiment or inventing something, you will be researching information to answer the question you've asked. As you collect information, look for patterns and begin to draw your own conclusions. The best study projects use high-quality information from scientific journals and then carefully analyze the data.
   - When doing your research, use sources that are reliable and trustworthy. Information from government, university, or academic sources are likely reliable (just ask a librarian for some help). Blogs, magazines, or YouTube may not reference where they got information, and may not be very reliable. Wikipedia can be a great starting point because they include references and links at the bottom of every article. You shouldn't use Wikipedia as a resource in your bibliography, but it may lead you to other reliable sources.

3) **Remember to Take Notes!**
   - Your logbook should contain all the information about your study, including ideas, notes, and research from beginning to end. Take detailed notes, write down your research findings, and keep an organized record of where you found the information. If you make a mistake with your research, it is important to include it in your results analysis and conclusion.

4) **Opposing Results? Troubleshoot!**
   - Troubleshooting is an important skill that enhances critical thinking and encourages curiosity. If you have opposing data or results, identify the potential errors and try to come up with logical explanations and solutions.

5) **Analyze Data and Look for Patterns**
   - Once you've completed your research, look at the results. Did anything stand out? Are there patterns that you've noticed? Any new information you've found by comparing different studies? Analyze the information you've looked at to highlight any patterns or trends. This may involve having a mentor help you perform a statistical analysis. After analyzing your research, find the clearest way of showing your results (e.g. a chart or graph).

6) **Draw Conclusions**
   - You've analyzed your research, but what does it mean? Your conclusion explains your question, how you researched it, and the results you've analyzed. This final project component involves considering the different parts of your study and deciding why your results are important.

7) **Build Your PowerPoint Presentation**
   - Use your logbook to look back on your notes, research, data, and conclusions, and share any relevant information in your PowerPoint project display.

Step 4: Project Components

Your project needs to include these three components.

1. Project Display
   - For the first round of the 4-H Canada Science Fair, your project display will be a PowerPoint presentation. It should cover everything about your project from start to finish to help judges understand your process, results, and conclusion. Keep it simple. It can include text, photos, videos, or anything that helps explain your project.
   - Format: PowerPoint
   - Your project display should include the following:
     - Background
     - Purpose
     - Hypothesis or Objective
     - Procedure
     - Results or Observations
     - Conclusions
     - Acknowledgements
     - Bibliography
   - Upload your project display to register.4-h-canada.ca.

2. Logbook
   - Logbooks don't have to be pretty, just detailed. Jot down notes, draw diagrams, insert pictures, and make mistakes. Use headings to keep yourself organized but make it your own. In the end, your logbook should contain enough information that a stranger could understand your project and repeat what you did.
   - Format: In a notebook
   - Make sure your Logbook includes the following:
     - Brainstorming, Topic Ideas, Questions
     - Research
     - Hypothesis or Objective
     - Materials and Prototype Designs
     - Procedure and other Processes
     - Observations and Data
     - Conclusions
     - Roadblocks or Challenges
     - And more...
   - Upload pictures of your logbook to register.4-h-canada.ca.

3. Report
   - Your one-page report will summarize your project. It is like your PowerPoint project display, but shorter and without visuals. References should be included on a second page. Upload your PDF report to register.4-h-canada.ca. The font should be 12-point Times New Roman or Calibri, single-spaced with margins of 1 inch (2.5 cm). Include your project title and your name at the top.

PROJECT COMPONENTS

- Format: PDF
- Make sure your one-page report covers the following:
  - Background
  - Purpose
  - Hypothesis or Objective
  - Procedure
  - Results and Observations
  - Conclusions
  - Acknowledgements
  - Bibliography

IMPORTANT INFORMATION

Important Information

Here are some final important factors to read and consider. This will ensure you don't miss or overlook crucial aspects of your science fair project.

Research

Research is an important step in any science fair project. Here are some final tips and important information on research and presenting your findings.

1. **Research Plan**
   The Science Buddies website (sciencebuddies.org) has this advice for creating a research plan:
   - Identify the keywords in your science fair project question.
   - Use "question words" (why, how, who, what, when, or where) to generate research questions.
   - Identify other research studies to inform and support your project.
   - Building an innovation? Research and understand how similar designs work.

2. **Research Notes**
   All research notes should be written down in your logbook as you do your research. These notes track where you got the information you've looked at or referenced. When you create your PowerPoint and report, refer to your notes to reference key pieces of information, and to create an accurate account of what the project process looked like.

3. **Cite Your Sources**
   Remember to track all of your research in your logbook. It is important to reference all the information that you use in your bibliography. Whether the work has inspired your project, or you've quoted text or data directly, you must give credit to the original authors. Science works by building upon previous experiments, innovations, or studies, but it is also necessary to give credit. A project that does not properly credit sources is considered to be plagiarized and would be disqualified from judging.

Plagiarism

What is plagiarism? Plagiarism is:

- Using information from your research but not saying where you got the information.
- Copying another person's science fair project.
- Presenting the work of other people as your own.
- Fabricating or falsifying data.

How do you avoid plagiarism? Cite your sources with APA style.

IMPORTANT INFORMATION

Citing Your Sources with APA Style

When referencing research in your project, it is important to give credit to the original source. Cite your sources in a bibliography following APA formatting (a bibliography is a list of all of the sources you reference in your project, and it should be included in your logbook, project display, and report). More information on this can be found in the Resource section.

What to cite:

- All information you quote directly.
  - For example: “There was a 20 per cent increase in growth…” (Brown, 2015).
- All the information you generally mention.
  - For example: This process has been used since the 1920s (Smith, 2011).
- Any images you use, including your own.
  - For example: Figure 1 – Sample of seeds sprouting (Brown, 2015).

Ideally, you should be using your own pictures, diagrams, charts, or graphs you’ve created with your own data. An APA formatted reference should look like this:

  - Brown, Joe. Groundwater depletion in Ontario. Journal of Watersheds and Groundwater. Published January, 2015.

4-H Canada encourages members to be truthful and acknowledge the information and resources they use in their projects. If you didn’t write it or think of it yourself, you should be referencing the source. This includes any significant work done by a mentor.

Follow Safety Procedures

4-H Canada encourages you to take all safety precautions for your project. If you are using chemicals, materials, or tools, it is important to read all instructions, be trained in how to use them safely, and have supervision. Talk to your parents, 4-H leader, or teachers before starting your project so they are aware of what you are doing. If your project feels unsafe, it probably is. Do not continue.

1) **Chemical Safety and MSDSs**
   MSDSs – Material Safety Data Sheets provide information about chemicals or materials, including dangers, and how to handle them safely. Before working with chemicals look them up here and follow the safety guidelines: ccohs.ca/oshanswers/legisl/msdss.html. Make sure you work in an appropriate environment (e.g. lab with a fume hood) with appropriate tools (e.g. clean glassware that won’t react with chemicals). Take precautions by wearing protective clothing and safety glasses, working on a clean surface, and keeping long hair or loose clothing tied back. Have your local poison control number handy in case you accidentally inhale or ingest chemicals. This includes a sink for eye-washing. You should always have adult supervision when chemical safety is a concern.

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2) **Fire Safety**
If you are working with an open flame, using flammable materials, or may cause a chemical reaction where heat is produced, make sure you have a proper fire extinguisher within reach. Take precautions by wearing protective clothing and safety glasses, working on a heat-resistant surface, and keeping long hair or loose clothing tied back. You should always have adult supervision when fire safety is a concern.

3) **Electrical Safety**
If you are working with an electrical current, even if it is from a small battery, you should always know when the electricity is "on" or "live", and how to shut it off. Take precautions by wearing protective clothing, working on a clean and dry work surface, keeping long hair or loose clothing tied back, and wearing safety glasses. You should always have adult supervision when electrical safety is a concern.

4) **Structural and Mechanical Safety**
If you are building something with dangerous moving parts, or it is of a size or mass that could potentially hurt someone, take every precaution to make sure you or other people are interacting with your design safely. You should always have adult supervision when structural safety is a concern.

5) **Biohazards**
If you are working with biohazards, you must work in an appropriate environment (e.g. lab with a fume hood), and with appropriate tools (e.g. clean glassware that won't react with biohazards). Take further precautions by wearing protective clothing, working on a clean work surface, keeping long hair or loose clothing tied back, and wearing safety glasses. Keep your local Poison Control number handy and make sure you know what to do should you accidentally inhale or ingest a biohazard. You should always have adult supervision when biohazards are a concern. This kind of project may also require an Ethics Review Request.

Consider the Ethics

Science is awesome, but it needs to be ethical science. Ethics are about considering the right and wrong conduct in a variety of situations, and in a science fair project it is especially important that proper ethical procedures are always followed.

You will be asked if you will be using humans or animals in your project when you register. Using humans or animals (both vertebrate and invertebrate) in an experiment requires submitting an Ethics Review Request. If you're using humans, you'll also need to complete the Informed Consent Letter and Permission Form. These forms also need to be reviewed by the 4-H Canada Ethics Review Committee and must be completed by each participant taking part in your project. You can find these documents in the Ethics Package, downloaded from either your profile on register.4-h-canada.ca or 4-h-canada.ca/sciencefair. These projects will be assessed by the 4-H Canada Ethics Review Committee to ensure they don't violate ethical science procedures.

IMPORTANT INFORMATION

These forms MUST be submitted before beginning your project work with animals/humans. Once you have submitted your forms for review, do not continue your project until you receive approval.

To give you an idea of what categories different projects fall into, look at the diagram below. Please note that all project topics aren't covered – this is just meant to give you an idea. If you are thinking of using an animal or human in your project, you must fill out an Ethics Review Request.

*The use of plants, fungi, and protozoa does not require a review by the Ethics Committee.

Glossary

Analyze: To look at results and data and notice patterns or draw conclusions.

Conclusion: To reach a judgement or decision based on the analysis of your project results. Conclusions either support or oppose your hypothesis.

Control Variable: Variables you keep the same throughout an experiment.

Data: Information that can be shown in the form of numbers, facts, or statistics.

Dependent Variable: The variable you measure in an experiment.

Experiment: An experiment involves testing a hypothesis through a specific method. An experiment has one variable that is changed, and the rest stay the same. The best experiments are original and are carefully planned out so that the results are as accurate as possible.

Hypothesis: A suggested explanation or "educated guess" that is used as a starting point for further investigation. "If [I do this] _____, then [this] _____ will happen."

Independent Variable: The variable you change in an experiment.

Innovation: An innovation involves creating and testing a new product, theory, technique, technology, or scientific method.

Objective: The goal or purpose of your project. An objective is what you aim to achieve or address.

Observation: Observations are what you see, hear, smell, or experience during your experiment. It could also be the measurements you take or the data you record.

Prototype: The first model of a design is a prototype. Changes can be made to improve this design.

Study: A study involves researching and analyzing data or facts that are accepted in science. For example, this could involve looking at a variety of scientific studies about the best way to shear sheep. Looking at all of the information together and comparing it may allow you to draw new conclusions, or recommend one study over the others.

Variable: A variable is an element within an experiment that can change.

Resources

4-H Canada Science Fair

Visit 4-h-canada.ca/sciencefair to access the following:

- Key Dates & Deadlines
- FAQs
- Registration Link
- Ethics Package

Project Idea Generators

- www.googlesciencefair.com/make-better-generator/en
- www.sciencebuddies.org/science-fair-projects/topicselection-wizard/background-info
- www.juliantrubin.com/fairencyclopedia
- youthscience.ca/for-students
- mystemspace.ca/project-library

Purdue University – Referencing in APA
owl.purdue.edu/owl/research_and_citation/apa_style/apa_style_introduction.html

Ethics Assessments for Science Fair Projects
mystemspace.ca/start-a-project/safety-and-ethics

Scientific Method Flowchart
www.sciencebuddies.org/science-fair-projects/science-fair/steps-of-the-scientific-method

Chemical Safety
www.ccohs.ca/oshanswers/legisl/msdss.html

How to Create a PowerPoint Presentation
www.youtube.com/watch?v=XF34-Wu6qWU

How to Create and Save a PDF
www.youtube.com/watch?v=LUPL4_y_HPM

Logbook Guide (p. 20)

Judging Rubric (p.22)

4-H Canada Science Fair

Logbook Guide

"Remember kids, the only difference between messing around and science is writing it down."

Andy Savage, *Mythbusters*

Your logbook is like a diary or your 4-H record book where you keep all of the information about your project. You write in it every time you work on your project the more detailed your logbook is, the easier it will be to write your report and create your PowerPoint display. Your logbook is any notebook you have available but make sure there are lots of pages to hold all of your findings! It doesn't have to be pretty, but it should include the following sections:

1. **Brainstorming notes**
   Draw web diagrams, make lists, flow charts, doodle, add photos… get your creative juices flowing!
2. **Topic ideas**
   Once you've done some brainstorming, which topic jumps out at you? Which one interests you the most? Write down your main topic ideas to help narrow down your project topic.
3. **Questions you've asked**
   What questions do you have about your topic? Is there a particular aspect of this topic that puzzles or interests you? These questions will guide your research as you work to answer them.
4. **Your research**
   Do general research first and then dive in and get more specific. Have fun with it! Make detailed notes, and if you use the information in your final project, you must include the source in your bibliography.
5. **Your hypothesis or objective**
   Based upon your research, create a hypothesis about the results you expect to get. If you are doing an innovation or study project, you should have an objective that you are working toward. State your hypothesis or objective clearly, and refer back to it often to make sure you're staying on topic.
6. **Your project procedure**
   Write all of the steps that you will follow in your experiment, innovation, or study. Your procedures should be so clear that a stranger could follow along and get the same results, just like a recipe!
7. **Design sketches and blueprints**
   Keep a list of any materials and expenses you used to conduct your project. These could be physical (e.g. soil, water, seeds), or digital (e.g., apps). Be detailed with your list and keep track of any costs.

8. **Any observations and challenges you've experienced**
   Write down **everything** you do or observe… really! This is a key part of your Science Fair project. What did you see, smell, or hear? What changed or stayed the same? Why? Also, include any challenges, mistakes, or issues you encountered to show that you recognized the problem and what you did to fix it!
9. **Data you've collected**
   Record all of the numbers, measurements, calculations, graphs, or charts that you created. These can also be put in your Observation section, but it may be more useful to put them in a section of their own.
10. **Your conclusion**
    Your experiment, innovation, or study is now done, but what conclusions did you come to? Based on the results you got, was your hypothesis supported? Did you meet your objective?
11. **Your bibliography**
    Keep a list of all the sources you use here. It will make it easier to cite them in your PowerPoint display and report. When putting together your bibliography, use the APA citation format

Project Judging Rubric
Canada-Wide Science Fair

Youth Science Canada
Sciences jeunesse Canada

Use this rubric to assign a level (**4**, **3**, **2**, or **1**) against the criteria for the project. In addition to the level, please enter a single letter rating: **H** (High), **M** (Medium), or **L** (Low) that reflects the quality and strength of the project relative to other projects you have assigned the same level.

SCIENTIFIC THOUGHT

Level (1-4) and rating (H/M/L) assessment may include the following criteria: project structure; appropriateness of research methodology; understanding; correspondence of the content to the question/problem, goals and objectives; technical skills; thoroughness and effort; accordance of conclusions/evaluations to results obtained; honest evaluation of academic or practical value.

DISCOVERY	INNOVATION
The project seeks to add to human knowledge by carrying out original research, or by synthesizing and analyzing data from a variety of sources.	The project seeks to solve a practical problem by developing and evaluating a new device, studying a model of a real-world system, or devising a new technique or method to address shortcomings of existing techniques or methods.
LEVEL 4 (most impressive)	
Devise and carry out original experimental research in which most significant variables are identified and controlled, or synthesize data from a variety of significant sources to develop new insight and draw new conclusions. The data analysis is thorough and complete. Conclusions are clearly described/presented and connected back to the data that justifies them.	Integrate several technologies, inventions, social/behavioural interventions, or design and construct an innovative application, or propose a new theory that will have human and/or commercial benefit. Performance of the prototype, method or theory is evaluated completely and realistically. Honest comparisons are made to alternative or previous solutions where possible.
Statements about the significance of the work (including human benefit, advancement of knowledge, or economic applications) are supported by the information presented and show awareness of context. For projects incorporating Indigenous Traditional Knowledge, the importance to the land and community are clear, and the project demonstrates a holistic approach to knowledge creation. Suggestions for future work are realistic and justified by the results of the current project.	
LEVEL 3	
Devise and carry out an original experiment. Identify the significant variables and attempt to control them, or synthesize data from a variety of sources to strengthen or extend existing conclusions. Analyse the results using appropriate arithmetic, graphical or statistical methods. Statements about the significance of the work are mostly supported by the information presented and show awareness of context. For projects incorporating Indigenous Traditional Knowledge, the project has demonstrable importance to the land and community and takes a holistic approach to knowledge creation.	Design and build innovative technology; or provide adaptations to existing technology or to social or behavioural interventions; or extend or create new theory. Human benefit, advancement of knowledge, and/or economic applications should be evident. For projects incorporating Indigenous Traditional Knowledge, the project has demonstrable importance to the land and community and takes a holistic approach to knowledge creation.
LEVEL 2	
Extend a known experiment with modest improvements to the procedures, data gathering and possible applications, or synthesize data from a variety of sources to confirm existing conclusions. Statements about the significance of the work are somewhat supported by the information presented and show a little awareness of context. For projects incorporating Indigenous Traditional Knowledge, the project may have importance to the land and community and is somewhat holistic in its approach.	Improve or demonstrate new applications for existing technological systems, social or behavioural interventions, existing theories or equipment, and justify them. For projects incorporating Indigenous Traditional Knowledge, the project may have importance to the land and community and is somewhat holistic in its approach.
LEVEL 1 (least impressive)	
Replicate a known experiment to confirm previous findings, or collate data from a variety of existing sources without further analysis. Statements about the significance of the work may be exaggerated and show little awareness of context. For projects incorporating Indigenous Traditional Knowledge, the project has little importance to the land and community.	Build a model or device to duplicate existing technology or to demonstrate a well-known theory or social/behavioural intervention. For projects incorporating Indigenous Traditional Knowledge, the project has little importance to the land and community.

ORIGINALITY and CREATIVITY			
LEVEL 4 (most creative)	**LEVEL 3**	**LEVEL 2**	**LEVEL 1 (least creative)**
This highly original project demonstrates a novel approach. It shows resourcefulness and creativity in the design, use of equipment, construction and/or the analysis. For projects incorporating Indigenous Traditional Knowledge, the project demonstrates a novel and/or highly creative approach to an issue of importance to Indigenous peoples as enunciated in, for example, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) or the Truth and Reconciliation Commission of Canada (TRC) calls to action.	This imaginative project makes creative use of the available resources. It is well thought out, and some aspects are above average. For projects incorporating Indigenous Traditional Knowledge, the project demonstrates a creative approach to an issue of importance to Indigenous peoples as enunciated in, for example, the UNDRIP or the TRC calls to action.	The project design is simple with some evidence of student imagination. It makes standard use of resources or equipment. The topic is a current or common one. For projects incorporating Indigenous Traditional Knowledge, the project has some connection to an issue of importance to Indigenous peoples.	The project design is simple with little evidence of student imagination. It can be found in books, magazines or web sources. For projects incorporating Indigenous Traditional Knowledge, the project has no clear connnection to issues of importance to Indigenous peoples.

COMMUNICATION			
The level is based on five elements: ① ProjectBoard video ② ProjectBoard content, ③ evidence of organized record keeping (e.g., logbook, notebook, journal), ④ judging interview and ⑤ exhibit poster/display materials.			
LEVEL 4 (strongest)	**LEVEL 3**	**LEVEL 2**	**LEVEL 1 (weakest)**
All five elements are complete and exceed reasonable expectations of a student at this age/grade. The online ProjectBoard content and exhibit poster/display are informative and clearly written, striking a balance between clarity and brevity. Visual elements, including graphs, are appropriate and clearly designed. The references extend beyond web-based articles. For projects incorporating Indigenous Traditional Knowledge, the project shows clear evidence of consultation with a Knowledge Keeper or Elder and clearly conveys or supports traditional values of the community. Records are organized and thorough. The oral presentation during the interview is clear, logical, and engaging. In a pair project, both members contribute equitably to the interview.	All five elements are complete and demonstrate attention to detail and substance. The communication components are each well thought out and executed. Some further explanation may be required or there may be some redundant material. A few sources beyond web-based articles were used. For projects incorporating Indigenous Traditional Knowledge, place-based information from community members is included and attempts to convey or support traditional values of the community. In a pair project, both members made an equitable contribution to the interview.	Some of the five elements are simple, unsubstantial or incomplete, but there is evidence of student attention to communication. A number of pieces may require clarification or explanation or there may be considerable redundant material. Sources are almost entirely web-based. For projects incorporating Indigenous Traditional Knowledge, non-place-based information (e.g. from the internet) is included and little attempt is made to convey or support traditional values of the community. In a pair project, one member may have made a stronger contribution to the interview.	Most or all of the five elements are simple, unsubstantial or incomplete. There is little evidence of attention to effective communication. Most pieces require clarification or further explanation or most of the material is redundant. Cited sources are insufficient or of poor quality. For projects incorporating Indigenous Traditional Knowledge, the project includes information from sources with no special knowledge of the Indigenous context and makes no attempt to convey or support traditional values of the community. In a pair project, one member may have dominated the interview.