CANADA
4-H Ontario

www.4-hontario.ca

4-H ONTARIO PROJECT

4-H Adventures in STEM

RECORD BOOK

The 4-H Pledge

I pledge my Head to clearer thinking,
my Heart to greater loyalty,
my Hands to larger service,
my Health to better living,
for my club, my community and my country.

The 4-H Motto

Learn To Do By Doing

4-H Ontario Provincial Office

111 Main Street, Box 212
Rockwood, ON N0B 2K0
TF: 1.877.410.6748
TEL: 519.856.0992
FAX: 519.856.0515
EMAIL: inquiries@4-hontario.ca
WEB: www.4-HOntario.ca

CANADA
4-H Ontario

Project Resource Information:

Written by: Teresa Ierullo
Edited by: Elizabeth Johnston and Marianne Fallis, 4-H Ontario
Layout by: Mary-Kathleen Dunn
Date: March, 2017

Thank you to the 4-H Adventures in STEM! Advisory Committee members who assisted with the creation of this resource:

Jennifer Pollock, Wellington 4-H Association
Melina Found, Science Coodinator, 4-H Canada
Carole Mutton, Parry Sound 4-H Association
Barb Scott-Cole, Renfrew 4-H Association

Thank you to those who piloted and/or reviewed the project.

Club Leaders - Paulette & Wayne Macdonald; Club Members - Hannah Ethier, Jena Ethier, Meaghan Ethier, Gabriel Glover, Amy Onolack, Austin Pavan, Avery Perigo, Hunter Perigo, Kaitlyn St. George; Sudbury 4-H Association
Jeff McCallum, Elgin 4-H Association

The development of this project resource was made possible through the support of Cargill.

Cargill®

INTRODUCTION

Record Keeping – Why?

Record Books are to document time and money spent, what you have learned, your ideas, memories and what you liked and didn't like. Your Record Book also….

- Helps you set goals for this project
- Has space to record important dates, your elected executive and the names and contact information of your leaders and club members
- Is a great way to get and stay organized

Down the road when you look back on your 4-H projects these books will be able to remind you what you learned so you can use those skills later in life. It will bring back memories of the project, your 4-H friends, your story and thoughts at the time of the project. You will never forget because this book will act as a reminder! It will also be useful at the Achievement Program, when looking at your progress and when reviewing your accomplishments.

How do I organize my materials?

1. Make your records neat and easy to read. This will make it easier to find information later on, and to share your information with others.
2. Use a three ring binder or duotang to hold your materials and divide your information into sections using dividers. This will keep things from becoming lost and will make it easier to find what you need later on. This will also allow you to add extra pages later.

How do I keep good records?

1. Keep track of activities throughout the meetings, as you complete different parts of the project. It's often difficult to remember things that happened in earlier meetings.
2. Make sure the information you write in your Record Book is complete and accurate. If you're not sure about something, ask your leader for help before writing it in your book. You can also consult people in your community or do some research on your own. If you borrow information from someone or someplace else, make sure you write down where you found it.

Remember that this is YOUR Record Book so make it your own! And, remember to bring your Record Book to every meeting!

BASIC INFORMATION

Record Book for 20_____

Name:_____

Address:_____

Name of Parent or Guardian:_____

Age as of January 1:_____ Number of Years in 4-H:_____

List the other 4-H projects you are currently involved in:_____

_____

Club Name:_____ Association:_____

Club Members:

NAME	PHONE NUMBER	EMAIL

WHO'S WHO

Club President:_____ Ph. # / E-mail:_____

Vice President:_____ Ph. # / E-mail:_____

Secretary:_____ Ph. # / E-mail:_____

Treasurer:_____ Ph. # / E-mail:_____

Press Reporter:_____ Ph. # / E-mail:_____

Meeting Dates:

	DATE & TIME	PLACE	NOTES (Things to bring, remember, etc)
Meeting 1			
Meeting 2			
Meeting 3			
Meeting 4			
Meeting 5			
Meeting 6			
Achievement Program			

LEADER NAME & CONTACT INFORMATION	*LEADER NAME & CONTACT INFORMATION*

MEMBER EXPECTATIONS & GOALS

Why did you join the Adventures in STEM! Project club?

What is one goal that you want to achieve in this project?

Do you have any ideas for fun things to do during the project?

Do you have any ideas for an Achievement Program for the Adventures in STEM! Project? (Keep in mind that an Achievement Program should include the community in some way).

Member Responsibilities

- Be a current paid member of 4-H Ontario
- Attend at least 2/3 of the meeting time allotted for this project
- Complete the Record Book for this project. Bring it with you to each meeting!
- Put your Record Book in a binder or duotang so you don't lose any of the pages
- Complete any other projects as required by the club leaders.
- *Remember the more you put into your 4-H club the more you will get out of it!*

ROLL CALLS - IN MY OPINION...

	ROLL CALL	MY ANSWER
1		
2		
3		
4		
5		
6		

PROJECT SUMMARY

The Adventures in STEM! Project

A. **Member Comments**

1. What did you gain from taking this project?

2. Which meeting or topic was the most/least interesting? Why?

   a. Most:

   b. Least:

3. Comment and/or give suggestions for improvements on the overall project (eg. Activities, tours, achievement program plans, member presentations, special activities, judging information).

4. What interests would you like to explore through future 4-H projects?

B. Parent/Guardian Comments:

C. Leader Comments:

This project has been completed satisfactorily!

Member:_____ Leader:_____

Date: _____ Leader:_____

SCIENTIFIC METHOD

The Scientific Method is not absolute. It's a framework for learning more about the world around us in a scientific way. Sometimes you might start with an observation and then you form a question; other times you might question something and then start to observe it. Below are the main steps scientists take when they want to test something.

1. **Make an Observation**: You are naturally curious about the world and if something peaks your interest, you are the type of person who wants to think about it some more and investigate it.

2. **Form a Question**: Why do things happen like they do? How does it happen? After making an interesting observation, you want to find out more about it and you start forming questions**.**

3. **Do Research:** Rather than starting from scratch to answer your question, you should do research (internet, library, interviews, etc.) to help you find the best way to do things and to be sure that you don't repeat mistakes made by other scientists.

4. **Form a Hypothesis**: Once you've done some observations, you develop an explanation or a theory as to why/how something is happening. It's an informed guess to the possible answers to your questions. The purpose of the hypothesis is not to guess the perfect answer but to give you a starting direction for your scientific investigation.

5. **Conduct an Experiment:** Once a hypothesis has been formed, it must be tested. This is done by conducting a carefully designed and controlled experiment. The experiment is one of the most important steps in the scientific method, as it is used to prove a hypothesis right or wrong. In order to be accepted as scientific proof for a theory, an experiment must meet certain conditions, and it must be controlled- especially the variables- and it must be reproducible so that it can be tested for errors.

6. **Conclusion**: The results of the experiments are measured, analyzed, and assessed.

7. **Communicate Results**: Share your results with other scientific methods. Scientists often find solutions to problems by knowing the results of other scientists' experiments.

4-H Hands-on Science

CANADA

POWERED BY smarter science éduca sciences

INITIATE & PLAN

- Identifying a problem or need through curious observation
- Defining testable questions, researching and considering possible answers and solutions
- Revisiting observations and predictions to improve testable question

Observing
Using the 5 senses to find out about objects and events: their characteristics, properties, differences, similarities, and changes. Observation can be made directly with the senses or indirectly through the use of simple or complex instruments.

Questioning
A strategy to make meaning or wonder about uncertainties.

Searching
Gathering information from a variety of sources, developing self-reliance in acquiring library and Internet skills.

Interviewing
Asking and corresponding to gain primary information.

Inferring
Using logic to draw conclusions from the results of investigating/problem-solving.

Predicting
Predictions are not random guesses but speculations of what may occur in the future based on prior knowledge, observations, and reasoning.

Hypothesizing
Making educated guesses or predictions based on evidence that must be tested through experimentation to establish credibility. Hypotheses guide investigations from which further predictions can be made. Hypotheses generally follow an "If..., then..., because..." statement format.

Modeling
Constructing physical/concrete or abstract representations of ideas, objects or events to clarify explanations or demonstrate relationships. Models are used to reinforce concepts, demonstrate learning, and/or illustrate phenomena which cannot be directly observed.

Selecting
Choosing an action from various alternatives based on justifiable reasons.

PERFORM & RECORD

- Developing and safely carrying out an investigation
- Observing, collecting, and recording results

Using Instruments
Knowing the instrument's parts, how it works, how to adjust it, its proper use for a given task, its limitations; knowing how to store it and transport it safely.

Calibrating
Checking, adjusting, or determining by comparison with a standard (e.g., calibrating a thermometer, balance, timer or other instrument).

Measuring
Assigning numbers to observations, e.g., metric units, time, student-generated units, using appropriate measuring devices and techniques.

Recording
Noting, documenting, tabulating, charting; working systematically, working regularly.

Planning
Working systematically, regularly organizing for future, seeing possible results.

Designing
The overall plan or strategy by which hypotheses / research questions and technological problems are answered (with or without innovation).

Gathering Data
Collecting evidence through measurements, facts, figures, pieces of information, statistics (either historical or derived by calculation), experimentation, surveys, etc.

Demonstrating
Setting up apparatus, making it work, describing parts and functions, illustrating scientific principles.

Constructing
Putting together component parts; to build or erect.

Inventing
Designing something useful, for the first time, through the use of the imagination, ingenious thinking and/ or experimentation.

Experimenting
Carrying out a designed investigation to test a hypothesis or answer a question.

ANALYZE & INTERPRET

- Reviewing results carefully by examining data and identifying patterns
- Deciding what the results mean
- Evaluating and refining solutions

Comparing
Looking for similarities.

Contrasting
Looking for differences.

Classifying
Putting things into groups and subgroups, identifying categories, deciding between alternatives.

Outlining
Employing major headings and subheadings; using sequential, logical organization.

Graphing
Visually representing data.

Reviewing
Picking out important items, memorizing, associating.

Analyzing
Seeing implications and relationships, discerning causes and effects, locating new problems.

Evaluating
Recognizing good and poor features; judging and assessing.

COMMUNICATE

- Explaining procedures and results through writing, speaking, visual or electronic means
- Reflecting on the process and checking with peers

Discussing
Engaging in oral, written, or any other appropriate form of communication with others.

Explaining
Clearly describing, clarifying main points and focusing on the "why" and/or "how" of the issue, concept or idea.

Reporting
Organizing and presenting information in a written or oral format.

Writing
Conveying information (e.g., questions, observations, experimental report) by graphical means.

Reflecting
The activity of either an individual or group that involves analyzing, judging the importance of, and making connections to the learning experience.

Defending
Supporting any and all aspects of inquiry using logical arguments backed up with evidence.

Teaching
Making meaning of concepts or processes by organizing them into key facts and ideas and clearly conveying them to others.

BEGINNING | EXPLORING | EMERGING | COMPETENT | PROFICIENT

ENGAGE | EXPLORE | EXPLAIN | EXTEND

ASSESS & EVALUATE

Adapted from research by Trowbridge, Bybee and Powell 2000

www.4-h-canada.ca www.smarterscience.ca

Youth Science Canada
Sciences jeunesse Canada

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:

- Brainstorming notes
  Draw web diagrams, make lists and flow charts, doodle, add photos...get your creative juices flowing!
- 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.
- 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.
- Your research
  Do general research first and then dive in and get more specific. Have fun with it! Make detailed notes and if you using the information in your final project, you must include the source in your bibliography.
- 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 that you are staying on-topic.
- Your project procedure
  Write all of the steps that you will follow in your experiment, innovation, or study. Your procedure should be so clear that a stranger could follow along and get the same results, just like a recipe.
- Design sketches and blueprints
- The materials and expenses required to conduct your project
  Keep a list of any materials you use, whether physical (e.g. soil, water, seeds) or digital (e.g. apps). Be detailed with your list and keep track of any costs.
- 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.
- 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.
- 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?
- Your bibliography
  Keep a list of all of 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.

A RECORD OF OUR EXPERIMENT

NOTE: Multiple copies of these Record Sheets will be required for this project.

EXPERIMENT

We want to find out:

_____

_____

_____

HYPOTHESIS

*In science, a **hypothesis** is an idea or explanation that you test through an experiment.*

We think this will happen:

_____

_____

CONSTANTS ("Controlled Variables")

It is important for your experiment to be a fair test. You can change only one factor (variable) and keep all other factors/conditions the same.

To make our test fair, we are keeping these things the same:

_____

_____

VARIABLES

*An experiment starts and finishes with the factors that change during the experiment. These are the **variables**. You will purposely change one of the variables at one time.*

We are only changing:

_____

_____

We will measure: (identify the units you will use to measure)

_____

_____

RESULTS

Now is the time to analyze the data (information) you collected from your experiment and make a conclusion.

We found out that:

_____

_____

_____

We think this is because:

_____

_____

_____

REPEATED TRIALS

You may want to change a variable and repeat the test to see if the results are different.

NOTE: if you have time, it's a good idea to repeat your experiment in exactly the same way (don't change any variables) more than once to be sure your first results are correct.

Trial	Changed Variable(s)	Results
#2		
#3		

COMMUNICATE YOUR RESULTS

Share what you learned.

OBSERVATION SHEET

NOTE: Multiple copies of this sheet will be required for this project.
This observation sheet can be edited to suit the individual activity.

Timeline	Variables/Constants	My Observations
1st observation Date: Time:		
2nd observation Date: Time:		
3rd observation Date: Time:		
4th observation Date: Time:		
5th observation Date: Time:		

Ethics Review Request Form
4-H Canada Science Fair

Instructions

If your science fair project will involve the participation of humans or the use of animals, please complete this form and email it to Melina Found, mfound@4-h-canada.ca before beginning your project. Your science project will be reviewed and you will receive a response regarding project appropriateness or special measures that should be taken from the 4-H Canada Ethics Committee. Please refer to the 4-H Canada Science Fair guidebook available at 4-h-canada.ca/4HCanadaScienceFair for more information.

Project Title			
	First Name	Last Name	Email
Member 1			
Member 2 (if applicable)			

Questions to Be Addressed in Your Description (next page)

1. Is your project using vertebrate animals or cephalopods?
    a. Describe your proposed project in a paragraph.
    b. Describe any special precautions you will take.
    c. Where will you carry out these experiments?
    d. Who will be your scientific supervisor and what are his/her qualifications?
    e. Where will you obtain the animals?
    f. How will they be cared for during your project?
    g. What will happen to the animals after your project is finished?

2. Is your project involving human participation?
    a. Describe your proposed project in a paragraph.
    b. Describe any special precautions you will take.
    c. Where will you carry out these experiments?
    d. Who will be your scientific supervisor and what are his/her qualifications?
    e. How many people will participate in your experiment?
    f. What are the age ranges of the human participants?
    g. Include the Informed Consent Letter of Information and Permission Form you will use. These *provided templates are the forms participants will sign when agreeing to participate in your project.*

SAMPLE JUDGING CARD

Judging – Judging Card

Criteria:

1. Is the item made properly?
2. Does the item serve the purpose for the class it is in?
3. Is it the proper size for its purpose?
4. Does it smell and/or look like it should?
5. _____
6. _____
7. _____

**note: additional requirements can be added to list specific to the item being judged

Giving Reasons:

I place this class of _____ _____, _____, _____, _____.

I place _____ _____ first because……

I place _____ _____ over _____ _____ because……

I place _____ _____ over _____ _____ because……

I place _____ _____ over _____ _____ because……

I place _____ _____ 4th because…….

For these reasons, I place this class of _____ _____, _____, _____, _____

Official Placing _____.

TAKE HOME ACTIVITY #1 (MEETING #4)

Myth Busting! Predicting the weather without technology

Weather Prediction Method	My Prediction	Actual Weather Forecast
Detect the direction of the wind. If you are unable to immediately detect the wind's direction, throw a small piece of grass in to the air and watch its descent. Easterly winds, which blow from the east, can indicate an approaching storm front; westerly winds mean good weather. Strong winds indicate high pressure differences, which can be a sign of advancing storm fronts.	Date:	
Check the grass for dew at sunrise. If the grass is dry, this indicates clouds or strong breezes, which can mean rain is coming. If there's dew, it probably won't rain that day. However, if it rained during the night, this method will not be reliable.	Date:	
Observe the leaves. Deciduous trees show the undersides of their leaves during unusual winds, supposedly because they grow in a way that keeps them right-side up during typical prevalent winds.	Date:	
Take a deep breath. Close your eyes and smell the air. Plants release their waste in a low-pressure atmosphere, generating a smell like compost and indicating an upcoming rain. A proverb says *Flowers smell best just before a rain.* Scents are stronger in moist air, associated with rainy weather.	Date:	
Check for humidity. Many people can feel humidity, especially in their hair (it curls up and gets frizzy). You can also look at the leaves of oak or maple trees. These leaves tend to curl in high humidity, which tends to precede a heavy rain.	Date:	

Pine cone scales remain closed if the humidity is high, but open in dry air. Under humid conditions, wood swells (look out for those sticky doors) and salt clumps.	Date:	
Take note of the birds. If they are flying high in the sky, there will probably be fair weather. Falling air pressure caused by an imminent storm causes discomfort in birds' ears, so they fly low to alleviate it. Large numbers of birds roosting on power lines indicates swiftly falling air pressure. Seagulls tend to stop flying and take refuge at the coast if a storm is coming. Birds get very quiet immediately before it rains.	Date:	
Pay attention to the cows. They will typically lie down before a thunderstorm. They also tend to stay close together if bad weather is on the way. They may also run around in a circle before a storm.	Date:	
Look at ants' hills. Some say ants build their hills with very steep sides just before a rain.	Date:	
Watch nearby turtles. It is said that they often search for higher ground when a large amount of rain is expected. You may see them in the road 1 to 2 days before a rain.	Date:	

ACTIVITY #33

Data Collection Form for Poking Fun at Math

Record your observations as you poke holes in your foil and turn on different numbers of bulbs:

1. Start with one hole and one bulb. How many lights (images) do you see on the wax-paper screen?
2. Turn on another bulb and record what you see. Then turn on the third bulb and record what you see.
3. Poke a second hole. Start over with only one bulb, then turn on a second bulb, then all three bulbs. Record the number of images you see each time.
4. Continue with this pattern of adding a new hole and turning on one light at a time until you have enough data to see a pattern.

# holes in foil	# bulbs turned on	# lights visible on wax paper
1	1	

Can you come up with a formula that predicts the number of images based on the number of holes and the number of bulbs that are turned on?

EXTRA ACTIVITIES

Activity #41

Plants Memory Game

Memory games can be a lot of fun! Begin the game with the phrase, “When I go walking outside my favourite plant to see is…..” and finish the phrase by adding one item. As each person takes a turn they add a new item and then they must repeat, in order, the items other people have added. The items can be real or silly items. When a person makes a mistake, they are out of the game. It will be fun to hear the silly additions and even more fun to find out how many items members will see before the game ends.

Activity #42

Ball Toss

This is a review exercise. Have everyone stand up and form a circle so that everyone is facing inwards looking at each other. Toss a foam ball or bean bag to a person and have them tell what they thought was the most interesting fact or idea that was discussed at the meeting relating to the meeting topic. They then toss the ball to someone else and that person explains what they thought was the most interesting fact learned. Continue the exercise until everyone has caught the ball at least once and explained an interesting fact or idea learned at the meeting.

ACTIVITY #43

Pollinator Word Search

L D O B S K M N L W J M F C V C V U F D A P Y S B S I M F Y
R T B T M T U L Z D W E O A A N I T V M L J X P Y J T S A F
K P S B E E L K L A G M U Z R O L F E H P N H W H O D P J N
Y R E C B N J U X Y M W N A I E Z Z I L T Y H A N G W H I J
B N R M O V K G S U Z M S W A C R A Q T E A P F G Q Q V P K
A Q V M Y X T Y N E K Q V J B I D K M R N X Y Q Z B Z K S F
V G A D Z K C I A I R Q T D L X L Z U O N E C R A D Q F M V
P I T D D H C Y L P S M R R E I E S I V H R I V G T O W N Y
B K I D R A G T L Y Y D C X S Q A R T S E T P C E I V I Q K
L X O V T C S G O D F H C T Y E E L P N C Y A T S K O M S C
C G N E E N R F T V T H T H M S G K X T M E O M E J F C K A
N O I T S E U Q E R Q J X U E T S I R V R K U M W O I D K S
O U T S A G J K E I W D M A Y N M X J Z O L X G K F Z C S S
P S I E E L B B Y O S H R X X E G J W O N U C M H K A W B E
N H H K C U A Z D S I C A A X M D J U M D O B L A Y Z P B S
H Y P O T H E S I S H I P T W I E L Z V J A E O D Z V J S S
V W O I Z P N Z N C H X S U R R Q T B J J Q G P P K U S R G
Q R R A Q A S O V X L Z O C C E V A H A J T E H V B M R E A
T T D C I Y A E L D O I H Z V P K K R O S X U I R T O J E V
S N E P Y F W H Y O J G Z P H X C Y R V D R U I J P M E R H
A N A L Y Z E R B H G K F A R E U T P V N A M P Q H M H A S
E A O L H W P Y N G F Y S H V F A B W O F Z I U L M S O C B
D Z M C S P Y L X L I N D N Z F J I I K X Y D T T T U J U J
Y H Z G G U R C F N U Z H M P T J S J Y Z I S H E W E Y O M
G N I R E E N I G N E D R V L C U N M M K U L P N R V V B F
G U N E T N B N T P T W T Q P L R R B D T J S E I Y T M K A
S G G Z Q N W L Y W B H D A C Q W V F O V C F K W F G I I N
K U E N G D C I M V C G E N L D S E N C L J Y Y U W I H H W
Z Y W Y S Z N X E W E H O L A Y P T J G T L L X I G N M T Y
Z X D W F N S D K Z K C Y U X P U E H H O M M J L W L E C W

ANALYZE
ASSESS
CAREERS
COMMUNICATE
CONCLUSION
ENGINEERING
EXPERIMENT
HYPOTHESIS
MATH
MEASURE
METHOD
OBSERVATION
QUESTION
RESEARCH
RESULTS
SCIENTIFIC
STEPS
TECHNOLOGY
TEST
VARIABLES