NIGHT OF SCIENCE
MAY 3, 2019

GUIDE BOOK

You may also use this package as your research notebook

COVER SHEET

Project Title

Project Type
(Experiment,
innovation, or
literature review)

By

Grade(s)

STEP #1: PRINT THIS NOTEBOOK

Print this notebook and submit it along with your project.

Use this notebook to help plan and present your project. Document your brainstorming, research, materials list, procedure, observations, and results here.

It is important to document all of your findings (both good and bad). Think of your notebook as a Science Diary.

Step #2 CHOOSE A TOPIC

To help you get started, think about things you are curious about. Talk to your teacher and parents, look on the internet, or look for books at both our school library and our public libraries.

Think of all the areas of science: health medicine, plants, rocks, the earth, space, computers, mammals, human learning and behavior, the environment, pollution, insects, birds, amphibians, the stars, fossils, etc. Don't forget things like cooking and sports, they are science too! Think about if you want to test something out – an **EXPERIMENT PROJECT**… or, if you have some great idea about creating a new program, tool or toy – an **INNOVATION PROJECT**…or, if you want to learn more about a certain science topic and explain it to others – a **LITERATURE REVIEW PROJECT.**

- Experiment Project: conduct an experiment, where you test a theory/hypothesis and you record your results and see if your theory/hypothesis is correct. See example below.
- Innovation Project: create new knowledge, solutions, ideas or technologies, and share information about their importance. Can you think of a way to do a task better? A way to make life better? Share your invention.
- Literature Review Project: study a topic from a variety of sources, then gather and record the information you discover and find interesting.

Experiment Project	Research Project
My interest - Melting Ice What could I ask? "What is the fastest way to melt ice without heat?" An experiment project by Jane Student.	My interest - Popcorn What could I ask? "Why does popcorn pop?" A research project by John Student.
Now you try!	

STEP #3 RESEARCH YOUR TOPIC

Select your favorite topic and learn more about it. Look at books, the internet or ask some experts (parents, friends, teachers, etc.) As you learn more, you will have more questions... that's good!

Don't forget to use people as resources—doctors, dentists, veterinarians, zoo keepers, librarians, college professors, teachers, parents, grandparents, nature center staff members and specialists in industries will be very helpful and informative—they're all scientists! Be polite! Be certain to thank the person you interview for the help they gave you!

Interview tips:

Over the phone or in person, write down your questions before you begin. That way you:

- won't forget important questions
- it will be easier to ask questions

Begin the conversation by telling your participant:

- your name
- what school you attend
- what grade you are in
- you are doing a science fair project and would like to ask some questions

By email:

- Begin your email by explaining:
- what school you go to
- what grade you are in
- you are doing a science fair project and would like to ask some questions

End the email by:

- thanking the person for their help
- including your return address in the letter

Don't forget to visit libraries! Librarians will be happy to help you find what you need.

What have you learned? Where did you get the information? Write it down—you must cite your sources.

Example

I found that you could melt ice on the sidewalk using salt. (Spangler Science Website and ask.yahoo.com) You can also melt ice in a glass using water (I have done it at home) Salt melts the ice because it lowers the freeze point of the water (Spangler Science) Adding salt to ice makes the ice cold enough to freeze milk and make ice cream (Spangler Science) It takes a 5:1 ratio of ice to salt to freeze ice cream in an ice cream freezer (mom's White Mountain Ice Cream Maker Cookbook)

Now Write Down What You Have Learned!!

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…And Write Down Your Sources (Name of the books you used or links to websites you have learned from):

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STEP #4 ASK A QUESTION / CHOOSE A TITLE

Now that you have researched your topic, it's time to formulate your question. Choose a question you can answer scientifically. What has your research made you curious about?

Research project: find resources (books, official websites, interviews). Examples of Research Project questions are: "Where Do Rocks Come From?" or "What Is The Solar System Like?" You can't do experiments to find the answers to those questions but you can research them!

Experiment: test your hypothesis, observe and record the results. Check to see if your question will allow you to do experiments and take measurements so you can answer your question. If not, re-word your question, think of another question or consider registering it as a Research Project and not an Experiment Project.

Brainstorm; write down at least 3 questions so you can see which one you like better.

Example:

1. Why does salt melt ice?
2. Does the amount of salt effect how fast the ice melts?
3. Does the salt make the ice colder?

Now you try!!

1. _____

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2. _____

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3. _____

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4. _____

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STEP #5 THE HYPOTHESIS (For EXPERIMENT PROJECTS)

Before you begin your experiments, you will need to write a hypothesis. A hypothesis is a guess you make before you test.

It is okay if your hypothesis turns out to be wrong. Scientists guess wrong all of the time. Sometimes you learn more when it doesn't work out like you expected.

When you write your hypothesis, give examples of why you are making the guess that you are making.

Example Hypothesis:
I think adding ½ cup of salt to 4 cups of crushed ice will make the temperature of the ice 0 deg C and freeze ½ cup of milk in 10 minutes. I think this because the recipe I found for making ice cream used a 5:1 ratio of ice to salt and I think it is too much salt.

YOUR HYPOTHESIS:

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STEP #6 MATERIALS (For EXPERIMENT PROJECTS)

Now you are almost ready to do your experiments! But before you begin, list all of the materials that you will need to do those experiments.

I WILL NEED:

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STEP #7 PROCEDURE (For EXPERIMENT PROJECTS)

How will you test your hypothesis? Experiment! A scientific experiment will test only the thing you are trying to measure or observe. When doing your experiment you want to change only one thing (independent variable). You want to do everything else exactly the same way every time you do the experiment. That way if something different happens you know what caused it. You also need to figure out what you are going to measure to prove your hypothesis (dependent variable).

When you change your independent variable the dependent variable will also change. Your experiment needs to be something you can repeat. You may want to try it two or three times to make sure the same thing happens each time.

Example:

1. Fill the large size bag with 4 cups of crushed ice.
2. Add about ½ cup of salt to the ice. Seal the bag and mix for 5 minutes. Measure temperature of ice and salt.
3. Use the medium size zipper-lock bag to mix the following ingredients:
   1/2 cup of milk, 1 tablespoon sugar, 1/2 teaspoon vanilla extract
4. Seal tightly, allowing as little air to remain in the bag as possible. Put inside another bag and seal.
5. Place the two bags inside the large size bag with the ice and seal the bag. Put on gloves and shake and massage the bag, making sure the ice surrounds the cream mixture.
6. Record what the milk mixture feels like through the ice every 2 minutes to see when it freezes.
7. Repeat using no salt, ¼ cup of salt, 1/3 cup of salt and 2/3 cup of salt.

Now you try:

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STEP # 8 THE EXPERIMENT (For EXPERIMENT PROJECTS)

Now that you have a question to answer, the materials that you need to do your experiments, and know how you are going to test your hypothesis (your procedure); you are ready to begin your experiments! Make sure you write down what you do, how much of the different materials you used, things you decided to change as you went along because it didn't work like you planned.

When you do your experiments, keep accurate records of what is happening! This is very important! Write down all the things you see happen (observe) in your notebook. You can also take pictures, take a video, etc.

Example**:**

The temperature of the ice was -4 deg C before I put the salt in. I put the ice in the bag with the salt and mixed it for 5 minutes. The temperature of the ice/salt mixture was -8 deg C mixing the salt with the ice. The milk mixtures temperature was 5 deg C when I put the bag with the milk mixture in the bag with the ice/salt mixture. After 15 minutes the milk was freezing. The temperature of the milk mixture was -6 deg C. The ice had crystals in it. I tried to freeze the milk mixture with ice only, but the milk did not freeze.

Now you try:

Your conclusion is a summary of what happened during your experiment. It explains how close your hypothesis came to telling what really happened in your experiments.

Review your notebook, review your observations and data and decide if you proved or disproved your hypothesis? Did it come out as expected? What would you do different next time?

Remember there is no wrong answer in science. If your hypothesis wasn't right, that is okay.

Do you know why the results happened the way they did? You may want to reread some of the books you found while doing your research and try to find out why. (The judges will probably ask, so it is good to think about it now!!)

Example:

I found that my hypothesis was close. With 4 cups of ice you only need 2/3 cups of salt to make the ice cold enough so that the ice cream freezes. The ½ cup of salt I thought I needed froze the ice faster than using 2/3 cup of ice. I found you need to get the temperature of the ice mixture down to -8 deg C in order to freeze the ice cream in 10 minutes. If I were to do this again I would try it with different flavors of ice cream to see if different flavors froze in different amounts of time.

Write down what you have concluded (figured out):

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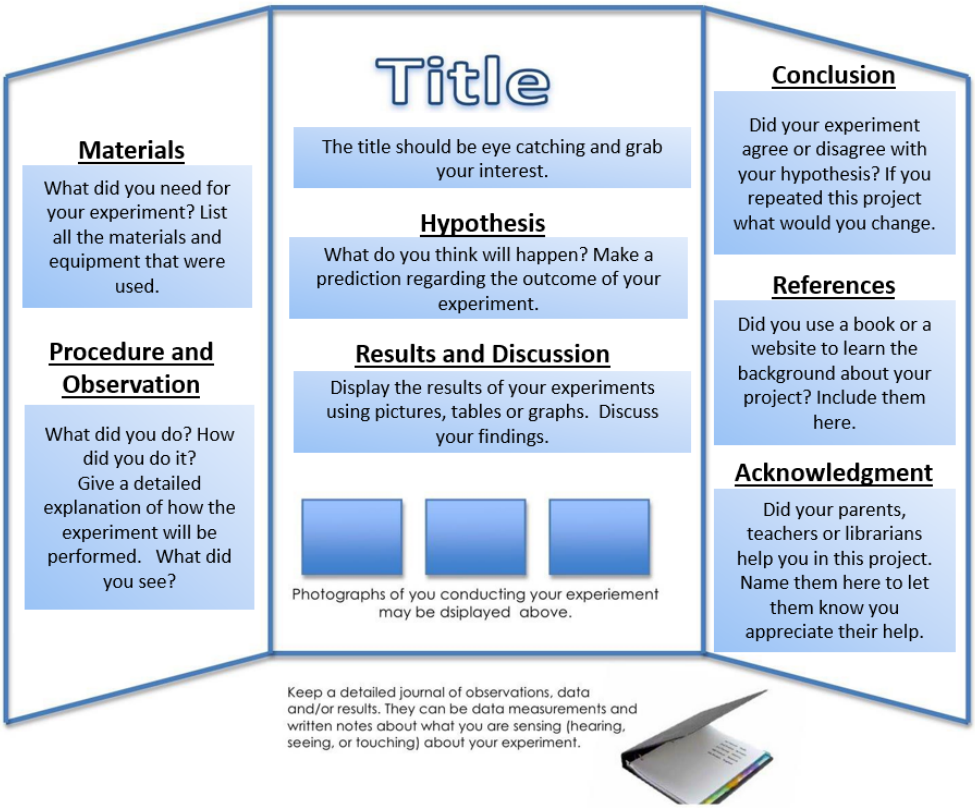
STEP #10 THE DISPLAY

Please follow the guidelines when making your display board for the science fair. Your projects should include:

- Title
- Your name and Grade/Division
- Abstract/ Question
- Materials/Resources
- Procedure (not needed for literature review projects)
- Observations/Research
- Conclusion
- References
- Acknowledgments

Here is an example of what your poster could you like. Get creative – this is YOUR project so have fun and try new things!



STEP #11 BRING YOU PROJECT TO OUR NIGHT OF SCIENCE AND CELEBRATE!!!

Your friends and judges are interested to see your work. You are welcome to be present and speak to the judges as they come around visiting your project. Judges love talking to you about your experiment! They, however, will judge your work even if you are not present. To score well with the judges, take a look at the rubric listed on the next page. This is the same rubric as is used in regional and provincial science fairs.

In case you are interested in competing regionally, there is a Coquitlam Library Science Expo on May 2nd. This event is not related to our NOS but if you are in grades 4 and 5 you are eligible to enter in it. Be sure to sign up for it early! Here is the link to the Science Expo:

http://www.coqlibrary.ca/programs-events/children/sci-expo

Above all, HAVE FUN!

JUDGING RUBRIC

The following rubric will be used to judge science fair presentations.

PART A: SCIENTIFIC THOUGHT		
Experiment Undertake an investigation to test a scientific hypothesis by the experimental method. At least one independent variable is manipulated; other variables are controlled.	**Innovation** Develop and evaluate new devices, models, theorems, physical theories, techniques, or methods in technology, engineering, computing, natural science, or social science.	**Study** Analysis of, and possibly collections of, data using accepted methodologies from the natural, social, biological, or health sciences. Includes studies involving human subjects, biology field studies, data mining, observation and pattern recognition in physical and/or socio-behavioural data.
LEVEL 1		
Replicate a known experiment to confirm previous findings.	Build a model or device to duplicate existing technology or to demonstrate a well-known physical theory or social/behavioural intervention.	Existing published material is presented, unaccompanied by any analysis.
LEVEL 2		
Extend a known experiment with modest improvements to the procedures, data gathering and possible applications.	Improve or demonstrate new applications for existing technological systems, social or behavioural interventions, existing physical theories or equipment, and justify them.	Existing published material is presented, accompanied by some modest analysis **and/or** a rudimentary study is undertaken that yields limited data that cannot support an analysis leading to meaningful results.
LEVEL 3		
Devise and carry out an original experiment. Identify the significant variables and attempt to control them. Analyse the results using appropriate arithmetic, graphical or statistical methods.	Design and build innovative technology; or provide adaptations to existing technology or to social or behavioural interventions; extend or create new physical theory. Human benefit, advancement of knowledge, and/or economic applications should be evident.	The study is based on systematic observations and a literature search. **Quantitative studies** should include appropriate analysis of some significant variable(s) using arithmetic, statistical, or graphical methods. **Qualitative and/or mixed methods studies** should include a detailed description of the procedures and/or techniques applied to gather and/or analyse the data (e.g. interviewing, observational fieldwork, constant comparative method, content analysis).
LEVEL 4		
Devise and carry out original experimental research in which most significant variables are identified and controlled. The data analysis is thorough and complete.	Integrate several technologies, inventions, social/behavioural interventions or design and construct an innovative application that will have human and/or commercial benefit.	The study correlates information from a variety of peer-reviewed publications and from systematic observations, and reveals significant new information, or original solutions to problems. Same criteria for analysis of significant variables and/or description of procedures/techniques as for Level 3.

PART B: ORIGINALITY & CREATIVITY			
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**
The project design is simple with little evidence of student imagination. It can be found in books or magazines.	The project design is simple with some evidence of student imagination. It uses common resources or equipment. The topic is a current or common one.	This imaginative project makes creative use of the available resources. It is well thought out, and some aspects are above average.	This highly original project demonstrates a novel approach. It shows resourcefulness and creativity in the design, use of equipment, construction and/or the analysis.

PART C: COMMUNICATION The level is based on four elements: visual display, oral presentation, project report with background research, and logbook.			
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**
Most or all of the four elements are simple, unsubstantial or incomplete. There is little evidence of attention to effective communication. In a pair project, one member may have dominated the presentation.	Some of the four elements are simple, unsubstantial or incomplete, but there is evidence of student attention to communication. In a pair project, one member may have made a stronger contribution to the presentation.	All four elements are complete and demonstrate attention to detail and substance. The communication components are each well thought out and executed. In a pair project, both members made an equitable contribution to the presentation.	All four elements are complete and exceed reasonable expectations of a student at this age/grade. The visual display is logical and self-explanatory, and the exhibit is attractive and well-presented. The project report and logbook are informative, clearly written, and the bibliography extends beyond web-based articles. The oral presentation is clear, logical, and enthusiastic. In a group project, both members contributed equitably and effectively to the presentation.

32