ENTRY FORM
for Troop 335's

STEM Night Science Fair
Palatine High School

September 11, 2017
7pm-9pm

Science Fair Participants:

Only Cub Scouts, Boy Scouts from Troop 335, family members under age 18 from Cub Scouts or Boy Scouts from Troop 335 are allowed to participate.

Science Fair projects may be completed by an individual or teams up to 3 members. All participants must follow the attached guidelines to participate and qualify for the STEM Night Science Fair.

To participate, please complete this form **by September 1, 2017** and return a scanned copy or email to: Troop335@aboutcooper.com

Subject: Troop 335 STEM Night

Participants Name(s): _____

Address: _____

Email: _____

Parent(s): _____

Pack # (or Troop 335): _____

Participant Age(s): _____

http://STEM.t335.org

Science Project Guidelines
for Troop 335's
STEM Night Science Fair
September 11, 2017

The following information should help Scouts have a successful science fair project experience. Above all — a Science Fair Project should be fun. So, keep that in mind when thinking about what you want to do.

The Scientific Method Through use of the "Scientific Method," scientists attempt to develop an accurate, reliable, consistent and non-arbitrary view of the world. Although procedures vary from one field of science to another, recognizable characteristics distinguish scientific inquiry from other approaches for obtaining answers to questions. Scientific inquiry is a powerful way of understanding science content. Scouts learn how to ask questions and use evidence to answer them. In the process of learning the strategies of scientific inquiry, Scouts learn to conduct an investigation and collect evidence from a variety of sources, develop an explanation from the data, and communicate and defend your conclusions. Although no single step-by-step scientific method captures the complexity of doing science, a number of shared values and perspectives characterize a scientific approach to understanding nature.

These shared values may include:
• explanations supported by evidence that is testable
• evidence must be observable
• arguments must be rational
• conclusions must be drawn from observations
• conclusions should include some element of skepticism
• conclusions must be subject to peer review (scientists review each other's data before it is published)
• methods must be repeatable (other scientists must be able to repeat the experiment and obtain very similar evidence)

Regarding scientific inquiry, Scouts should:
• "learn how to identify and ask appropriate questions that can be answered through scientific investigations;" **[Scientific Method: Question]**
• "design and conduct investigations to collect the evidence needed to answer a variety of questions;" **[Scientific Method: Hypothesis, Methods]**
• "use appropriate equipment and tools to interpret and analyze data;" **[Scientific Method: Results]**
• "learn how to draw conclusions and think critically and logically to create explanations based on your evidence;" **[Scientific Method: Conclusions]**
• "communicate and defend your results to your peers and others" (publish in a journal).
(National Science Teachers Association (NSTA) (http://www.nsta.org/about/positions/inquiry.aspx)

1: Design and Plan a Science Project

STOP! Are you using animals or human subjects? Review possible risks in the proposed projects and discuss them with an adult sponsor. If any Scout is working with animals or humans, you must have your methods reviewed and preapproved by a school's Institutional Review Board (IRB) **BEFORE** you begin work on your project. In fact, it's **FEDERAL LAW** that you do this.

2. Create the Science Project Logbook

Before Scouts begin your projects, you should start your Science Project Logbook, which will be a very important part of the project.

Tip: Leave the first page of the project logbook blank, so you can make a table of contents at the end of the project.

Scouts should keep the logbook nearby to record all ideas, thoughts, experiments and activities. The notebook serves many purposes:

- the place to keep notes while you plan the project;
- the place to keep notes while you perform your experiments;
- illustrates the quality of work you perform and shows the amount of time and effort that went into your project.

Scouts should handwrite everything into this book that pertains to the project, no matter how insignificant it might seem. You never know when that piece of information will come in handy. You should write in ink and not erase or tear out pages just because you made a mistake. When Scouts enter notes in your logbook, you should try to:

- be as complete and clear as possible;
- write neatly enough that other people can read it;
- use correct grammar and spelling;
- enter the date and time of day every time you have ideas, at the time you think of them, or when you are working on your project;
- have your entries witnessed at least once a week, either by the you or a parent, depending on where you are performing the experiment.

This logbook must be included with the Science Project Display Board, and the quality of the logbook will be part of the judging criteria.

3. Project Design

You should begin to design your project using the Scientific Method as a guide, and record everything in your Science Project Logbook as you proceed.
The following is very important:

- **This is the participant's project.** That means that the ideas and the work must be YOURS—not your parents. Age-appropriateness will be part of the judging criteria.
- **Originality counts.** Scouts should use your imagination to think of a science project themselves. Originality will be part of the judging criteria.

4. Ask Questions

You should think about your areas of interest and questions within that area that might be worth exploring. You should narrow your ideas down to define one question that you want ask concerning your interests. Scouts should formulate a question. As an example, let's say a Scout is thinking about the environment, and then perhaps about the effects of acid rain on buildings. Since many buildings are made of brick, you decide your question will be: "How does acid rain affect brick buildings?"

5. Do Some Research

Getting information from existing sources helps Scouts develop your ideas. Here are some suggestions:
• Talk to lots of people, including teachers, parents and friends, or experts in your area of interest. Scouts should read scientific magazines and books, and other written material.
• Research the Library and the Internet to see what is currently being done in the area of your question.
• Refer to the Librarian for help in your research.
• Write down your sources ("citations") in your logbook. In our example above, the Scout should do some research in the library to find information on acidity, acid rain, and the effects of acid rain on the environment, including buildings. Scouts should record your thoughts, investigations and citations in your Science Project Logbook. Then you are ready to form a Hypothesis.

6. Develop a Hypothesis

Scientists create hypotheses as early attempts to explain patterns observed in nature or to predict the outcomes of experiments. (Wikipedia http://en.wikipedia.org/)

Scouts form your hypothesis based on the information that you found in your research. Scout's Hypothesis should be age appropriate. A hypothesis consists of a reasonable suggestion of a possible explanation for something Scouts observe, or a correlation between many things you observe.

Remember from our previous discussions above, the scientific method requires that you test your hypothesis, and confirm or disprove your hypothesis; if you can't test your hypothesis, then you can't use the Scientific Method. Typical hypotheses are statements, and often are presented in the form of an "IF-THEN" statement. Using our previous example:

- "IF rain water is more acidic, THEN bricks in buildings will fall apart faster;" OR in the alternative,
- "IF rain water is less acidic, THEN bricks in buildings will take longer to fall apart;"

Don't forget — if the results show your hypothesis to be false that is perfectly acceptable. False hypotheses still give us information. Scientists frequently find your hypothesis is false. The "Hypothesis"

should be recorded in the Scouts' Science Logbook and included on the final Project Display Board. Now you are ready to think about your methods.

7. Plan the Methods

Scouts should develop Methods to test your hypothesis. You should think about your Methods in an organized way, and write them so that someone who reads the logbook could repeat the methods. Scout's Methods should be age appropriate. Here are some considerations:

- **Think about the actions that you will take in your experiment, and how you will measure the results of these actions.**
    - In our example, Scouts could decide that your actions will be to use water with different acidities, and see if there are any differences in the effects on brick.
    - You might want to measure the difference in brick break-up by measuring the weight of the bricks after the treatments.
- **Determine what your actions will be under "normal" conditions."**
    - In our example, the Scout would make water samples with a neutral pH (about 7.0).
    - This is called the "control group".
- **Determine what your actions with be under "changed" conditions."**
    - In our example, you would make up water samples with differing pH.
    - This group is called the "experimental group." Your actions are the same as under normal conditions: apply water to the brick. The acidity of the water is different in the "experimental group."
    - The Scout decides what acidities to use, and how to measure the results of applying this water to the brick.
    - Scouts must also decide how often to expose the bricks to acidic water and measure brick break-up over time.
- **What tools and materials do you need to use to complete the experiment?** In our example, you might need water, vinegar, pH paper, bricks and containers to hold them, and a scale to weigh them.
- **Decide how to record these measurements in your Science Logbook.** You might want to use a table and maybe draw pictures to illustrate your methods.
- **Remember, you should record the methods that you PLAN to use in your experiment.** When Scouts actually perform the experiment, you will write down the methods you actually perform as you perform the experiment.
- **Decide how you will compare the measurements for the experimental group to the control group.**
    - You should draw a plan for a template to record your data in your Science Logbook.
    - Charts and graphs should be hand-written or drawn directly in the Science Logbook.

8. Test the Hypothesis (the Experiment)

Scouts should begin the experiment by carefully following your Methods. Scout's Testing (experiment) should be age appropriate. You should:

- record the dates and time of day of each step, and the acidity used;
- record any mistakes or unusual observations; use more detail rather than less detail; illustrate results — take photographs or make drawings of the methods and materials if desired and tape, glue or otherwise fix into the Science Logbook; you might want to also use these pictures on your Project Display Board (if so, you need two prints each); record the data or results.

9. Analyze the Results

Scouts should think about the data and what it means. Scout's Analysis should be age appropriate.

- Do you see differences between the experimental group and the control group for the phenomena measured?
- If you didn't get the results you were expecting, is the hypothesis false, or do you need to reexamine the experimental method, the hypothesis or redefine the original question? For example, what if the bricks don't fall apart when treated with acidity? How can you change your methods?
- You might want to use visual aids to illustrate the data in the table, such as quick hand-drawn graphs of the data.
- These analyses should be recorded in the Science Logbook.

10. Form Conclusions

After analyzing the data, does the Scout think that your hypothesis is true or false? Why? Scout's Conclusions should be age appropriate. You should record this in your Science Logbook and on the Project Display Board.

11. Create a Table of Contents

Write a Table of Contents on the first page of your Science Project Logbook (you left this page blank when you began your project).

12. Write an Abstract

Scouts should write a one-paragraph summary of the steps in the project and record this in your Science Logbook and on the Project Display Board. Scout's Abstract should be age appropriate.

Gather Citations Scouts should gather your Citations from the Logbook so that you can include them on the Project Display Board.

Citation Format Examples:

Book

Lastname, Firstname. *Title of Book.* Place of Publication: Publisher, Year of Publication.

Magazine or newspaper

Author(s). "Title of Article." *Title of Periodical* Day Month Year: pages.

If you are using a fancy scholarly journal, like American Mathematical Society Monthly, there is a different format:

Author(s). "Title of Article." *Title of Journal* Volume.Issue (Year): pages.

Website

Name of Site. Date of Posting/Revision. Name of institution/organization affiliated with the site (sometimes found in copyright statements). Date you accessed the site <electronic address (this is www.something.com)>.

13. Create the Project Display Board

Scouts should create your Project Display Board according to the guidelines that appear on this website. Remember, you must include the on the board the steps that you followed using the Scientific Method: Questions, Research, Hypothesis, Methods, Results, Conclusions, Abstract, and Citations. Scouts do not need a computer at home in order to do a Science Fair project. The display of the completed project does NOT need to be typed. Scout's Display should be age appropriate.

Judging

Participation certificates and recognition will be given to all Scouts that submit your entry form prior to August 11, 2017 and participate with a qualifying Science Project on September 11, 2017 during the Troop 335 STEM Night. Feedback about the Science Project will be given by qualified judges (such as adults in the engineering, science or similar professional field) during the event. Judging Criteria:

1. Creativity (20 pts.)
2. Scientific Thought (35 pts.)
3. Skill and Thoroughness (5pts.)
4. Clarity (20 pts.)
5. Oral Presentation (20 pts.)

Total 100 pts. Max.

Citations for these "Science Project Guidelines"

- Intel/ISEF http://www.societyforscience.org/isef/
- Wikipedia: http://en.wikipedia.org/wiki/Scientific_method#Introduction_to_scientific_method
- National Science Teachers Association (NSTA) http://www.nsta.org/about/positions/inquiry.aspx
- Clark County School District Curriculum Overviews K-8
- Southern Nevada Regional Science & Engineering Fair; http://www.nevadasciencefair.net/