2021 STEM Expo Guidelines Packet
3rd, 4th, 5th and 6th Grade Students

For up-to-date information and all the forms: http://www.ohef.org/stem-expo-2022.html

Important Dates:

Fri Oct 15th, 2021	**Reply to Google survey to show interest**
Wed October 20th, 2021	**Any 6TH grader interested in advancing to the County Fair MUST contact Dr. Tonia Cohen by this date to discuss details of their project plan**
Fri December 18th, 2021	**Registration forms DUE**
Tue January 25th, 2022	**Posters due in the MPR at Dropoff**
Wed & Thur - Jan 26th & 27th, 2022	**Interviews for 3rd through 6th grade**
Friday January 28th , 2022	**STEM Expo Award Ceremony - 6:30 PM** ***Eat before you come - dinner for purchase will NOT be available this year.***

Two types of projects will be described in this packet:
Traditional Science Fair Projects AND Innovation Projects

What a STEM Expo project is NOT for 3rd, 4th, 5th and 6th Graders:

It's **NOT** a research report or literature review on a topic.
- Example: What is nearsightedness? How do solar panels work?

It's **NOT** a model.
- Example: the exploding volcano or a model of our solar system

It's **NOT** a collection.
- Example: examining collections from nature such as leaves or seashells

It's **NOT** the reproduction of a known procedure with no experimentation.
- Example: How to make a homemade rocket.

Table of Contents:

Traditional Science Fair Projects

Selecting a **topic** of interest Asking a **question** Doing **background research** Making a **hypothesis** Collecting **materials** and writing out the steps of the **procedure** Conducting the **experiment** (at least 3 times) **Measuring and recording the results** in a data log book **Organizing the data** into tables/graphs/charts **Summarizing the results** Stating your **conclusions**

1. TOPIC

Select a **TOPIC** that interests you.

- *Example: Insect Behavior…ants in my backyard!*

2. A GOOD PLAN

Plan a project that:

*you can do yourself
*is not costly or dangerous
*has something you can test AND measure (such as length, time, weight, number, distance traveled, circumference, speed, temperature, volume, etc.)

3. DATA LOG BOOK

Get a bound notebook to use during your project. This will be your **DATA LOG BOOK (or journal).**

*Handwritten in pen
*Write down the date/time every time you write anything in your data log book.
*Never remove any pages.
*Simply put one line through any errors, don't scribble over errors or white them out.
*Contents of your date log book:
observations you make about your topic, thoughts/ideas about your project, all the notes you take while doing your background research, list of your materials, procedure, etc., and MOST IMPORTANTLY your DATA (meaning everything you see and measure while actually doing your experiment).

You can begin by recording in your data log book any **OBSERVATIONS** you have made that are related to your topic.

- *Example of a related observation: When I dropped my half-eaten popsicle near an anthill, the ants were attracted to the popsicle so I think ants are attracted to sugar.*

4. All great Science Fair projects start with a great TESTABLE question!

Ask a **QUESTION** related to your topic that you can answer with an experiment.

Three Types of Questions for Science Fair Projects

The "Effect" Question:

What is the effect of _____ on _____?

sunlight	plant height
golf ball diameter	distance traveled
local wildfires	air quality

The "How Does/Affect" Question:

How does _____ affect _____ ?

temperature	how far a hockey puck will slide
moisture	the distance snails can travel
wearing makeup	people's opinions about celebrities

The "Which/What and a *Verb*" Question:

Which/What _____ *(verb)* _____?

salt concentration	*decreases*	the temperature at which water boils
heart rate monitor	*is*	the most accurate
smells	*attract*	ladybugs

- *Example of a "which/what and a verb" **QUESTION**:*
  Which type of liquid attracts the most ants: sweet, salty or savory?

- *Example: What exactly are you **MEASURING** in this ant experiment?*
  ***The number of ants** attracted to each liquid*

5. Background Research

Find background information from different references and **read** about your topic. You should use **THREE different references** for your project (<u>at least one</u> should be from a non-internet source).

- *Examples of information to research: What is already known about ants and their behavior around food sources? What do ants need nutritionally? What is known about sugar and why insects are attracted to sugar?*

Types of References for Background Research

Encyclopedias/textbooks/books
Magazines - such as Scientific American, National Geographic, Time, Smithsonian, etc.
Newspaper articles
Respected websites on the internet
Interviews with experts (mechanics, physicians, farmers, exterminators, dentists, etc.)

*Record in your data log book where/when you found each of your references and the information you learned and your thoughts and ideas about your project.

*List your references in your data log book and on your poster (your Judge may ask to see your list of references). Here are examples of how to properly list your references:

Examples of How to List References

Book:
Smith, G. 2010. The Insects Around Us. Little and Brown, Inc., Boston, 23-59.
Magazine:
Cochran, J.A., Wiles, G. and J. Manack. 2012. Ants and their habits and habitats.
Scientific American. Volume 34 (3): 47-55.
Personal Communications with an Expert (via phone, email, or in person):
Black, Dr. Charles –Interviewed via phone on December 16, 2015. Prof. of Biology, UCLA, Los Angeles, CA.
Internet Resource:
Q & A's about Flies & Ants. Viewed on December 9, 2015. Penn State College of Agricultural Sciences website.
http://extension.psu.edu/pests/ipm/schools-childcare/schools/kids/pesky-pest-questions-answers/q-as-about-flies-ants

6. Hypothesis

Based on your observations and background research, propose a hypothesis for your Science Fair project. A **HYPOTHESIS** is an educated guess/prediction. It is your "best guess" of what you think will be the answer to your question and what you think will happen when you do your experiment. Your hypothesis should be written down in your data log book BEFORE you perform your experiment.

- *Example: Your question - Which type of liquid attracts the most ants: sweet, salty or savory?*

**Your hypothesis should make a claim about how the <u>two</u> factors relate.*

- *Example: 2 factors: <u>liquid food sources</u> and <u>the number of ants attracted to the food source</u>*

Your hypothesis is a prediction often written as an **If-Then statement.*

- *Example: **If** ants have access to liquids containing sugar or salt or chicken broth, **then** more ants will be attracted to the liquid containing sugar.*

7. Materials

In your data log book, write a detailed and specific list of **MATERIALS** (items) needed to do this experiment. Use metric measurements if at all possible.

- *Example: an active anthill, 4 mini Petri dishes, 10 milliliters (mL) tap water, 10 mL of tap water containing 2 grams of store-bought C&H sugar, 10 mL of tap water containing 2 grams of store-bought Morton's salt, 10 mL homemade chicken broth made with tap water, measuring/graduated cylinder, ruler, timer*

8. Procedures

FIRST - Write out a "step by step" set of directions (procedures) in your data log book.

•*Example: Step 1. Make and label four 10mL batches of the following liquids: water, water+sugar, water+salt, and chicken broth. Step 2. Measure 2mL of the water, put it into a clean mini Petri dish and place the dish 5 cm away from an active anthill. Step 3. Measure 2 mL of the water+sugar liquid, put it into a clean mini Petri dish and place that dish 5 cm away from the same active anthill. Step 4. Measure 2mL of the water+salt liquid, put it into a clean mini Petri dish and place that dish 5 cm away from the same active anthill. Step 5. Measure 2mL of chicken broth, put it into a clean mini Petri dish and place that dish 5 cm away from the same active anthill. Step 6. Wait exactly 3 hours then count the number of ants in each mini Petri dish. Step 7. Record the number of ants in each mini Petri dish in a table in your data log book. Step 8. Repeat the entire experiment (Steps 2-7) two more times, at the same time of day but on different days that are approximately the same temperature. Take photographs of your procedure steps and the results to display on your poster.*

SECOND - Identify the **VARIABLES** in your experiment:

*The **Independent Variable** is the one thing you are changing in the experiment. A well-designed experiment has only ONE independent variable.

•*Example: the type of liquid food source*

*The **Dependent Variable** is what you are observing/measuring.

•*Example: the number of ants that move into each mini Petri dish*

*The **Controlled Variables** are all the variables in the experiment that you do not change.

•*Example: use the same anthill, use the same tap water to make the 4 batches of liquids, use the same 10 milliliter (mL) batches of these 4 liquids for all 3 trials of this experiment, use the same brand/size of mini Petri dishes, perform the experiment 3 times at the same time of day on days with similar weather, give the ants the same amount of time to move (3 hours), place the liquids the same distance of 5 cm from the anthill*

THIRD - Perform your experiment at least three times to see if your results are reproducible.

FOURTH - Collect your DATA by recording everything in your data log book.

9. Results/Data Analysis

Organize your data into well-labeled tables and/or graphs to display the results on your poster. Explain what happened in your experiment and what the data means.

•*Example: The "water only" Petri dish served as a control for this ant experiment. The experiment was performed 3 times, using the same anthill. An average of 32 ants was found in dishes containing water+sugar, an average of 10 ants was found in dishes containing chicken broth, and an average of 21 ants was found in dishes containing water+salt. No ants were found in the empty dishes. The data from this project demonstrates that more ants were attracted to the water+sugar liquid compared to the other liquids that were tested. The ants were not attracted to the dish with water only. Sugar is an efficient source of energy for insects, so ants may have evolved to seek out sugar. There were a significant number of ants attracted to the water+salt liquid in this experiment, suggesting that eating salt may also be beneficial for these ants.*

10. Conclusions

Your conclusion should be a written summary of the results and what you learned from this experiment. Compare your results with your hypothesis and state whether your hypothesis was supported or not supported by your results. Remember, it's OK if your data does not support your hypothesis! That's part of scientific discovery! Give possible reasons for the difference between your hypothesis and the experimental results. Explain what you would do differently if you repeated the experiment. Explain how your results apply to the real world. Give examples of future directions you could take.

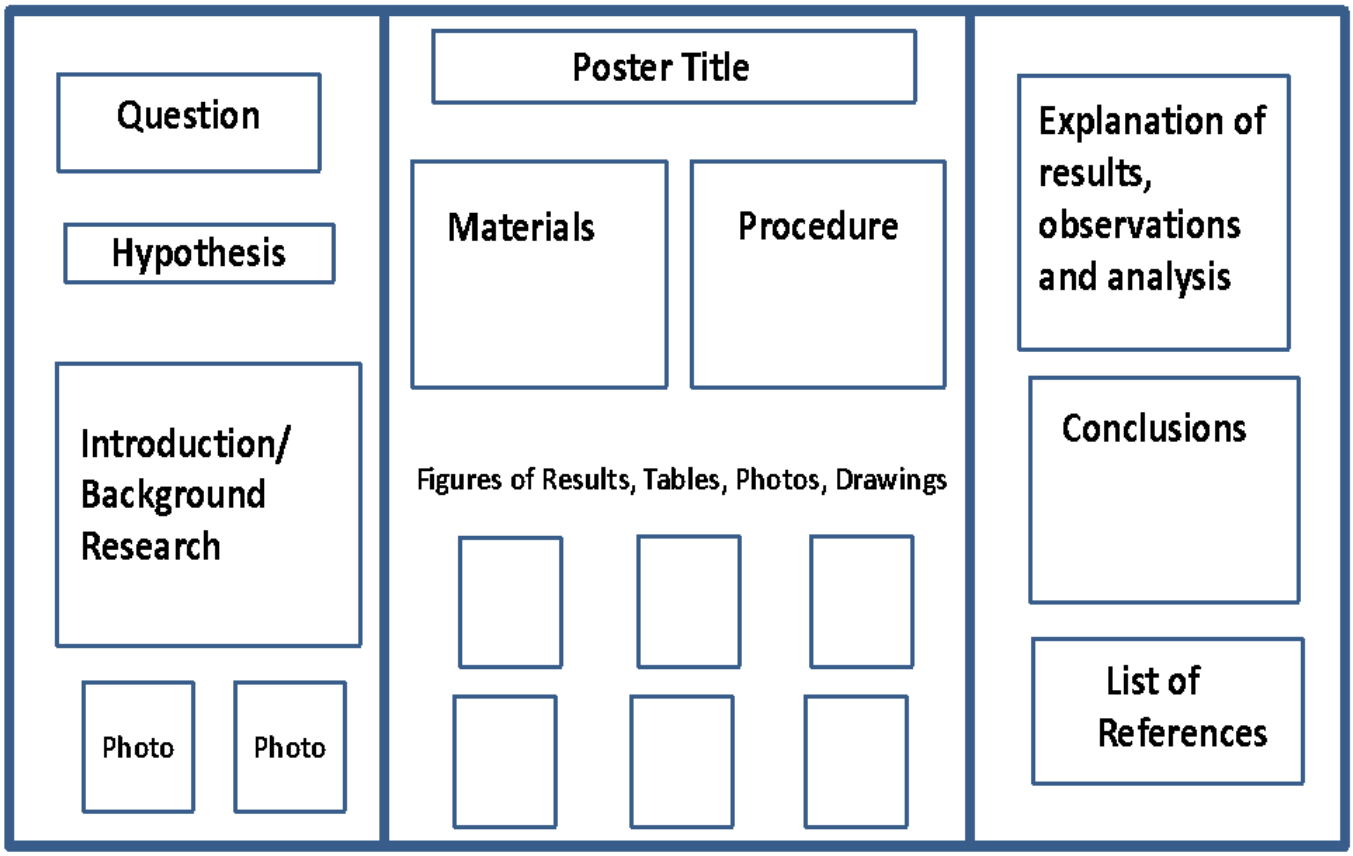
- *Example: In conclusion, this experiment demonstrated that these ants were more attracted to sugar. There may have been another ingredient in the savory liquid (chicken broth) that was repelling many ants. Or, maybe the ants preferred the sugar water because it contains sucrose which is an efficient source of energy for the insects. The hypothesis for this project was:* ***If*** *ants have access to liquids containing sugar, salt or chicken broth,* ***then*** *more ants will be attracted to the liquid containing sugar. The hypothesis WAS supported by the results from this experiment because an average of 32 ants was attracted to the sugar water compared to an average of 21 ants for the saltwater and an average of 10 ants for the chicken broth. Salt (sodium chloride) may be an important part of the ant diet because a large number of ants were attracted to the salt water. This experiment could be repeated using store-bought ant farms in an enclosed environment rather than the outdoor anthill to see if the experiment yields similar results. In the future, more experiments could be performed examining the effect of different types of sugars or different concentrations of sugar (or salt) on the attraction of ants.*

11. Make your Poster

The following image is a suggestion for how to organize your poster.

Sample of a STEM Expo Poster Display for 4th-6th Graders

Traditional Science Fair Project



Posters must be legible and neatly presented on a display board and, due to limited space, can be *no larger than 36 inches tall by 48 inches wide by 18 inches deep*. The poster display board must be able to stand by itself on a table top without support. Your full name, grade level and your teacher's name must be legibly printed on the back of your display board.

Example - For a **Traditional Science Fair Project** your submitted document could include a:
Title slide
Question and Hypothesis slide
Introduction/Background Research slide
List of Materials slide
Step by Step List of your Procedure slide
Figures/Photos/Tables/Graphs slides (showing your observations, measurements and data)
Explanation of the Data slide
Conclusions and Future Directions slide
List of References slide

Innovation Projects

These types of projects are true engineering projects which seek to solve a problem by 1) creating something new or taking something old and making it better. This type of project involves:

Defining the **problem** Proposing a **solution** Doing **background research** Collecting **materials** and writing out the steps of the **procedure** Making and testing a **prototype** Recording the **results** in data log book **Making design changes to prototype** based on results **Re-testing prototype** Stating your **results and conclusions**

1. What is a **PROBLEM** you would like to solve? What can you create to solve this problem? Or how can you modify something that already exists to solve the problem? Also, think about what or who could benefit from this project.

Examples:
**How can I improve the design of a vacuum handle so my grandma with arthritis can more easily use the vacuum?*
**How can my dog get in and out of the house without using a traditional doggie door?*
**How can I help my little sister get up and down the stairs safely?*
**How can we stay cool while sitting in the sun at this sporting event?*
**How can I design a better life vest for water safety?*
**How can I help my grandparents be more active by creating a new app on their phone?*

2. Get a bound notebook to use during your project. This will be your **DATA LOG BOOK (or journal).**

*Handwritten in pen
*Write down the date/time every time you write anything in your data log book.
*Never remove any pages.
*Simply put one line through any errors, don't scribble over errors or white them out.
*Contents of your date log book:
observations you make about your topic, thoughts/ideas about your project, all the notes you take while doing your background research, list of your materials, procedure, etc., sketches of your prototypes, any data you collected (meaning everything you see and measure while testing your prototypes).

You can begin by recording in your data log book any **OBSERVATIONS** you have made that are related to your project.

3. Perform **BACKGROUND RESEARCH**: Find different references and **read** about your chosen problem and the other solutions people may have attempted to solve this problem. You should use **THREE different references** for your STEM Expo project (<u>one</u> reference should be from a non-internet source) – see page 3. Also, on page 4 you can find examples of how to properly list your references. Show your

list of references on your STEM Expo poster and in your data log book. Your Judge may ask to see your list of references.

4. List all the **MATERIALS** you will need and the **PROCEDURE** for testing your prototype (which is your first model of your new creation).

5. **BUILD/CREATE** your prototype and then **TEST** its function.

6. **RECORD** exactly what happens and write the **RESULTS** in your data log book.

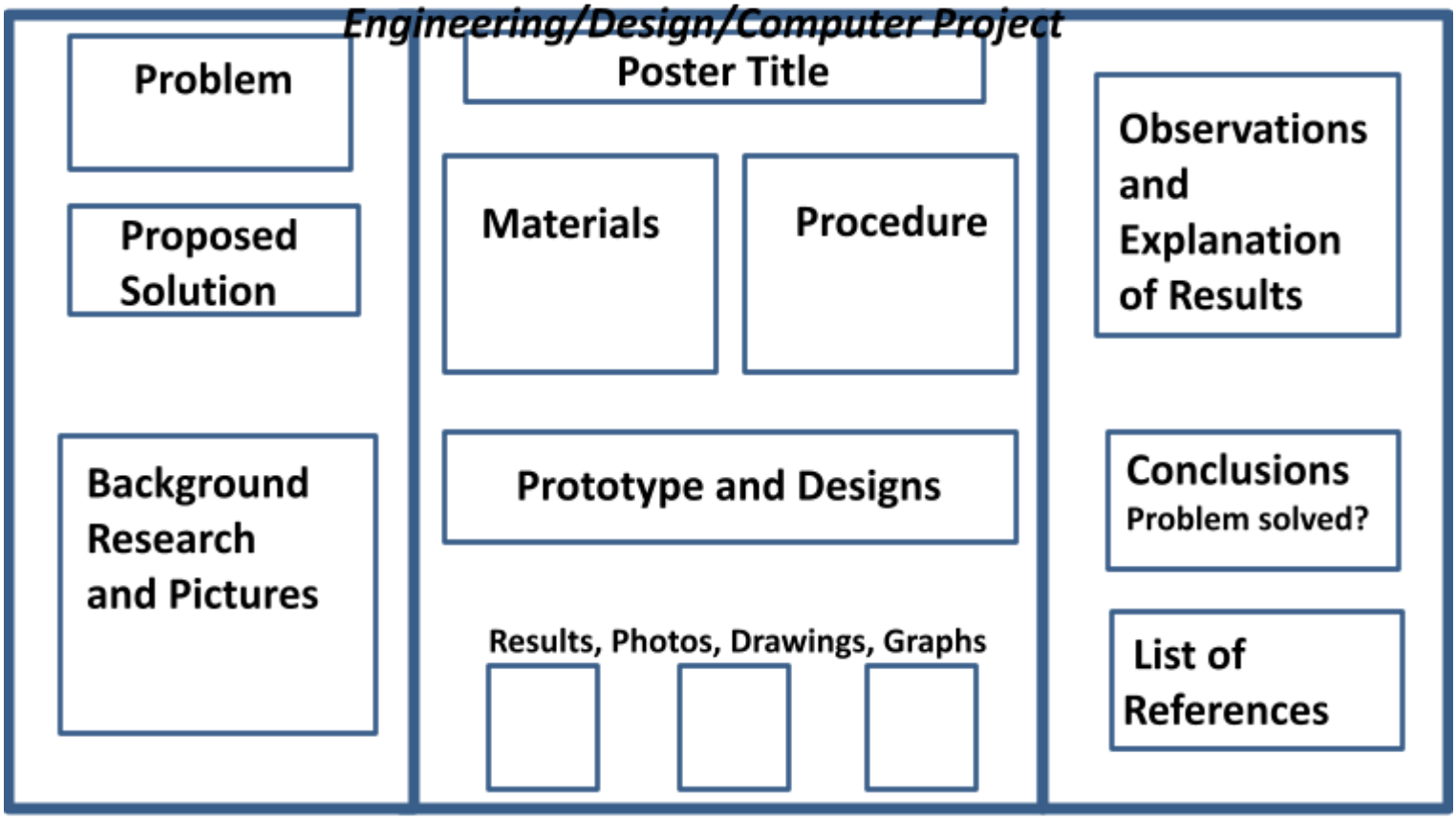
7. **REDESIGN** and **RETEST** your model – were the results reproducible? Make adjustments and redesign and retest again if needed!

8. Report your **RESULTS** and make **CONCLUSIONS**. Does your design effectively solve the problem or meet the need? Who or what will benefit from your innovative project?

9. Make your **POSTER** for the STEM Expo. The following image is a suggestion for how to organize your poster.

Sample of a STEM Expo Poster Display – 4th-6th Graders

Engineering/Design/Computer Project



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Example - For an **Innovation Project (engineering/design/computers)** your submitted document could include a:

Title slide
Problem to be Solved slide
Proposed Solution slide
Introduction/Background Research slide
List of Materials slide
Step by Step Process of the Creation of your Prototypes(s) slide
Prototypes slide (containing an embedded video 1min or less showing your prototype in action)
Drawings/Photos/Graphs slides (showing what you observed and any data from testing your prototypes)
Explanation of the Results slide
Conclusions and Future Directions slide
List of References slide