**All NEW and Improved SCIENCE FAIR - UPDATE

The Gwinnett County Science Department is introducing a new Science Fair format. Students will select one of seven community driven problems with STEM focus:

Household Fats, Oils and Grease
Road Bank Erosion
Lake Lanier Phosphorous Levels
Energy Conservation in Georgia's Residential Homes
Protecting Georgia's Pollinators
Small Trash Pickup
Soil Health in Georgia

Students will be required to follow the Engineering Design Process by designing a new solution to a problem, building it, and testing the outcomes. Students may choose to work individually or in groups of up to three.

The top three STEM projects (but no more than six students); will go to the Gwinnett Country Regional Science Fair on Friday, February 21, 2020. Students will showcase their projects, view other students' projects, and experience fun breakout sessions.

A packet of information, detailing the problems, background information, a project guide, and a judging rubric, will be available on the Simpson school and PTA websites, and a hard copy is available in Simpson Square.

We hope that the students enjoy participating in a project that could directly impact their community.

****While only STEM projects are eligible for the Gwinnett County Science Fair, students are welcome to submit traditional experimental or demonstration projects to the Simpson Science Fair.**

Elementary School Problem #1

Household Fats, Oils, and Grease

Question: How can individual homeowners capture fats, oils, and grease before these substances enter the Gwinnett County sewer system?

Problem: Gwinnett County maintains over 2,600 miles of sewer pipes. When materials such as fats, oils, or grease are allowed to enter the sanitary sewer system, they create large clogs that can cause backups and overflows. While food service establishments are required to maintain a grease trap to capture this material, private homeowners are not. In order to prevent a majority of sewer spills and overflows, substances like fats, oils, and grease need to be kept out of the sewer system pipes.

Sponsored By: Gwinnett Water Resources

Elementary School Problem #2

Road Bank Erosion

Question: How can new and established road banks be stabilized to prevent the erosion of sediment into roadways, stormwater systems, and local waterways?

Problem: Thousands of miles of roadway cross Gwinnett County. As these roads are built, the steep banks erode away over time. Densely packed clay soils can make it difficult for grass and other plants to take root and protect the exposed bank. As the sediment runs off from the embankments, it clogs the stormwater system and enters our local streams, rivers, and lakes. Not only does it make these waterways unattractive for human use, it can pollute the waterway and have a negative impact on the organisms that live in the waterways.

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Elementary School Problem #3
Lake Lanier Phosphorus Levels

Question: How can the phosphorus levels within Lake Lanier be reduced or what can be done to lower the current amount of phosphorus entering the lake?

Problem: Lake Lanier is a source of drinking water for the businesses and residents of Gwinnett County. Lake Lanier is also the destination for much of the treated wastewater from the county. The Georgia Environmental Protection Division (EPD) monitors levels of nutrients and pollutants in all waterways in the state. Over recent years, they have observed increasing phosphorus levels within Lake Lanier. Phosphorus is a naturally occurring mineral, but it is also a bi-product found in human and animal waste. Large amounts of phosphorus can lead to algae blooms, which can kill fish and make the lake unpleasant to swim or boat in. Although Gwinnett County closely monitors the phosphorus levels of treated wastewater sent to Lake Lanier, the Georgia EPD could reduce the amount of treated wastewater we are allowed to send.

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Elementary School Problem #4

Energy Conservation in Georgia's Residential Homes

Question: How can we easily conserve energy in residential homes in Georgia? (i.e. How can we design a device or structure to improve the insulation and air-tightness of a home? OR How can we monitor and manage vampire loads?)

Problem: The average family in Georgia can spend over $2,000 on energy bills each year, which means that reducing our home energy use is the single most effective way to save money and reduce our contributions to climate change. The Energy Information Administration says that home residences account for 21% of all energy consumption nationwide, and is responsible for 20% of our country's carbon emissions. Residents in Georgia should take certain measures to reduce their energy use in the home. This can include reducing the use of indoor A/C and heating units, using less electricity, and being mindful of "vampire loads" (e.g. phone chargers, computer monitors, and other devices that use electricity when plugged in and not in use). Residents need easy, cost-effective ways to reduce energy consumption.

Sponsored By: Southface Institute

Southface

Elementary School Problem #5

Protecting Georgia's Pollinators

Question: Is there an efficient and cost-effective solution that homeowners can use to protect pollinators in Georgia?

Problem: Pollinators play important roles in supporting the world's biodiversity, crop production, and even the economy. A 2014 economic study by the University of Georgia showed that the annual value of pollination to Georgia is over $360 million. Pollination is key to seed production, and without pollinators like hummingbirds, bees, ants, butterflies, wasps, and many others, our favorite fruits and vegetables would never make it to our tables. Pollinators are also key to the survival of wild plant species, they help to control pests that destroy crops and they help in decomposition, which is extremely important in crop production because the process aerates the soil. Although wasps, ants, and bees don't yield warm and fuzzy feelings for most people, that doesn't mean they should be ignored. Pollinator populations are drastically decreasing. Research from UGA is helping to identify some of the reasons for the decline, which include colony collapse, lack of water, lack of shelter, disease, and pesticide use. Scientists are looking for ideas that can be easily utilized across homes (especially in urban areas) on ways to promote, and protect, the pollinators of Georgia.

UNIVERSITY OF GEORGIA
EXTENSION
Gwinnett County

Elementary School Problem #6

Small Trash Pickup

Question: Is there an efficient way to pick up tiny pieces of Styrofoam and other small trash from roadways and streams in Gwinnett?

Problem: Small pieces of Stryofoam and other types of small trash - things that measure less than one inch - are a common pollutant on the streets and waterways in Gwinnett County. The Department of Water Resources sponsors frequent stream and road cleanups to pick up the trash from the environment. While larger pieces of trash such as water bottles and tires are easy to pick up, small pieces of trash are very difficult to collect.

Sponsored By: Gwinnett Water Resources

Gwinnett
Water Resources

Elementary School Problem #7
Soil Health in Georgia

Question: Is there an effective way for urban gardens to promote carbon storage in soils by easily increasing the amount of organic material in the soil?

Problem: The world's soils hold a significant amount of carbon – more than double the amount in the atmosphere. The Intergovernmental Panel on Climate Change's most recent report finds that storing, or "sequestering," carbon will be essential in lowering atmospheric carbon levels. Agriculture, forestry and other land use practices that store carbon in the ground offer an opportunity to mitigate climate change. Healthy soils with more organic matter can store carbon while providing agricultural and environmental benefits. The CDC is interested and has been working in health aspects of healthy soils particularly with the rise of urban agriculture and community gardens as popular activities. In Atlanta, there are an estimated 300+ community gardens, and this number continues to grow due to the local food movement and the many benefits associated with community gardens. Increasing organic material in soils can not only help with the soils ability to store carbon, but also helps reduce the exposure to heavy metals in urban gardens, which can be harmful to humans.

Sponsored By: National Center for Environmental Health, Centers for Disease Control and Prevention

CDC
CENTERS FOR DISEASE™
CONTROL AND PREVENTION

2020 Gwinnett Regional Science, Engineering, and Innovation Fair

K-5 STEM Project Guide:
How to Do a STEM Project

TABLE OF CONTENTS

1.0 WHAT IS A STEM FAIR PROJECT?

STEM Projects differ from most traditional research projects. In a STEM project, students will design a new solution to a problem, build it, and test the outcomes.

For the 2019-20 Gwinnett Science, Engineering and Innovation Fair, our elementary students will have the opportunity to design solutions to real problems that we face in Gwinnett County and in Georgia. Students will select a problem that they have an interest in and then work within the engineering design process to create their solution.

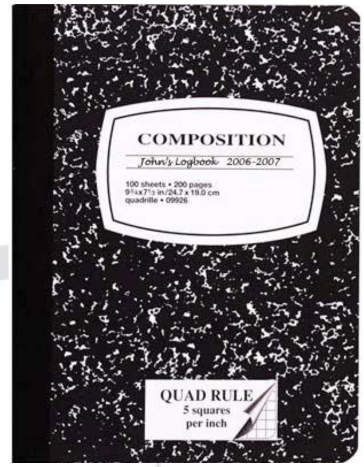
All students completing a STEM project will need to have a STEM project log and follow a common set of steps. The steps in the project will be as follows:

1. Decide on the problem/question that interests you from the GCPS sponsored problems provided.
2. Identify constraints.
4. Gather information about the problem and start to brainstorm ideas.
5. Design a solution to test.
6. Test (3 trial minimum) and evaluate the solution.
7. Reflect on results and redesign, as necessary.

Safety Note: Students are **not** allowed to work with the following: Human subjects, Non-Human Vertebrates, Pathogenic (Biological) Agents, Microorganisms, Recombinant DNA, Human or Animal Tissue.

2.0 KEEPING A STEM PROJECT LOG

One of the most important aspects of doing a STEM project is documentation. Every test that you conduct should be reproducible and the entries in your notes should be sufficient for someone else to reproduce the tests.



The first thing to do when beginning a STEM fair project is to get the notebook. You will work out your thinking and the development of your problem in the notebook. The scientific notebook is a bound or spiral book with pages that are not removable.

When preparing the notebook there are several things that need to be done.

1. Write your name inside the front cover.

2. Every page in the notebook must be numbered from the start. If the book pages are not already numbered, number every page in order at the upper corner along the outside edge of the pages.

Suggested Table of Contents for a STEM Project Log:

- *ASK - Selecting a Problem*
- *IMAGINE - Background Research and Ideas*
- *PLAN - Initial Solution Design*
- *IMPLEMENT – Log of tests and evaluation of solution*
- *IMPROVE – Reflection and Conclusion*

3. Divide the book into sections and start a table of contents. Successful students typically divide their logbook into at least five sections (see box).

a. In the first section (ASK), begin your quest for ideas by listing the problems that you might investigate, and your thoughts about each. Identify the problem you have chosen and list the possible constraints to your design.

b. Next, make a section of the notebook for research on the problem (IMAGINE). List the resources you examine and important facts that you find.

c. The next section contains the solution design(PLAN) and should include plenty of models and sketches of your possible design. Don't forget to include your math in the design – we want to see your measurements!

d. The next section is the daily log where daily activities related to the STEM project are recorded(IMPLEMENT). Your tests should be recorded neatly and data tables and graphs should be utilized.

e. After the tests are recorded, complete the last section(IMPROVE), starting with your reflection on the results. You will finish with a section on your final conclusion and thoughts about redesign. Did your solution work as intended? What can you do to change the design to improve? Why?

4. When making a new entry, begin on a new page. Date each page as you use it.

3.0 RESEARCHING THE PROBLEM AND CONSTRAINTS

You have decided upon a problem and are thinking, "Where do I begin?".

Students should start asking questions to help understand the problem better, what the constraints may be, and to help develop the solution.

Students should visit the sponsor's website with help from an adult, to understand what they do and how the problem impacts them or the community. Students should also identify constraints within the selected problem. Constraints are limitations on the design. Typically the limitations include limitations with measurements, or materials that can or cannot be used.

4.0 GATHERING INFORMATION AND BRAINSTORMING IDEAS

Scientists and engineers rely on research to help them develop solutions that are likely to work as designed or intended. They also apply empathy in the design process to ensure they are creating a solution that is safe and usable by the individuals that need it.

The best place to begin is the media center, the online research library, or in a collaboration with your teacher or teammates.

The Internet is also a valuable tool for students doing research. Have an adult help you check for important facts online. Remember, when conducting research on the Internet, make sure that you use reliable sources to find your data.

5.0 DESIGNING A SOLUTION

Once you have completed enough research and you have a good understanding of the problem, you can start to imagine possible solutions to the problem.

First, sketch a real world design of your ideas to show what your solution would look like if you had no barriers in creating it. You should include all sketches in your STEM project log and date each entry. Next, identify available materials you could use to construct a possible prototype/testable model to use in testing your solution. Finally, you should draw your finalized design, labeling the materials, the dimensions, and the function of each part. Consider drawing it to scale to provide a good representation of the real design.

You should list all of the materials you will need to make the prototype/testable model.

After you have designed your possible prototype/testable model, you can start to build. You should have an adult help to supervise the construction/assembly of your prototype/testable model.

Remember, students are **not** allowed to work with the following: Human subjects, Non-Human Vertebrates, Pathogenic (Biological) Agents, Microorganisms, Recombinant DNA, Human or Animal Tissue.

6.0 TESTING AND EVALUATING THE SOLUTION

Scientists and engineers use data that they record/observe from tests to determine if their solution works.

Decide what data you are going to collect from your tests to prove your solution works and create a data table to record the results of your testing. All prototypes/testable models should be tested a **minimum of 3 times** and each test should be recorded in a data table.

Data collected can be qualitative(color, texture) or quantitative(distance, weight, time, size). **Do not forget to use your units of measurement as you collect your data.**

All data should be recorded and dated in the STEM project log. You should also provide a written conclusion of how your designed solution worked, based on the data you collected.

A few tips for conducting your tests:

Keep your STEM project log handy. Design and set up the tables and graphs you expect to use prior to starting your experimentation. Include units where appropriate.

Keep a camera on location. The camera is a useful tool for documenting your project. Have another person take photos of you performing the experiment, and use the camera to record the progress and the results of experimentation.

Observe safety rules. Cover safety issues with your science fair advisor/teacher. Do not use any equipment that is unfamiliar to you; learn to use it before beginning the tests.

Make entries in your STEM project log as you go. Record data, both quantitative and qualitative, in your logbook. Sometimes what appears to be irrelevant or a failure on one day may become important information at a later date.

Enter measurements in your tables. As you proceed with your project, make certain you include the units for any numbers you record.

7.0 REFLECT ON RESULTS AND REDESIGN

Scientists and engineers rarely solve problems the first time they try. They typically go through a redesign process that involves thinking about their observations and data to improve their idea.

Ask yourself these questions:

1. What were the constraints of your design?
2. What went wrong? What went right?
3. How might you improve your design in future studies?

After you have completed the trials of your prototype testing, now is the time to look at the results of your tests and the analysis of your findings.

- Did you collect enough data?
- Do you need to collect more data?
- Do your results seem reasonable?
- Are there any trends in your data?
- What might explain these trends?
- Do you need to do more experimentation?

Ask and answer as many questions about the project as you can. This will help to direct your thoughts and help you to decide on your redesign.

Remember one very important thing - keep an open mind about your findings. ***Never change or alter your results to coincide with what you think is accurate or with a suggested idea.*** Sometimes the greatest knowledge is discovered through so-called mistakes.

8.0 PREPARING YOUR BOARD AND VISUAL DISPLAY

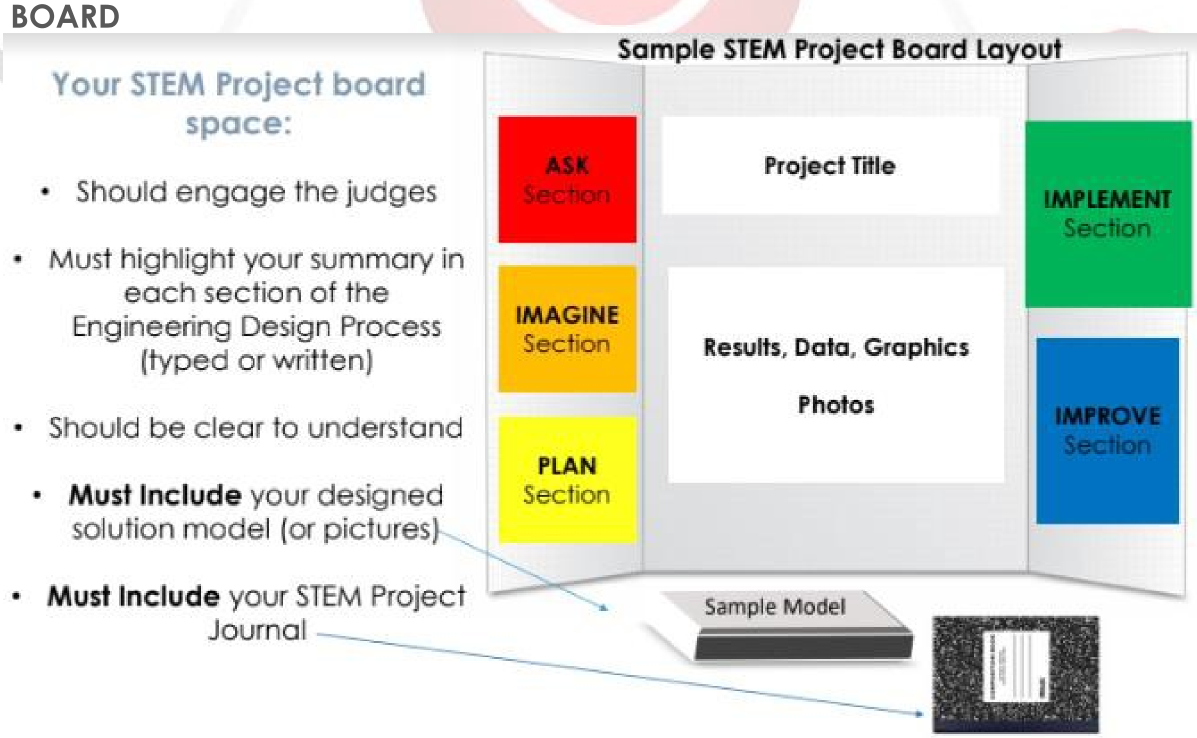
The visual display on the board is meant to attract attention and provide information. Your visual display should challenge onlookers to want to know more about your project. Photographs, graphics, and tables, along with the written text should be included. A well-thought-out and interesting title can also attract attention.

You should take pride in the assembly of the board and it should reflect your work as you want it represented. Neatness, completeness, and clarity are very important. The board and visual display should help you to present your project logically and serve as a prop for you to illustrate what you have done.

Your project title and section headings on your board should be large enough to be easily read from six feet away. The regular text displayed on your board should be readable from a distance of three feet.

Correctly and clearly label graphs, diagrams, and tables. Make certain that the graphs are titled and have both axes labeled clearly and accurately. Use photographs to validate and help explain parts of the project that would be difficult to explain, or that would require time to explain. You must obtain informed consents from any people you show in the photographs. Decide if photographs of this type would be better placed in your notebook or a photo album rather than on your board. Also, you must have permission to use pictures from books or other sources.

SAMPLE BOARD



9.0 ORAL PRESENTATION

Be ready to explain your project to another person — possibly a student, a parent, a teacher, or a judge. A description of each part of the project — from how the idea originated, through the research, the formation of the solution, the tests you conducted, the results, conclusions, and redesign — is important to relay to the listener.

Below are some key points to a good presentation.

- Be positive and confident of your work. You have worked hard and know your project better than anyone else. Now present!

- Practicing ahead of time in front of a mirror, family members, friends, your class, or others is very important. Sometimes practicing in front of a video camera can be helpful. While watching the video you may notice habits or ways of presenting that you wish to change.

- Try not to read from a script.

- Look interested in what you are doing. The judges or other interested people want to know what you have done and what you have learned.

- Dress appropriately and neatly. Wear comfortable shoes. Remember, you are representing yourself, your family, and your school at all times.

- Keep eye contact with your listeners during your presentation.

- Use your board/poster as a prop and tool to help you present you work.

- Present your work enthusiastically. Make certain you guide the listener or judge through your project. Have notebooks and reports in clear view and refer to them in your presentation so that the listener or judge will be cognizant of the amount of time, work, and effort you have invested in your project.

Gwinnet Regional Science and Engineering Fair ES <u>STEM Project Evaluation Form</u>

Adapted from Georgia Science & Engineering Fair Scoring Sheet

Teachers and students should consider these new judging criteria when planning 2020 science projects and school-level fairs. They are based on the Intel ISEF and Georgia Science and Engineering Fair criteria. ISEF and GSEF offer a second set of criteria that may be applied to projects in engineering, mathematics and computer science, where appropriate.

Judging Categories	Maximum Points	K-5 STEM Projects
ASK - Research Question or Problem	10	• description of the problem to be solved and why it was chosen by student(s) • identification and explanation of constraints
IMAGINE - Design and Methodology	15	• identification of ideas and information that helped to design a solution • identification of a possible solution • development/engineering of a prototype/model
PLAN – IMPLEMENT Execution of Project	20	• prototype/model demonstrates intended design for the problem selected • prototype/model has been tested in multiple conditions/trials and results recorded • sufficient data has been collected from trials
IMPROVE - Reflection	15	• Evidence of reflection on the results • Identification of possible improvements that can be made on redesign
Creativity	15	• project demonstrates significant creativity/originality/inventiveness in one or more of the above criteria
Presentation	25	• poster is organized, easy to follow, and includes visual details (pictures, graphs, drawings) • STEM project log is used and present at time of judging • clear, concise, thoughtful responses to questions • understanding of basic science and math relevant to project • understanding of results and possible improvements • for team projects, contributions to and understanding of project by all members
TOTAL	100	

TRADITIONAL SCIENCE PROJECTS (not eligible for Gwinnett County Science Fair)

Experimental Projects require a testable hypothesis, documentation of how the hypothesis was tested, and the conclusions.

Demonstration / Model Projects demonstrate a scientifically interesting phenomenon or a technology.

All projects should include:

- Title (as a header at the top of the display board)
- Hypothesis (experiment) or what is being shown and why (demo / model)
- Procedures / Methods (experiment) or Preparation / Build (demo / model)
- Results (experiment)
- Conclusions
- Equipment or material used
- The notebook used to record results (experiment)
- Any charts, graphs, tables, notes, photos or other visual aids that support your project
- Copy of entry form

2020 Simpson Elementary Science Fair Judging Form (Experiment Display)

Name of Judge:____

Student Number: ____________ Grade: __________ Initials:_________________

Title of Project:____

	No Evidence	Evident but Incomplete	Evident & Complete	Superior Example
1. Presented a testable question that could be answered with an experiment.	0	1	2	3
2. Proposed a hypothesis that gives a testable answer to the question.	0	1	2	3
3. Correctly identified one independent / manipulated variable and one dependent / responding variable.	0	1	2	3
4. Evidence of grade-level appropriate background research.	0	1	2	3
5. Procedures are described in sufficient detail to allow replication by another person.	0	1	2	3
6. Evidence of a thorough experiment with proper controls (i.e. photos, diagrams, data tables)	0	1	2	3
7. Appropriate tools/equipment were used to collect data.	0	1	2	3
8. Data presented is relevant to the question.	0	1	2	3
9. Data is displayed in an age-appropriate table and graph.	0	1	2	3
10. The data was used to answer the question or to evaluate the hypothesis.	0	1	2	3
11. The conclusion was supported with experimental evidence. (No penalty for inconclusive data)	0	1	2	3
12. The project is presented in a manner that makes the purpose, procedure, and results clear.	0	1	2	3
13. Included age-appropriate visual components to provide a detailed description of the project.	0	1	2	3
Count				
Multipliers		x1	x2	x3
Subtotal				
DISPLAY SCORE	/ 39			

2020 Simpson Elementary Science Fair Judging Form (Model/Demonstration Display)

Name of Judge: ____

Student Number: ________________ Grade: ___________ Initials:__________________

Title of Project: ____

____

	No Evidence	Adequate	Good	Outstanding
Original Topic or Approach	0	1	2	3
Clear & Specific Title	0	1	2	3
Age-Appropriate Background Research	0	1	2	3
Explanation of the Demonstration (Step-by-Step)	0	1	2	3
Explanation of the Scientific Importance of the Demonstration	0	1	2	3
Appropriate Materials & Construction	0	1	2	3
Documentation of Build Process or Materials	0	1	2	3
Creativity	0	1	2	3
Organization/Aesthetics	0	1	2	3
Count				
Multipliers		x1	x2	x3
Subtotal				
DISPLAY SCORE	/ 27			