THOMAS EDISON ENERGYSMART CHARTER SCHOOL

TEECS Science and Engineering Innovations Fair

HANDBOOK 2017-18.

Student's Name _____

Parent's Name_____

I have read this booklet with my child and will consult it during the innovations fair process.

Parent's Signature_____Date_____

The students will be bringing this signed paper and Safety Contract back to class by March 12, 2018.

Why participate in the science and engineering innovations fair?

The features of the Next Generation Science Standards include the use of a conceptual framework; clarification statements to explain the level of rigor expected and connect concepts with applications; concrete links between the standards and assessments; and the development of inquiry and design processes to facilitate students in both science and engineering practices.

Scientific practices in the NGSS are the behaviors that scientists engage in as they investigate and build models and theories about the natural world. The NGSS also include engineering practices, which are behaviors that engineers engage in as the apply science and mathematics to design solutions to problems. **Scientific inquiry involves the formulation of a question that can be answered through investigation, while engineering design involves the formulation of a problem that can be solved through design.**

Cross cutting concepts help provide students with a framework for connecting knowledge from the various disciplines. **These concepts are: Patterns, Cause and Effect, Scale, Proportion and Quantity, Systems and System Models, Energy and Matter, Structure and Function, and Stability and Change.** These concepts provide an organizational schema for interrelating knowledge from various scientific fields into a coherent and scientifically-based view of the world.

Engaging in opportunities such as TEECS Science and Engineering Innovations Fair will allow students the chance to plan activities and delve deeply into these types of **thinking.**

Due Dates and Points

	Assignment	Due Date	Points	Weight
1.	Science Booklets 1st page signed	March 16th, 2018	10	HW
2.	Safety Contract form signed	March 16th, 2018	10	HW
3.	Project Ideas signed	March 19th, 2018	10	HW
4.	Teachers return approval one of the project idea.	March 26, 2018		
5.	First draft of Research paper due	April 20, 2018	10	HW
6.	First draft of the research paper graded & returned to students	May 4th, 2018		
7.	Final Research paper due/ Approved students start working on presentations	May 18th, 2018	50	Project
8.	Final Research paper Returned (graded)	May 25th , 2018		
9.	Poster boards due	June 4-5, 2018	10	HW
10.	TEECS science FAIR (includes Participation)- in the GYM	June 11th (3-5) June 12th, (6-9) 2018	10	CW

CATEGORIES :

LIFE SCIENCE	PHYSICAL SCIENCE – PHYSICS/CHEMISTRY	ENVIRONMENTAL SCIENCE
ENGINEERING: ELECTRICAL, MECHANICAL, CHEMICAL	COMPUTER SCIENCE/TECHNOLOGY	EARTH/SPACE SCIENCE
MEDICINE AND HEALTH SCIENCE	MATHEMATICAL SCIENCE	Energy efficiency, Energy conservation, Renewable energy resources, or other topics relating to Sustainable energy

Safety Contract

I, _____, hereby certify that on this day of _____, I have successfully completed a review of safety procedures for a science project. I agree to follow the safety guidelines listed below, and I will take every necessary precaution to operate safely throughout my experiment.

• I will follow the safety guidelines of my teacher and my school.

• I will keep my work area neat and free of unnecessary papers, books, and materials. I will keep my clothing and hair neat and out of the way, and I will wear a safety apron and/or gloves if necessary.

• I know the location of all safety equipment (such as the fire extinguisher and first-aid kit) and the nearest telephone.

• I will wear safety goggles when handling chemicals, working with a flame, or performing any other activity that may cause harm to my eyes.

• I will not use chemicals, heat, electricity, or sharp objects until my teacher or parent instructs me to do so, and I will follow the adult's instructions carefully.

• I will be especially careful when using glassware. Before heating glassware, I will make sure that it is made of heat-resistant material, and I will never use cracked or chipped glassware.

• I will wash my hands immediately after handling hazardous materials.

I will clean up all work areas before I leave the laboratory, put away all equipment and supplies, and turn off all water faucets, gas outlets, burners, and electric hot plates.

I understand and agree to the above and all other safety precautions presented to me in class. I am hereby ready to undertake my science project with safety from this day forward.

Student name (printed) _____

Student's signature _____

Parent's/guardian's signature _____

Project Ideas(Testable Investigation, New Innovation or Improvising Existing Innovation)

First Choice

1.

Second Choice

2.

Research Paper

Provided below is a checklist of each section of the research paper that has to be included. Please use each section provided on the checklist as the headings for your research paper.

1. Title Page (with title, your name, grade and subject)

2. Table of Contents

3.Introduction

3. Project Idea/Problem (in form of question)

4. Gathering

a. Materials (list of materials you will be using)
b. Planning (your planning to carry out experiment or build a prototype)
c. Experiment/investigate or design and testing (steps you followed to experiment or test)
d. Collect and enter the data in data table

5. Reasoning

a. Data Analysis: Analyze the data gathered and represent using various graphic displays.

6. Communication

a. Conclusion: Write a conclusion for the testable question (your project idea) you investigate or the innovation that you designed.
b. Communicate: Present the project to class/teacher/judges using the display board.

7. Bibliography

TEECS Science and Engineering Innovations Fair

Parent Letter

Dear Parents,

As you know, science, technology and engineering are basic skills expected by employers. As twenty-first century citizens, these students will also have to make some of the toughest decisions of any generation, based on their understanding of emerging science and technology.

Innovations fair involve students in the practices of science and engineering, requiring them to apply those skills to a topic of interest to them. Doing science is key to understanding science.

TEECS is holding the Science and Engineering Innovations Fair for the year of 2017-18 to all students from grades 3- 5. Hands-on scientific investigation and innovation is the focus of our fair. Over an eight-week period, your child will design, test, analyze, and present a project. **Students can choose to either work alone or with a partner from the same class and grade level.**

Please note that the bulk of the work will be done at home. Students will be given project guidelines and timelines at school, and teachers will check in with them periodically. ELA teachers will guide them to write the research paper using the APA format. However, much of the work will be self-directed. Parents are encouraged to offer emotional support and reminders but to allow children to do the projects by themselves. No ready made models will be accepted , you may however buy parts to use in your project.

for valuable information. Don't hesitate to call or email with any questions to your child's r Science teachers. Thank you very much in advance for your support!

Sincerely,

Science and ELA Department

Choosing a Project Idea

Students will choose to either do an investigation for testable questions, or come up with new innovation or improvise an existing innovation in the field of science and engineering.

The most important part of choosing a topic is picking one you're interested in. You can use books, online resources, watch news, ask why questions or interview people or look around objects around you to come up with a topic. Ideas for a science or engineering project can come from anywhere, so for one day, think about your surroundings and come up with questions. How does the bus lower to let people on? Could that mechanism be used somewhere else? Why does a piece of rubbish decompose in a particular way? Here are some questions to help you interview: 1. What do you wish was better in your community? Why? 2. If you could make one thing better in the world – anything – what would it be? 3. If you could ask one question to anyone about anything, what would it be and why? 4. What do you think I am good at (e.g., math, singing, making conversation with customers at work, analysis)?

Some online resources are:

http://school.discoveryeducation.com/sciencefaircentral
https://www.education.com/science-fair/fifth-grade/
https://mynasadata.larc.nasa.gov/science_projects/
https://www.sciencebuddies.org/science-fair-projects/project-ideas/third-grade
http://www.hookedonscience.org/nextgenerationsciencestandards.html
http://www.sciencebuddies.org/
http://www.virtualsciencefair.com/
www.arborsci.com
www.makershed.com
www.harmonyphysics.com
www.populationeducation.org

These websites can be useful for generating IDEAS. Please note, however, that you may not simply copy a procedure from the website. If you use one of these websites for a project idea, you must come up with ways to modify the project to make it unique. Remember, you need to know WHY you're doing what you're doing. If you don't understand the WHY of an experimental step, you need to do more research!

Safety:
Are the tools and other materials safe for you to use? Will an adult be available to help with anything that might not be safe for you to do alone? Are any of the materials ones that someone could be allergic to?

- The use of construction tools or potentially harmful chemicals will require adult supervision.
- Locate the nearest sink or fire extinguisher as a safety precaution.
- Determine how to dispose of materials. For example, some chemicals should not be mixed together or put down a sink drain.
- Wear protective clothing such as goggles and gloves. Tie back loose hair so that it does not get caught on any of the equipment.

Animal care:
If you are going to do anything with animals, will they be kept safe? Will you be putting anyone in danger who is allergic to the animals?

Investigation

To learn how scientists discover things, students will conduct a hands-on investigative experiment. While scientists study a whole area of science, each experiment is focused on learning just one thing at a time. This is essential if the results are to be trusted by the entire science community.

What is a Testable Question?

The key to a good and manageable investigation is to choose a topic of interest, then ask what is called a "testable question." Testable questions are those that can be answered through hands-on investigation by the student. The key difference between a general interest science question and a testable question is that testable questions are always about changing one thing to see what the effect is on another thing.

Here are some examples of broader science questions and testable questions:

Broad Questions (lead to science reports)

How do plants grow?
What makes something sink or float?
How do rockets work?
How does the sun heat up water?
What happens when something freezes?
What makes cars move?

Testable questions (lead to investigations)

What amount of water is best to grow tomatoes? or What type of soil is best to grow petunias? or What amount of sunlight is best to grow daffodils?

How well do different materials sink or float in water? How does changing the shape of a rocket's fins change its flight? Does the sun heat salt water and fresh water at the same rate?

Do different liquids freeze at the same rate? How does the surface on which a car moves affect how fast it goes?

Conduct Background Research

Once students have a testable question, it is important to do some background research. What do scientists think they already know about the topic? What are the processes involved and how do they work? Background research can be gathered first hand from primary sources such as interviews with a teacher, scientist at a local university, or other person with specialized knowledge. Or students can use secondary sources such as books, magazines, journals, newspapers, online documents, or literature from non-profit organizations. Don't forget to make a record of any resource used so that credit can be given in a bibliography.

Background research:

- helps students gain in-depth knowledge about the topic and processes they will be observing during the investigation.
- sparks ideas about different variables to test when setting up the investigation.
- provides the basis for predicting what will happen in the investigation when making a hypothesis.
- provides the understanding needed to interpret and explain the results to others – especially a science fair judge!

Citing All Your Sources:
Your sources may include books, magazines, newspapers, Websites, television programs, videos, or even interviews with live people. You will need to include all of these sources in the bibliography for your research paper. Your science project journal is the perfect place to keep track of this information.

How to Cite a Reference:
In your science project journal, record the title, author, publisher, and copyright date of each source that you use. If you perform an interview, record who you spoke to, what you

discussed, and when and where the interview took place. You can keep all this information organized by devoting a few journal pages to your notes on information sources. Grades 6-8 your ELA teachers will guide you to write a APA format research paper.

Design Experiment

Once students formulate a hypothesis for their investigation, they must design a procedure to test it. A well-designed investigation contains procedures that take into account all of the factors that could impact the results of the investigation. These factors are called variables.

There are three types of variables to consider when designing the investigation procedure.

- The independent variable is the one variable the investigator chooses to change.
- Controlled variables are conditions that are kept the same each time.
- The dependent variable is the variable that changes as a result of /or in response to the independent variable. It is measured or observed to see if it changes when the independent variable changes.

Having students talk through the investigation will help them to clarify the different variables involved in the experimental design. What factors will change? What factors will stay the same? What factors will be measured or observed for changes?

A hands-on way to introduce a fair test is to ask students, "Who can make the best paper airplane?" Once two students are selected to compete, hand one a large piece of construction paper and the other a piece of regular copy paper. Students will immediately note that this is "unfair." If we want the test to be fair, only the paper airplane design can be different. Everything else, including how hard the airplane is tossed, must be the same.

Set Up and Collect Data

After designing the procedure and gathering the materials, it is time to set up and to carry out the investigation. When setting up the investigation, students will need to consider...

Choose a low traffic area to reduce the risk of someone accidentally tampering with the investigation results—especially if the investigation lasts for several weeks.

Avoid harmful accidents by using safe practices.

Making a rough sketch or recording notes of the investigation set up is helpful if the experiment is to be repeated in the future.

Carrying out the investigation involves data collection. There are two types of data that may be collected—quantitative data and qualitative data. Students should collect both types of data.

Quantitative Data

1.Uses numbers to describe the amount of something.

2.Involves tools such as rulers, timers, graduated cylinders, etc.
3.Uses standard metric units (For instance, meters and centimeters for length, grams for mass, and degrees Celsius for volume.

Qualitative Data

As data is collected it can be organized into lists and tables. Organizing data will be helpful for identifying relationships later when making an analysis. Encourage students to make use of technology such as spreadsheets to organize their data.

- Uses words to describe the data
- Describes physical properties such as how something looks, feels, smells, tastes, or sounds.

Analyze Data and Draw Conclusions

After students have collected their data the next step is to analyze it. The goal of data analysis is to determine if there is a relationship between the independent and dependent variables. In student terms, this is called "looking for patterns in the data." Did the change I made have an effect that can be measured?

Besides analyzing data on tables or charts, graphs can be used to make a picture of the data. Graphing the data can often help make those relationships and trends easier to see. Graphs are called "pictures of data." The important thing is that appropriate graphs are selected for the type of data. For example, bar graphs, pictographs, or circle graphs should be used to represent categorical data (sometimes called "side by side" data). Line plots are used to show numerical data. Line graphs should be used to show how data changes over time. Graphs can be drawn by hand using graph paper or generated on the computer from spreadsheets for students who are technically able.

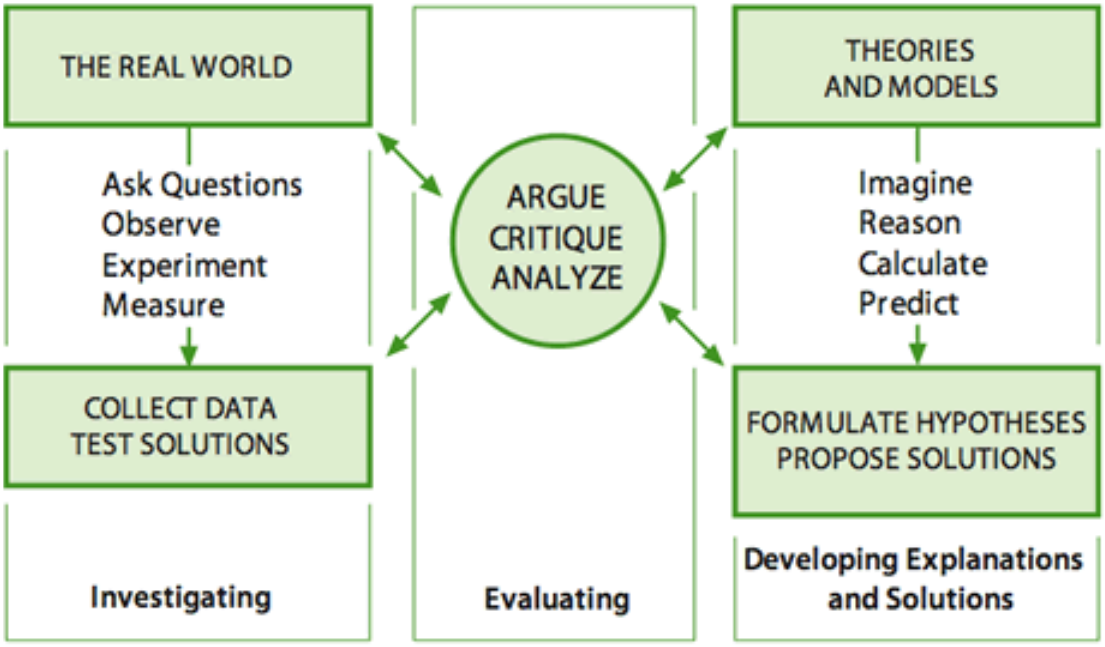
Display Board

Your display can reflect your personality:
Is the presentation the part of the science fair I've been waiting for, or is that the part I dread?

Stand Out from the Crowd

Whether they're the kind of person who loves to design and decorate and dabble with computer graphics, or the one who always opts for the standard black-and-white report cover, this is a time for students to get creative. Edit the text down to the essentials, pick and choose the best photos and graphics, and display them all in the most clear and compelling way possible. Through creative use of color, type and graphic elements, students can make their ideas pop and bring their projects to life.
Please refer to the following websites to see the layout of some display boards:

http://school.discoveryeducation.com/sciencefaircentral/
http://www.sciencebuddies.com/science-fair-projects/project_display_board.shtml



- Instead of the purpose have your testable question.
- Your results can refer to your data and analysis.
- You MUST have graphs or tables on your board.
- You don't need to follow this order exactly but it must be organized and easy to read.
- No live animals allowed.
- When in doubt ASK YOUR TEACHER!

Oral presentation for your classmates

The student will present their project to the rest of the class in order to practice talking to judges. **The presentation should be 3-5 minutes long,** briefly covering most of the parts of the project. This will be done few days before the science fair and you will use one of the visual aid or in combination to communicate.

This project is considered as your 4th marking period project.