2018
Hopewell Elementary School
Science Fair
Student Guide

Oxford Area School District

Name: _____

Homeroom Teacher: _____

Due Date: Friday, January 26, 2019

** Projects will be displayed in the hallways of the school during the night of the STEM Fair on Wednesday, January 30, 2019.

Selecting A Problem to Investigate

Select a problem that interests you! Make it something that you would actually enjoy researching and solving! Below are some sites to consider when figuring out THE MOST IMPORTANT PART OF YOUR PROJECT!

Science Fair Central www.sciencefaircentral.com

Science Buddies www.sciencebuddies.org

Education.com www.education.com/science-fair/

The 3 Areas of Science... Which one interests you more?

Physical Science: Do you find yourself wondering why or how things work? If so then you might want to choose Physical Science for your category.

Topic examples may include things about matter, electricity, magnetism, sound, light, or energy.

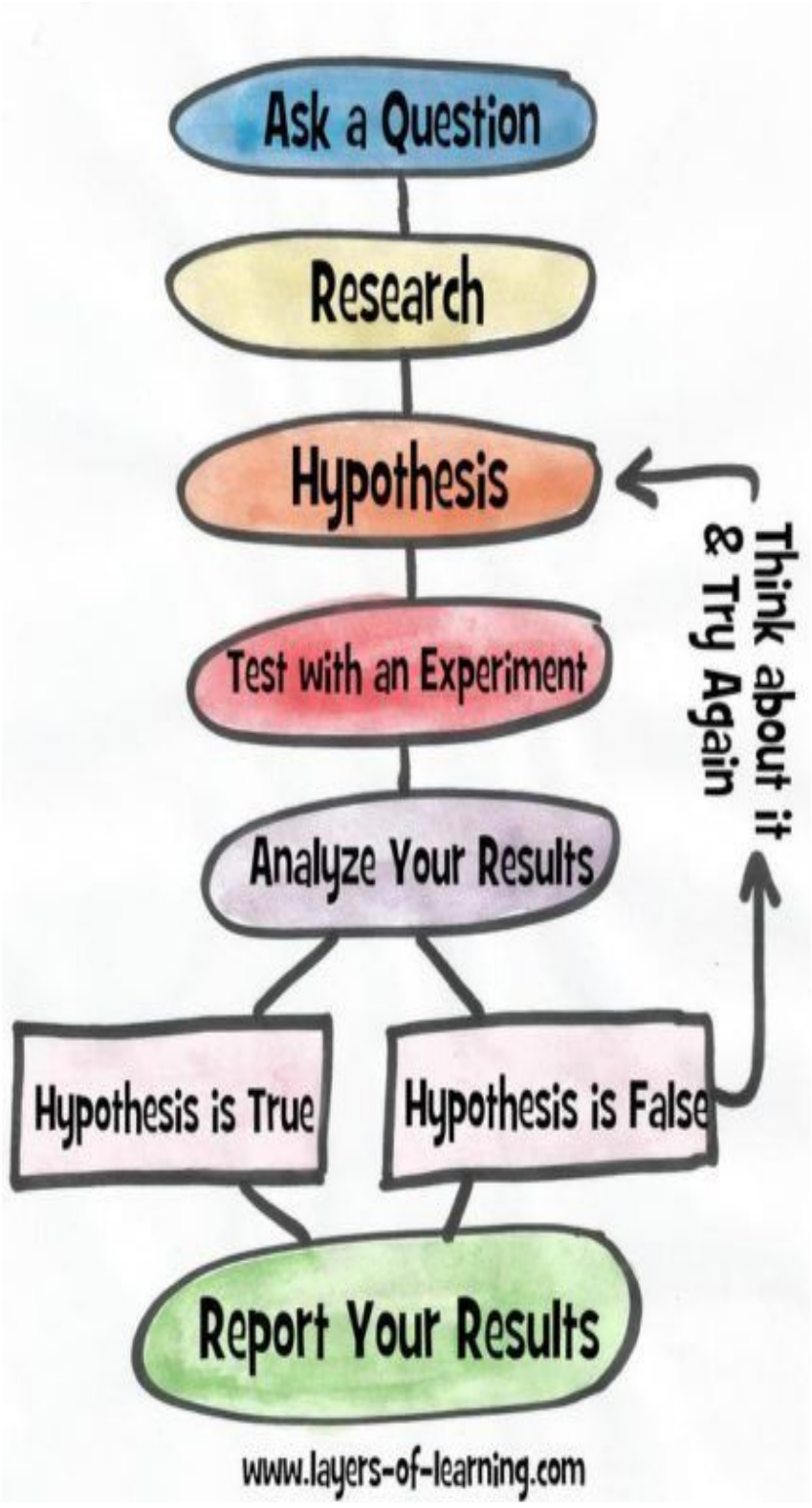
Earth and Space Science: Do you find yourself curious about our Earth or outer space? If so then this may be the category for you.

Topic examples may include things about weather, geology (things that make up the Earth such as rocks, fossils or volcanoes), or our Sun, stars and planets. Just a reminder, a model is not an experiment, so be careful when thinking about your investigation.

Life Science: Do you like plants, animals or are curious about why humans behave certain ways? If so then Life Science may be the category your investigation could fall under.

(There are special rules anytime you work with animals. Please talk to your teacher to ensure you are following any rules concerning animal care and projects involving animals.)

The Scientific Method



About the Scientific Method

The scientific method is a process that scientists, engineers and many other people in lots of different careers use to help them solve problems!

<u>Purpose of the Scientific Method</u>
The scientific method is used to understand how something works or why something does what it does.

Let's say that you are having an issue with drafty windows in your home. You notice that there is always a little bit of air flow from the top of the sliding window around the locks.

You might do some research on air flow and drafts in a home and develop an experiment to test different weather seals for windows to see which prevents the most air from flowing through cracks around the top of your window pane.

Sometimes the experiment doesn't go as planned and you need to rethink how you can test the products you've chosen.

Understanding the results from an experiment like this allows people to understand why something is happening and the steps they can take to solving the problem.

Researching your Problem or Investigation

The first step in solving your problem or investigation topic is researching information about it. Below is a list of valuable sources to consider when you research your topic:

Sources of Valuable Information

- **INTERNET SITES -** education (.edu), government (.gov), or reputable educational or scientific websites like Time Magazine, Popular Science, or an organization that specializes in the topic you are researching.
- **PRINTED PUBLICATIONS -** books, magazines, newspapers or journals. Just make sure they are reputable.
- **PEOPLE IN THE INDUSTRY -** interviews with people who work in a career that relates to your investigation topic or problem.

Keeping a Scientific Journal

You are responsible for keeping a scientific journal to document what you have learned from your research and throughout your project. There are no guidelines for your journal except that it should include information that you found while researching and thought was important to document. Your journal can be an interactive notebook, a binder, or a folder where you keep your work. You can include pages you printed off to read, articles you found, pictures you've drawn, notes you made, or anything that you've collected or written down about your topic or problem.

Whenever scientists and engineers conduct research, they have to document the things that they learn - they can't just "retell" what they learned like retelling a story from memory - it needs to be written down so that when people view your project, they can look through your journal to understand the thinking you put into the project.

YOU WILL TURN IN THE JOURNAL WHEN YOU TURN IN YOUR PROJECT!

Creating a Hypothesis

After gathering background research, the next step is to formulate a hypothesis. More than a random guess, a hypothesis is statement that explains what you expect to happen from your experiment.

Example of a Hypothesis/Prediction

IF ice is placed in a styrofoam container, **THEN** it will take longer to melt than if placed in a plastic or glass container. I think this is true because my research shows that a lot of people purchase styrofoam coolers to keep drinks cool.

A hypothesis should contain an **"IF, THEN Statement"**. What this means is… IF you change something in your experiment, THEN something will happen because of that change.

Other Examples of Hypotheses and Predictions

Question	Hypothesis	Prediction
How does the size of a dog affect how much food it eats?	Larger animals of the same species expend more energy than smaller animals of the same type. To get the energy their bodies need, the larger animals eat more food.	If I let a 70-pound dog and a 30-pound dog eat as much food as they want, then the 70-pound dog will eat more than the 30-pound dog.

Question	Hypothesis	Prediction
Does fertilizer make a plant grow bigger?	Plants need many types of nutrients to grow. Fertilizer adds those nutrients to the soil, thus allowing plants to grow more.	If I add fertilizer to the soil of some tomato seedlings, but not others, then the seedlings that got fertilizer will grow taller and have more leaves than the non-fertilized ones.
Does an electric motor turn faster if you increase the current?	Electric motors work because they have electromagnets inside them, which push/pull on permanent magnets and make the motor spin. As more current flows through the motor's electromagnet, the strength of the magnetic field increases, thus turning the motor faster.	If I increase the current supplied to an electric motor, then the RPMs (revolutions per minute) of the motor will increase.
Is a classroom noisier when the teacher leaves the room?	Teachers have rules about when to talk in the classroom. If they leave the classroom, the students feel free to break the rules and talk more, making the room nosier.	If I measure the noise level in a classroom when a teacher is in it and when she leaves the room, then I will see that the noise level is higher when my teacher is not in my classroom.

Designing An Experiment

Once you make your hypothesis, it is time to design an experiment to test it. A well-designed experiment contains procedures that include **variables**.

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

- The **independent variable** is the variable the investigator chooses to change.
- **Controlled variables** are variables that are kept the same each time.
- The **dependent variable** is the variable that changes as a result of the independent variable.

Step A - Clarify Variables

Clarify the variables involved in the investigation by developing a table such as the one below.

EXAMPLE

Testable Question	What detergent removes stains the best from a t-shirt?
What is changed? (independent variable)	In this experiment, the **independent variable** is the type of detergent because you are changing which detergent you are testing each time so that you can determine which detergent works best.
What stays the same? (controlled variables)	The **controlled variables** in this experiment are the tshirt that you are washing with the different detergents (you have to use the same exact type of shirt for each test) and also the stains on the shirt that you are trying to wash out (you can't stain one shirt with grass and another with dirt - that's inconsistent).

Results (dependent variable)	The dependent variable in this experiment is the amount of the stain that comes out of the t-shirt after washing with each kind of detergent.

Step B - List Materials

Make a list of materials that will be used in the investigation.

Step C - List Steps

List the steps needed to carry out the investigation.

Step D - Estimate Time

Estimate the time it will take to complete the investigation. Will the data be gathered in one sitting or over the course of several weeks?

Step E - Check Your Work

Check the work. Ask someone else to read the procedure to make sure the steps are clear. Are there any steps missing? Double check the materials list to be sure all to the necessary materials are included.

Graphing the Data

After you record the results in your scientific journal, you need to display them in a way that makes sense to you and others who are reviewing the data from your experiment or prototype trials.

Helpful Websites:

https://nces.ed.gov/nceskids/createagraph/

https://www.mathsisfun.com/data/data-graph.php

Creating A Graph

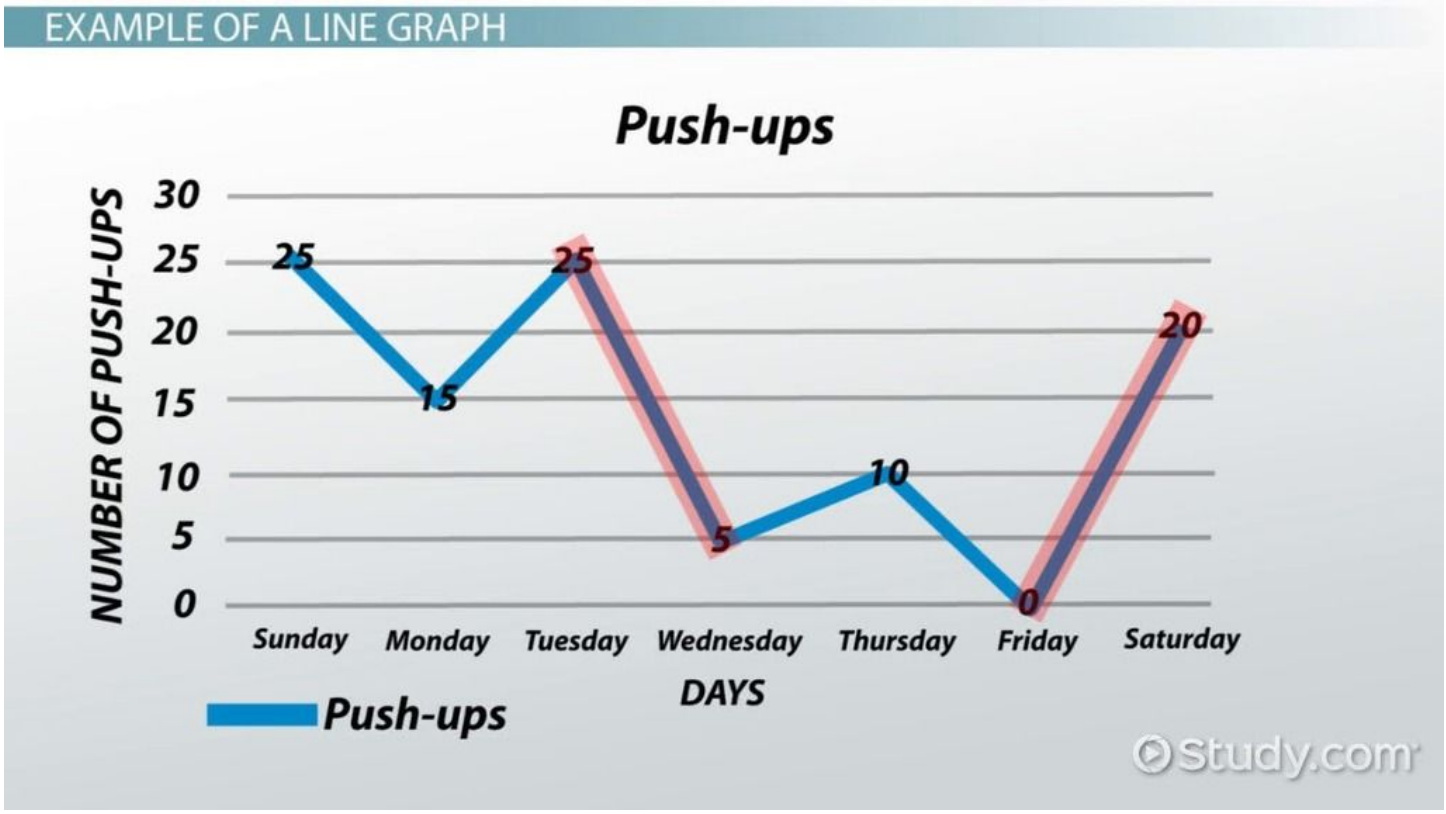
All graphs need the following items:

- Title
- Labeled Axiis (a label on the X-axis and Y-axis)
- A scale (always on the Y-axis and on the X-axis if necessary)
- Data

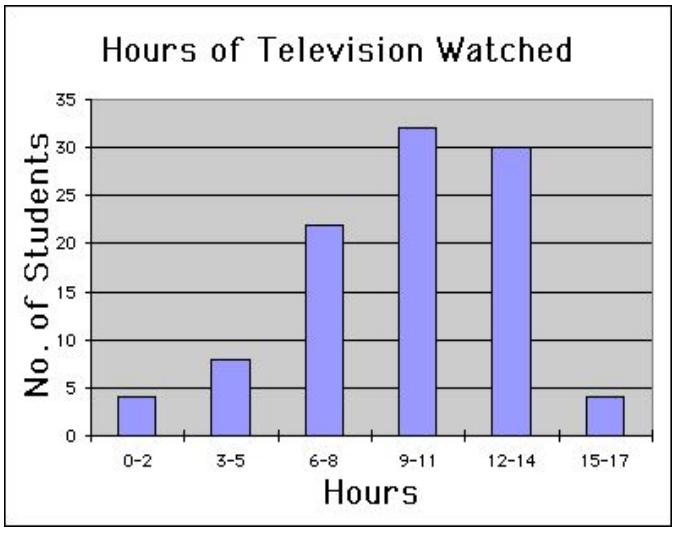
Choose the graph that best fits your data. Here are some common graphs…

- **Bar Graph** - Use this graph if your project is showing comparisons between two or more things.
- **Line Graph** - Use this graph if your project is showing how something changes over time. Line graphs can compare things, but its best to use one when time is involved.
- **Pie Chart** - Use this graph if you want to show comparisons among a group, like asking 30 people which ice cream flavor is their favorite. Pie charts are mainly used to show the categories/choices (vanilla, chocolate, strawberry, etc) as a percentage out of 100%.
- **Scatter Plot** - Use this graph if you want to show a relationship between two things. A scatter plot would be a good graph to use if you were comparing your arm length to the size of your foot. It helps to show what's normal and what's not, like a line of reference

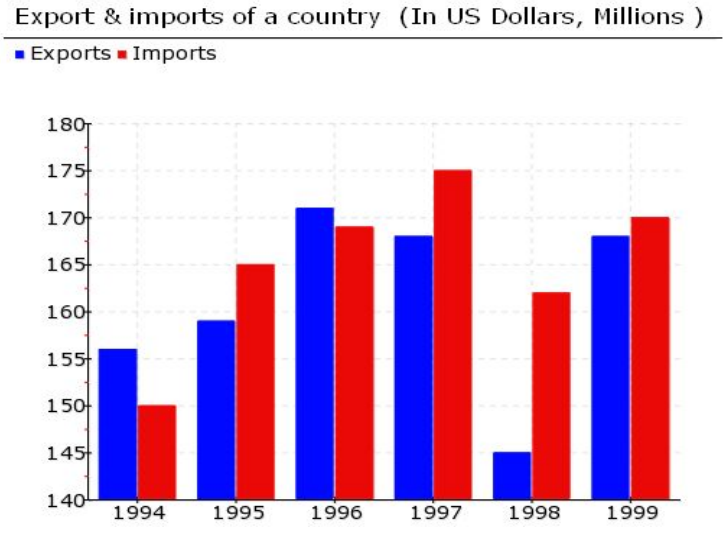
Graphing Examples



BAR GRAPH



DOUBLE BAR GRAPH



Presentation Board

Investigation Question

Title of Project Name (First and Last)

Results of the Experiment

Background Research

Include only a brief paragraph or bullet points.

Testing of Experiment

Include the following:

- Steps/Procedures of the experiment
- Variables and Controls

Hypothesis

Data from the Experiment

Include any charts, graphs, tables or other data that you used to analyze the results of your experiment.

Conclusion & What you learned from the investigation

Materials

Make a list of your materials.

HOPEWELL ELEMENTARY SCIENCE FAIR PACING GUIDE

***** This is your pacing guide for the project. All of these sheets will be graded and will be part of the final grade for your project. *****

PROJECT DUE at SCHOOL on: FRIDAY, January 26, 2019

ASPECT OF PROJECT Student Work Journal Pages	DUE DATE Due Dates are set by your teacher!
My Science Fair Project Topic (Pages 2 - 3)	
Research Annotations (Pages 4-5)	
Stating Your Hypothesis (Page 6)	
My Experiment Information (Pages 7-8)	
Results & Observations (Page 9)	
Graphing Your Results (Page 10)	
Communicating Your Results (Pages 11-12)	
Science Project Poster and Presentation Materials	Friday, January 26, 2019

Hopewell Elementary STEM Fair Grading Rubric

for SCIENTIFIC METHOD PROJECTS

Scoring Section	1	2	3	4
Question or Problem	• Incomplete question or question is not well suited for scientific investigation. • Research subject is virtually untestable.	• Identified a complete question in a suitable subject area. • Familiar research subject.	• Clearly testable scientific question in a suitable subject. • Interesting research subject.	• Clear scientific question with a specific purpose that could be investigated using the scientific method. • Unique research subject.
Hypothesis	• Has a hypothesis but does not apply to the research question or has no hypothesis.	• Has a hypothesis that answers the research question, but no explanation as to why that prediction was made.	• Has a hypothesis that answers the research and includes an explanation of why that prediction was made.	• Has a well-constructed and thorough hypothesis which answers the research question and includes an impressive explanation of why that prediction was made.
Experiment and Testing Procedures	• Experiment procedures and/or materials are not easily followed. • Important steps are missing.	• Materials list is mostly complete. • Little attention to the details of the procedure. or the variables	• Complete procedures and materials list. • Variables and controls are noted within the procedures, but may have some error in planning.	• Complete procedures and materials list, a strong understanding of the project is evident. • Variables and controls are noted within the procedures and planned to accommodate the experiment.
Data	• Data is absent or does not accurately show the results of the experiment or tests. • Data is not presented in graphs, pictures or charts and/or is extremely minimal.	• Data is present, but does not accurately show the results. • Data is unsuccessfully presented in graphs, pictures or charts.	• Data is present and clearly organized. • Data is successfully presented in graphs, pictures or charts and reflects the outcomes of the experiments or tests.	• Data is present and much attention was paid to the organization. • Graphs, pictures and/or charts were well-organized and very clearly reflected the outcomes of the experiments or tests.
Results And Conclusion/What You Learned	• Results presented in a disorganized manner. • Conclusion is not related to the problem or the research question. • Does not reference the hypothesis. • There is little or no personal reflection from the student about what was learned.	• Results are somewhat organized. • Conclusion is related to the problem or research question. • Provides a summary of the findings, but does not tie back to the hypothesis. • The personal reflection is vague and shows a limited understanding of the results.	• Results are organized. • Conclusion is related to the problem or research question. • Provides a good summary of the findings and relates back to the hypothesis. • The personal reflection demonstrates a quality understanding of the results.	• Results are very organized and clear. • Conclusion addresses the problem or research question and is supported by facts and logic. • Provides an excellent summary of the findings and relates back to the hypothesis. • The personal reflection demonstrates a complete and thorough understanding of the results and other implications.

Presentation and Creativity	• Display board was sloppily composed. • Information on the board was absent and/or presented in a disorganized manner. • No originality.	• Display board was somewhat sloppily composed. • All or most of the information on the board was present, but somewhat disorganized. • Very little originality.	• Display board was neatly composed. • All of the information was present and clearly organized. • The display board included some original design and was creative and supported the understanding of the entire project.	• Display board was neatly composed and a great deal of attention was paid to the details. • All of the information was present and well-organized. • The display board was original and creative and supported the understanding of the entire project. It is clear the presenter went far beyond the standard approach to showcase their project.

WEBSITE and GUIDANCE

The Science Fair packets will be online and available to download at:

https://stemathopewell.weebly.com/science-fair

The website will also include website links for support for the project as you work.

If you have any specific questions, please email Mark Neff, STEM Teacher or your child's math/science teacher.

mneff@oxfordasd.org