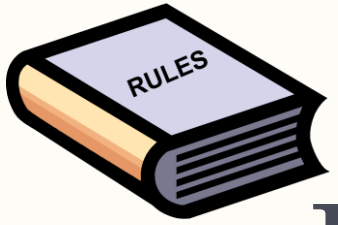
Science Inquiry and Science Showcase Procedures

Projects to Avoid

- **Consumer economics or product testing projects** (i.e. which brand of popcorn pops the most kernels; which paper towel absorbs the most water)
  - Although these qualify as experiments, they are seldom original and are not fair to the companies that make the products.
- **Models, demonstrations or inventions** unless they are used to measure cause-and-effect relationships. Model created to collect data (i.e., which type of bridge structure will support he most weight, which shape of board hull has the least water resistance; etc.) are acceptable and usually quite creative.
- **Human or vertebrate animals**
- **Projects that are dangerous or expensive** (i.e. plants – 30 total)

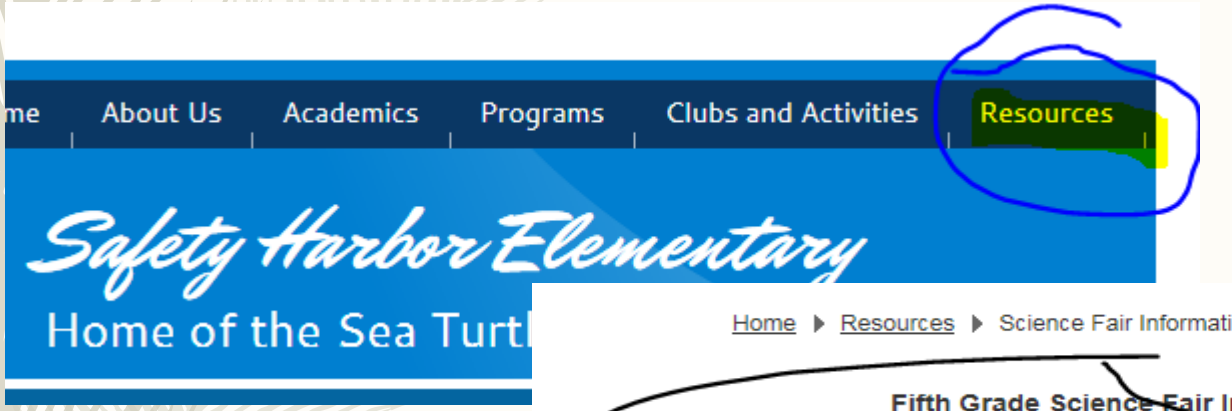


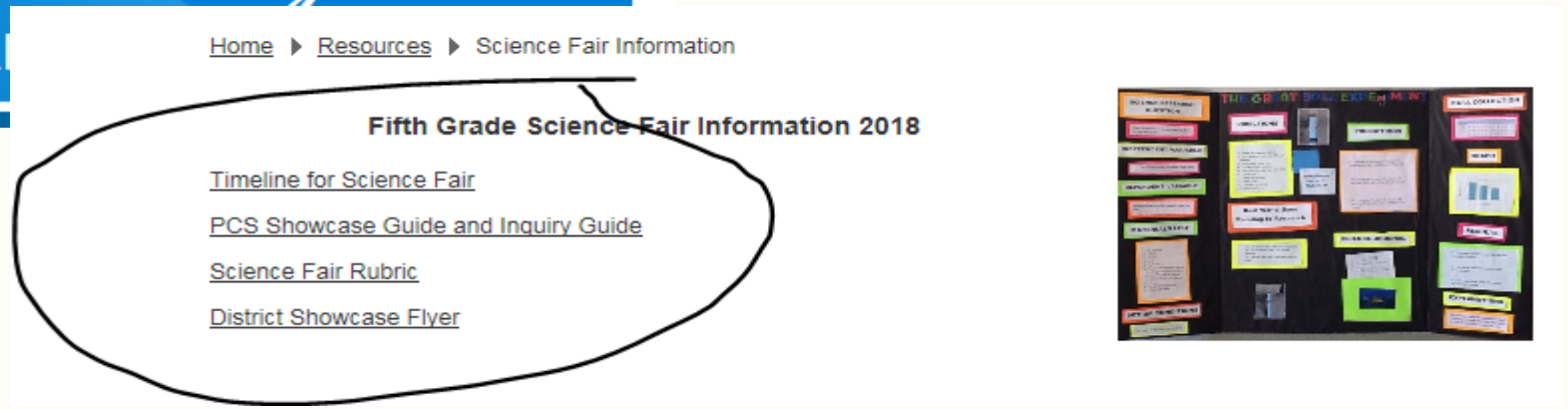
During Experimentation

- All projects must be supervised by an adult
- Use appropriate protective clothing and equipment must be worn or used by anyone when using any potentially harmful materials.
- No humans (students or adults) may be used as subjects of experimentation.
- No living organism is to be harmed in any way (plants excluded).
- No drugs or substances that may be a health hazard.
- Standard household appliances (lights, fans, hair dryers) **may** be used in their original form, without modification, and with adult supervision.
- Heating sources (stoves, hot plates) may be used with adult supervision.
- Projects involving electrical circuits must use standard batteries not to exceed 12 volts DC. All wiring must be properly insulated.
- No explosives of any type (firecrackers, etc.)
- No microbes (mold, mildew, or fungi) may be cultured or used.

Inquiry Tools and Resources

Make sure to check out the SEAMS resources and folders on the Elementary Science eLearn page





Start with a WONDERING…

How much does fertilizer actually help plants?

Why isn't rain salty?

I wonder if magnets work under water.

RESEARCH QUESTION

- A question that has an independent and dependent variable mentioned
- Independent and dependent variables should include measurements or tools being used
- Is the question a “TESTABLE” or “MEASURABLE” question?
- Includes cause and effect (x and y)- (If this happens, then this will happen next)
- Provides ample detail to investigate project (specific, measurable, and understandable)
- The “Pinellas County Science Showcase Fair and Guide” PDF found in the eLearn resources folder has a list of sample questions you can choose from if you don’t want to come up with your own.

Sample Science Investigation Questions

Force and Motion:

- Does the number of coils of wire in an electromagnet affect its magnetic strength?
- Does voltage affect the strength of an electromagnet?
- Does the weight of a permanent magnet affect its strength?
- Does the height of a ramp affect the distance a toy car will roll?
- Does the mass of a car affect the distance it will roll from the bottom of a ramp?
- Does the material that the ramp is made of affect the distance a toy car will roll?
- Does the distance a rubber band is stretched affect how far it will fly when released?
- Does the amount of weight suspended from a rubber band affect how far it stretches?
- Does the weight of a wooden block affect the force that it takes to drag it across a table top?
- Does the height from which a rubber ball is released affect the height that it bounces?
- Does the surface of the ground affect how far a ball will roll?
- Does the amount of air (pressure) in a basketball affect how high it bounces?
- Does the number of blades of a propeller affect how fast it will turn in the wind?
- Does the angle of a wing affect the amount of lift it develops in the wind?
- Does the number of pulleys affect the force necessary to lift a weight?
- Does the length of a lever (from the fulcrum) affect the force necessary to lift a weight?
- Does the length of a pendulum affect its period (time it takes to swing)?
- Does the weight of a pendulum affect its period (time that it takes to swing)?

Heat and Temperature:

- Does the temperature of the water affect how fast an Alka-Seltzer tablet will dissolve?
- Does the color of water affect the time it takes to freeze?
- Does the kind of water affect how long it takes to boil?
- Does the kind of water affect how quickly it will evaporate?
- Does the surface area of a container of water affect its evaporation rate?
- Does the depth of the water affect its evaporation rate?
- Does the temperature of water affect its evaporation rate?
- Does the kind of material used to insulate a refrigerated can of soda affect its temperature change?
- Does the color of a can affect its rate of temperature change when placed in the sun?
- Does the kind of soil (sand, gravel, clay) affect its temperature change in the sun?
- Does the color of a crayon affect its melting rate?
- Does the temperature of a tennis ball affect how high it bounces when dropped?
- Does the shape of an ice cube affect how slowly it melts?
- Does the mass of an ice cube affect how slowly it melts?

Try to avoid the overly popular and over-used rolling a car down a ramp investigation!

If you are doing group projects, you can use the same type of investigation with each group changing a different variable to save yourself some sanity.

VARIABLES

Independent

- Describes the ONE thing that the student changes.
- Should accurately state what will be changed with enough detail to assure accuracy.
- Should include **how** the variable will change
- Example: I will change the type of liquid (water, milk, juice)

Dependent

- Describes what the student measures.
- Should accurately state what will be measured with enough detail to assure accuracy.
- Should include units of measurement (metric) and measurement tool.
- Example: I will measure the distance the marble travels **in centimeters using a meter stick.**

CONTROL GROUP

- Should accurately state the set of data that will be measured under “normal conditions”
- Some control groups will need to be determined by the teacher and students while other controls are clearly identifiable

Example:

- For our experiment, the teacher and students will need to generate their own control group and say that under “normal conditions’ the ramp could be set at 10 cm high. The ramp can then be increased two separate times for additional trials.
- For an experiment on how weight affects the distance a paper airplane travels, under “normal conditions”, the paper airplane would fly without any paperclips. Two sets of trials would then be conducted by increasing the number of paperclips. http://www.cpalms.org/Public/PreviewResourceStudentTutorial/Preview/122091

SET-UP CONDITIONS

- Should accurately list ALL necessary constants with good detail **and** description of set-up –BE SPECIFIC
- May include sizes, shapes, measurements, time of day, location as well as person/people conducting the experiment. What does the setup look like? (Pictures are great on the board.)
  - Same surface, same car, same person releasing the car, don't push the car, etc.
  - Students need to be reminded that only ONE thing is changed – the independent variable. Everything else MUST remain the same, or constant.
- This can be a bulleted list.

PREDICTIONS

- Should state THREE possible (different) outcomes that include the independent and dependent variable (cause and effect)
- Should clearly identify the most likely outcome (with an *or circle)
- Should use the words increase, decrease, and no effect to describe the possible outcomes.

1. *Increasing the height of the ramp will increase the distance the marble will roll.
2. Increasing the height of the ramp will decrease the distance the marble will roll.
3. Increasing the height of the ramp will have no effect on the distance the marble will roll.

MATERIALS LIST

- A list of all of the items that were used to complete the experiment
- Must provide sufficient detail to duplicate directions
  - Is the marble glass or metal? What size of marble (diameter) is being used?
- Metric unit of measurement must be used

DIRECTIONS

- Should list the steps in order of EXACTLY what was done
  - Includes set-up and execution of experiment
- Procedures list should allow the experiment to be duplicated by another person.
- Includes the use of metric measurements and possible safety tips
- Be sure to discuss WHY a scientist would want his or her experiment to be able to be repeated.

DATA COLLECTION

- Chart with data that was measured in the experiment
- 10 or more trials should be conducted with averages
- All units, labels and details should be present
- Discuss the importance of repeated trials!

RESULTS

- Should tell what happened with the data using MATHEMATICAL LANGUAGE
- Should list **at least** three mathematical results accurately and with detail (averages, difference between averages)
- Just the FACTS- numbers and comparisons of data using numbers (difference between results)
  - The milk had the highest average number of drops with 47.8.
  - The paper airplane with 8 paperclips had the shortest average distance of 5.6 meters.

GRAPH

- A mathematical picture of THE AVERAGE of each data set.
- Proper graph is used (99.9% of the time it's a bar graph.)
- All elements of the graph are present, complete and accurate
  - Title
  - X-axis and y-axis are both labeled with units and a title
  - Scale is considered after looking at data (0-10 OR 0 – 300)
  - Proper intervals (skip count by 2, 5, 10, 100, etc.) are used depending on scale
  - Bars are neat and precise

EXPLANATION

- Does your data support or not support your prediction?

- A summary of findings that evaluate the experimental procedure
- Provides scientific reason that support experiment findings based on evidence or results
- Student(s) should revisit their chosen prediction and state whether the data supported or did not support their prediction.

REAL WORLD USES RELATING TO RESEARCH

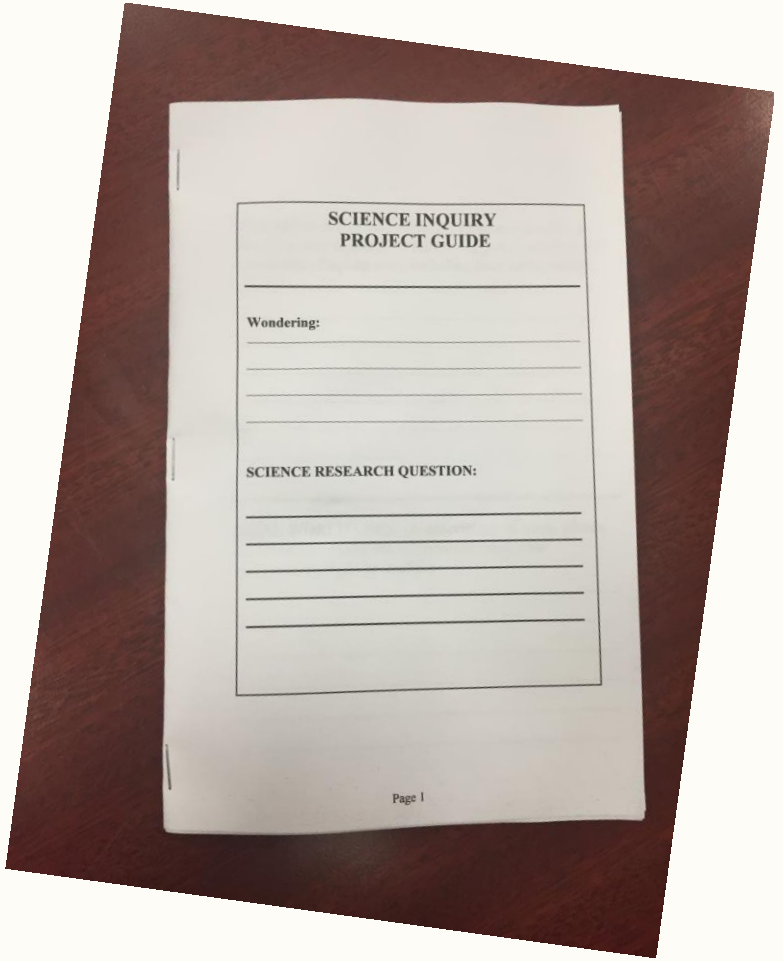
- Ways that information might be used, places, or situations where the information might be important to someone's daily life ("Who cares?!")
- States **THREE or more** possible uses related to the research question with good detail

REFLECTION

- Write a paragraph which includes thoughts, concerns, discoveries, or further questions to explore.
- What might you do differently next time?

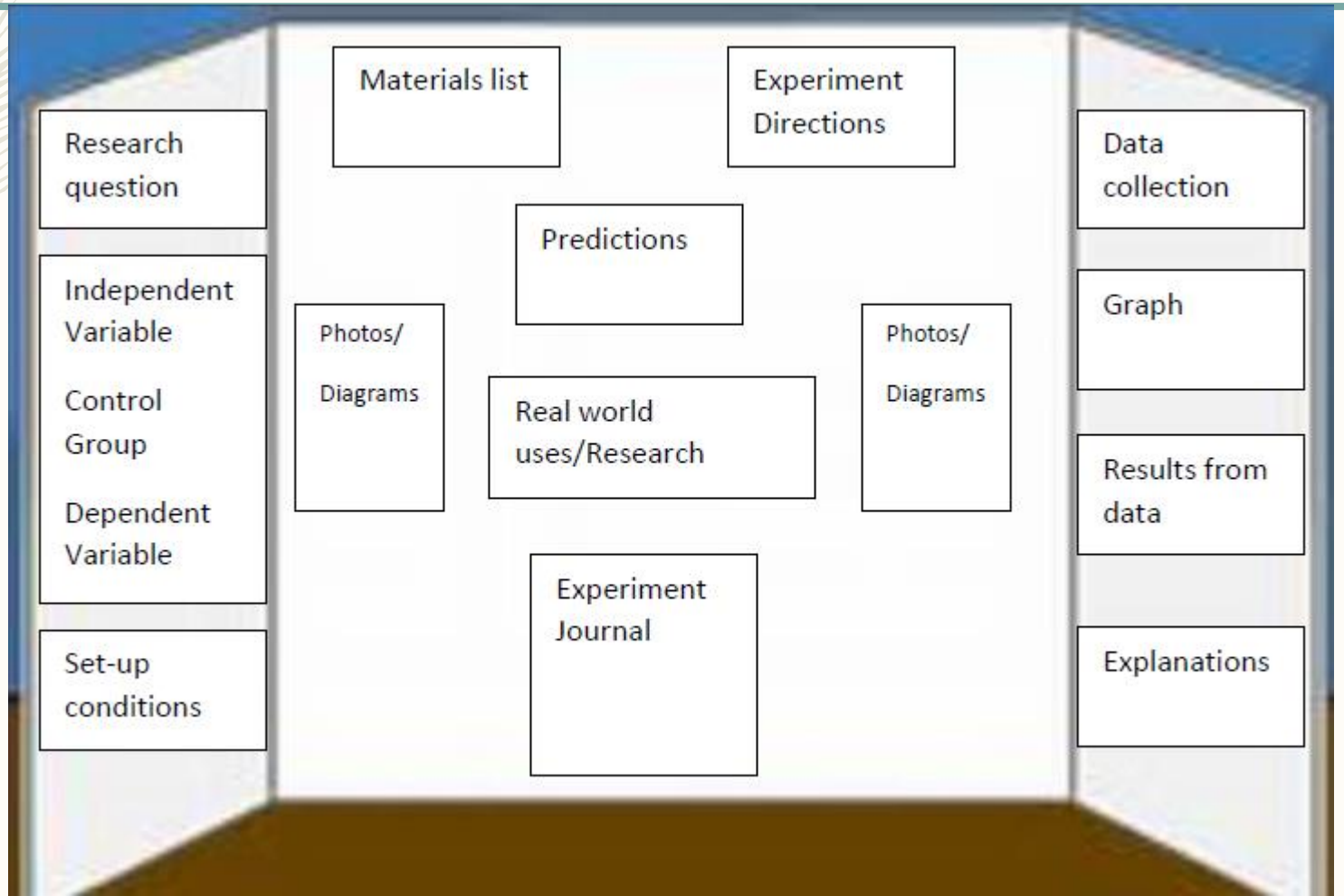
SCIENCE JOURNAL

- All elements present, accurate, good detail and few errors
- Dated narrative present
- District-created journals or individual student notebook journals (Do not HAVE to have both.)



DISPLAY BOARD

All elements present and accurate with good detail and few errors. (May re-arrange the piece, if needed, and include pictures/extras.)



Inquiry Project Rubrics

Science Showcase Rubric 2015-2016
Grades 3-5 Small group or Individual projects

Using the Rubric: Begin in the left hand column (Required Elements). Mark each category by circling the description that best matches the project, and record that numeric score in the score box. Multiply each score with its weighting factor (wt column) to get a final score. Total the final scores to the bottom.

Required Elements	0	1 Point	2 Points	Score	Wt	Final Score
Research Question (A question that explains what was studied)	ELEMENT NOT PRESENT OR NOT SCOREABLE	States a research question; but inaccurate, incomplete, or lacks enough detail.	Accurately states research question: includes cause and effect (x and y), and provides ample detail to investigate project.		x 3	
Predictions (Lists the three possible outcomes of the experiment and identifies the outcome that will most likely occur)		States one or more predictions; but inaccurate, or incomplete, or lacks enough detail to follow.	Accurately states three predictions that include cause and effect (x and y); Clearly identifies the most likely outcome.		x 3	
Independent Variable (Describes the one thing that the students changed)		States what will be changed but with inaccurate or incomplete details.	Accurately states what will be changed with enough detail to assure accuracy.		x 3	
Dependent Variable (Describes what the students measured)		States what will be measured but inaccurate or incomplete details.	Accurately states what will be measured with enough detail to assure accuracy.		x 3	
Control Group (Describes the set of data measured under normal conditions)		Identifies the set of data that will be measured under normal conditions but is inaccurate.	Accurately states the set of data that will be measured under normal conditions.		x 4	
Set-Up Conditions (List all of the things that were kept constant)		Lists some constants; some inaccurate or incomplete.	Lists all necessary constants with good detail and description of set-up.		x 3	
Materials List (List of all of the items that were used to complete the experiment)		Lists partial, confusing, or inaccurate materials; or lacks quantities or measurements.	Lists complete set of materials; sufficient detail to duplicate directions. (metric)		x 3	
Procedures (List of steps in order of exactly what was done)		Gives partial, confusing or non-sequential directions; or lacks enough detail to follow.	Gives complete list of procedures with detail such that the experiment could be duplicated by another. (metric & safety)		x 3	
Data Collection (Chart with the data that was measured in the experiment)		Most data shown; some data missing, or not organized in chart form, or missing units or averages.	Proper chart shown with complete data; 10 or more trials and averages; all units, labels, and detail present.		x 5	
Graph (Mathematical picture of the data)		Graph shown; some elements incomplete or inaccurate.	Proper graph shown; all elements complete and accurate.		x 5	
Results (Tells what happened with the data using mathematical language)		Lists some results; some statements inaccurate or incomplete.	Lists at least three mathematical results accurately and with detail.		x 3	
Explanation (Summary of findings that evaluate the experimental procedure and provides scientific reason that supports experiment findings)		Explanation statement present but inaccurate or incomplete.	Explanation is accurate and provides specific scientific detail related to experiment.		x 4	
Real World Uses relating to Research (Ways that the information might be used)		States one or more uses; but incomplete, inaccurate, or lacks details.	States three or more possible uses related to the research question; with good detail.		x 3	
Science Journal		Some elements are missing, incomplete or inaccurate.	All elements present, accurate, good detail and few errors; dated narrative present.		x 2	
Display Board		Some elements are missing, incomplete or inaccurate.	All elements present and accurate with good detail and few errors.		X 3	

Comments:

Total Score
/100

Class Project Experiment Rubric
(Grades K – 2)

Using the Rubric: Begin in the left hand column (Required Elements). Mark each category by circling the description that best matches that element in the project. The final proficiency level is the general trend location (Emerging, Developing or Accomplished) of all the circles on the chart.

Required Elements	Emerging	Developing	Accomplished
Research Question (A question that explains what is to be studied.)	States a research question; but inaccurate, incomplete, or lacks enough detail.	Accurately states research question; but lacks both cause and effect (x and y).	Accurately states research question: includes detail and cause and effect (x, y).
Predictions (Lists the three possible outcomes of the experiment; the one that is most likely to occur is identified.)	States one or more predictions; but inaccurate, or incomplete, or lacks enough detail to follow.	Accurately states three predictions, but lacks clear cause and effect (x and y); or no prediction that is likely to occur is identified	Accurately states three predictions that include cause and effect (x and y); and a prediction that is most likely to occur is identified.
Independent Variable (Describes the one thing that the students will change.)	States what will be changed but with inaccurate or incomplete details.	Accurately states what will be changed but lacks details (tools, quantities, units, method).	Accurately states what will be changed with enough detail to assure accuracy.
Dependent Variable (Describes what the class will measure.)	States what will be measured but inaccurate or incomplete details.	Accurately states what will be measured but lacks details (tools, units, how).	Accurately states what will be measured with enough detail to assure accuracy.
Set-Up Conditions (The things that will be kept constant.)	Lists some constants; some inaccurate or incomplete.	Lists all constants; lacks detail or description of how the conditions are set-up.	Lists all necessary constants with good detail and description of set-up.
Materials List (List all of the items that will be used in the experiment.)	Lists partial, confusing, or inaccurate materials; lacks quantities or measurements.	Lists most materials used; lacks some detail about type, quantity or size.	Lists complete and detailed set of materials; includes type, quantity and size.
Directions (List of steps in order of exactly what was done.)	Gives partial, confusing or non-sequential directions; or lacks enough detail to follow.	Gives most steps in the procedure; lacks proper sequence or enough detail to be followed.	Gives complete list of directions with detail such that the experiment could be duplicated by another.
Data Collection (Chart with the data that was measured in the experiment.)	Most data shown; some data missing, or not organized in chart form, or missing units or average.	Proper chart shown with complete data and average; some units or labels missing; or less than 10 trials done.	Proper chart shown with complete data and average; all units, labels, and detail present; 10 or more trials were done.
Graph (Mathematical picture of the data.)	Graph shown; some elements incomplete or inaccurate.	Proper graph shown; most elements complete and accurate.	Proper graph shown; all elements complete and accurate.
Results (Tells what happened in the experiment.)	Lists some results; some statements inaccurate or incomplete.	Lists most results; most statements accurate and complete.	Lists all results accurately and with detail.
Explanation (Summary of findings that evaluate the experimental procedure and/or possibilities for further study?	Explanation statement present but inaccurate or incomplete.	Explanation statement present and accurate; but incomplete.	Explanation is accurate and with specific detail.
Real World Uses (Ways that the information might be used.)	States one or more uses; but incomplete, inaccurate, or lacks details.	States two possible uses with some detail; or more uses with incomplete detail.	States three or more possible uses with good detail.
Project Diary and Display (Presentation of the class process and project board.)	Some elements are missing, incomplete or inaccurate.	All elements present; most complete or accurate.	All elements present with good detail and few errors.