SCIENTIFIC INQUIRY
GRADES 4/5

Name: _____ Grade: _____ Date: _____

Title of Inquiry Report:

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	Original Score	Revision Score	Second Revision Score
Framing the Investigation	1 2 3 4 5 6		
Designing the Investigation	1 2 3 4 5 6		
Collecting and Presenting Data	1 2 3 4 5 6		
Analyzing and Interpreting Results	1 2 3 4 5 6		

FRAMING THE INVESTIGATION

Process Dimensions	6/5	4	3
Forming a Question or Hypothesis • **Scientific Question or Hypothesis** • **Observations and Scientific Principles**	A testable question or hypothesis is formed that clearly guides the experiment. Observations and relevant science knowledge is used from multiple sources.	A testable question or hypothesis is formed. Observations and relevant science knowledge is used.	A testable question or hypothesis is partially formed. Observations and limited science knowledge is used.

Research Question: State the research question you are trying to answer. Ask a question that you can answer through observation or experimentation.

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Background/Research Information: State the purpose or reason for asking this scientific question. What are you trying to discover. Also, following the teacher's directions, write a background research section. This section should be used to help make a hypothesis. Include a least a minimum of 10 facts with cited sources.

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Variables: Scientists design experiments so they can observe or measure if change to one thing causes something else to vary in a repeatable way. The things that are changing in an experiment are called variables. A variable is any factor, trait, or condition that can exist in differing amount or types. An experiment usually has three kinds of variables: independent, dependent and controlled. (www.sciencebuddies.org)

Independent Variable-What will you be changing in the experiment? (There should only be ONE item listed here)

Dependent Variable-What will you be measuring or observing?

Controlled Variable-What will you be keeping the same during the experiment?

Examples from http://sciencebuddies.org/science-fair-projects/project_variables.shtml

Question	Independent Variable (What I change)	Dependent Variable (What I observe)	Controlled Variables (What I keep the same)
How much water flows through a faucet at different openings?	What faucet opening (closed, half open, fully open	Amount of water flowing, measured in liters per minute	-the facet -water pressure, or how much water is "pushing" Different water pressure might also cause different amount of water to flow and different faucets may behave differently, so to ensure a fair test, I want to keep the water pressure and the faucet the same for each opening that I test
Does heating water allow it to dissolve more sugar?	Temperature of the water measured in degrees Celsius	Amount of sugar that dissolves completely, measured in grams	-stirring -type of sugar More stirring might also increase the amount of sugar that dissolves and different sugars might dissolve in different amounts, so to ensure a fair test I want to keep these variables the same for each cup of water
How fast does a candle burn?	Time measured, in minutes	Height of candle, measured in cm, at regular intervals of time (every 5 min.)	-use same type of candle for every test -wind-make sure there is none

Hypothesis

Hypothesis: A hypothesis is a statement that predicts the outcome of your experiment, based on what you already know. The sentence proposes an explanation that can be tested. What do you think that the answer to your research question will

be? Remember, hypotheses don't need to be correct-but they do need to be educated guesses! Hypotheses are written using an, "If…, then…, because….format."

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DESIGNING THE INVESTIGATION

Process Dimensions	6/5	4	3
Designing an Investigation **Practical Plan with Tools** • **Logical Procedure** • **Multiple Trials and Observations**	A practical and repeatable plan is developed that includes tools used and procedures followed. A logical procedure that identifies what is being tested is presented. An organized plan and procedure with multiple trials (runs) and observations is included.	A practical plan is developed that includes tools used and procedures followed. A logical procedure for collecting data is presented. Presents a plan and procedure with multiple trials (runs) or observations.	A plan is developed that includes not useful tools or limited procedures. A procedure for collecting incomplete data is presented. Presents a plan with not enough trials (runs) or observations.

Materials List: List ALL materials used!

Procedure

The procedure describes the experiment in a step-by-step sequence. It may help to think of the procedure as a recipe, in which every step is clearly explained. How will your materials be used and how and when will they be measured? Another person should be able to follow the procedures of your experiment and get the same, or similar, results.

Step by step numbered procedure:

Drawings/Diagrams:

COLLECTING AND PRESENTING DATA

Process Dimensions	6/5	4	3
Collecting and Presenting Data (Student – directed with Teacher Support) • **Data Collect. Method** • **Raw Data and Observations** • **Data Format (charts, graphs, illustrations, tables, etc…)**	A detailed and logical data- collection method using multiple trials and observations is used. Accurate and detailed data or observations consistent with the procedure are present. Original data is accurately transferred into a useful format that enhances thorough analysis. **(Limited teacher support)**	An appropriate data-collection method using multiple trials and/or observations is used. Data or observations are collected that are consistent with the procedure are present. Original data is transferred into a useful format.	A data- collection method lacking multiple trials and/or observations is used. Data or observations are partially collected. Transfers original data into a format that is not useful or is presented with errors.

Data Collection

Record detailed records of the results of your tests and observations. Results should always be explained in a written format first, followed by graphs, charts and/or tables.

Data Table: (USE A RULER)

Title: _____

Independent Variable (x-axis)	Dependent Variable (y-axis)			
	Trial 1	Trial 2	Trial 3	Average

Data Transformation (INCLUDE GRAPHS ON GRAPH PAPER)

ANALYZING AND INTERPRETING RESULTS

Process Dimensions	6/5	4	3
Analyzing and Interpreting Results • **Conclusion** • **Communication**	Data or observations are used to clearly support and defend an accurate explanation of the results. A detailed summary which identifies and explains variables, sources of error, limitations, patterns in the data and possible explanations for results is present. Clearly communicates and identifies the most important results to fully address the original hypothesis or question.	Data or observations are used to support an explanation of the results. A summary which discusses some variables, sources of error, limitations, patterns in the data and possible explanations for results is present. Clearly communicates the relationship of the results to the original hypothesis or question.	Data or observations are partially used. A minimal summary which discusses variables, sources of error, limitations, patterns in the data and possible explanations for results is present. Partially communicates the relationship of the results to the original hypothesis.

Reporting Results and Error Analysis

Data Analysis: Summarize your results shown in your data and/or graph using words

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Conclusions: According to your results, was your hypothesis proven or disproven? Explain why your hypothesis was supported or not using your data to back up your findings (Remember it's ok for your hypothesis to be disproven!) How would you change or expand this experiment if you were going to do it again? What did you learn from the experiment or the scientific process? How could this information be used to help people or to make the world a better place?

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Error Analysis: Explain what did or could have gone wrong, how they would affect your data and how you would improve upon them.

Science Fair Project Planner

Name(s):_____

	Due Dates	Tasks
		Choose topic and write project question.
		Get approval from your teacher.
		Research your topic. Write science terms (vocabulary) and background information paragraph.
		Write hypothesis.
		Design experiment; list variables and write procedure.
		List and gather materials.
		Conduct experiment multiple times. Record observations and data.
		Create a table, chart, or graph of the data.
		Draw conclusions. Explain how you would improve your experiment.
		Make the project display and/or trifold board,
		Scientific Inquiry project reflection.
		Present project at science fair.

Scientific Inquiry Project Reflection

Name:_____

What are three successes with your science fair project?

What was challenging with your science fair project?

How well did you/your group stay on task to meet deadlines?

What would you do differently if you were to do your science fair project over again?

What HOWLS did you use throughout the scientific inquiry process? Give specific examples.