Name:_____ Period:_____

Engineering Work Sample

Start Date:_____ End Date:_____

Title of Engineering Report:

_____

Scores

Student Score	Section	Teacher Score
1 2 3 4 5	Define the Problem (or Possibility)	1 2 3 4 5
1 2 3 4 5	Design a Solution	1 2 3 4 5
1 2 3 4 5	Collect Data	1 2 3 4 5
1 2 3 4 5	Analyze	1 2 3 4 5

5—Highly Proficient
4—Proficient
3—Nearly Proficient
2—Working Toward Proficiency
1—Novice

(Attach additional pages as necessary.)

We created this packet using the Beaverton-Hillsboro Science Fair Judging Rubric for Engineering, by Melissa Potter.

1. Defining the Problem (or Possibility)

Explain the problem, and identify the criteria as well as the constraints within which it must be solved.

Background-Information and Existing-Solutions Scoring Guide

Nearly Proficient	Proficient	Highly Proficient
The background information and previous solutions only partly relate to the problem and design.	The background information and previous solutions relate to the problem, and the student has used supporting details accurately to suggest a design.	The decryptions of background information and previous solutions are thorough and clear, revealing extensive understanding of scientific and engineering concepts.

Background Information and Existing Solutions

Provide background information about the problem (or possibility) and describe the science and engineering concepts that you can use to create a solution. If possible, include and cite previous solutions that others have engineered.

(Add additional pages as needed.)

Identify the Problem Scoring Guide

Nearly Proficient	Proficient	Highly Proficient
The student needs to explain the problem more clearly so it is better understood and testable.	The student has clearly explained the problem so it is testable.	The student has clearly explained the problem in terms of related science and engineering concepts so it is testable.

Description of problem (or possibility)

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Explanation of Criteria and Constraints Scoring Guide

Nearly Proficient	Proficient	Highly Proficient
The criteria and constraints are missing or are limited in scope.	The student has clearly identified the criteria and constraints.	The student has thoroughly analyzed the criteria and constraints using a decision-making tool such as a list of pros and cons, a Pugh chart, or a decision tree.

Criteria

What standards will you use to make decisions about the quality of the design when you test it?

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Constraints

These are the limits in terms of time, resources, material strength, and sustainability that frame the solution.

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Pugh Chart

You can use this tool when you need to compare more than one option. Select a datum. A datum is the existing solution with which you will compare your new ideas to see whether they are better, worse, or the same. List the criteria (or standards) that you will use to measure the quality of the proposed solution. Select different options, and decide whether each option is better (+), worse (-), or the same (0) as the datum.

	Datum	Option 1	Option 2	Option 3
Evaluation Criteria	Description:	Description:	Description:	Description:
	0			
	0			
	0			
	0			
	0			
	0			
	0			
	0			
Totals	0			

2. Design of Solution

Explain how you've designed the solution, and describe how to make a prototype.

Exploring-Options Scoring Guide

Nearly Proficient	Proficient	Highly Proficient
The student needs to compare the options, or they are unclear.	The student has described and compared each option clearly.	The student has thoroughly analyzed each option using detailed reasoning.

Explore different options to see how to design the solution.

Discuss the alternatives in the list of pros and cons, the Pugh chart, or the decision tree.

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Identification of Solution Scoring Guide

Nearly Proficient	Proficient	Highly Proficient
The solution needs to be more directly related to the problem.	The solution fits with most of the criteria and constraints.	The solution is thoughtfully selected based on the design criteria and constraints.

Solution

Describe the solution you chose and how it fits within the design constraints.

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Research Question

Make a claim that one can test.

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Creation of a Prototype Scoring Guide

Nearly Proficient	Proficient	Highly Proficient
The prototype needs to have a practical design that one can test.	The prototype is practical and one can test it as a solution.	The prototype is creative and practical. One can test it, and it meets both the criteria and constraints.

Materials List

List all the items you need to make a prototype and the amount required.

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Procedures for Making the Prototype

Number the steps and make them clear so that they easily explain how to build the prototype.

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(Add additional pages as needed.)

Initial Schematic

Draw the prototype to scale, and label each part.

Testing the Prototype Scoring Guide

Nearly Proficient	Proficient	Highly Proficient
The testing procedures need to allow for collecting more relevant data to determine whether the prototype meets the criteria.	The procedures test the prototype in a way that measures whether the design is adequate to meet the criteria for a successful solution.	The testing procedures are based on mathematical and scientific principles. They are thoughtfully designed to collect enough data to determine whether the prototype meets the criteria and constraints for a successful solution.

Evaluation Criteria

Choose which evaluation criteria you will use to measure whether the prototype is successful.

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Dependent Variable

Identify what you are measuring and which units you will use to measure the quality of the design.

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Controlled Conditions

List the variables that must be held constant.

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Testing Procedures

All steps should be clear and numbered.

(Add additional pages as needed.)

3. Data Collection

Collect, transform, and graph data to evaluate the design.

Data-Collection Scoring Guide

Nearly Proficient	Proficient	Highly Proficient
The tables or graphs need to be more understandable. The title needs to be more descriptive, the axes need to be labeled, or the units are missing.	The tables and graphs are clear and labeled.	The tables and graphs answer the research question and are thoroughly labeled.

Data Table(s):

Label columns and rows and give the units.

Graphs

Give each graph a descriptive title, label axes, and indicate units.

Explain Patterns and Trends

Show computations that explain patterns and trends so that we can make inferences.

4. Analyzing

Summarize the results of the test and design process by evaluating the solution and suggesting improvements.

Results Scoring Guide

Nearly Proficient	Proficient	Highly Proficient
The student needs to support the results with the data.	The student has given a clear explanation of the results using the data.	The student has given a clear explanation of the results, using the data to highlight any patterns or trends.

Results of Prototype Test

Summarize results shown in the data and graphs. Compare the results with the criteria. Restate the research question, and discuss the claim based on whether the data supports it or does not support it.

Appropriateness of Design Scoring Guide

Nearly Proficient	Proficient	Highly Proficient
The student needs to provide more discussion of the appropriateness of the design as a solution to the problem.	The student has provided a clear explanation of how the design solves the problem.	The student has provided a thorough analysis of the appropriateness of the design and has compared it with other possible designs.

Appropriateness of Design

Explain, with specifics, how the design successfully solved the problem.

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Evaluation of Solution Scoring Guide

Nearly Proficient	Proficient	Highly Proficient
The student needs to explain and deal with any errors and limitations of the solution in a serious and logical manner.	The student has clearly identified errors and limitations in the design's ability to solve the problem.	The student has clearly identified errors and limitations and has discussed trade-offs in the design's ability to solve the problem.

Evaluation of Solution

Identify any trade-offs that you had to make in the process of designing a solution.

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Improving the Design Process Scoring Guide

Nearly Proficient	Proficient	Highly Proficient
The student needs to add ideas for making improvements.	The student has based ideas for improvements on the information gathered through the creation and testing of a prototype.	The student has based ideas for improvements on the information gathered through the creation and testing of a prototype as well as the identified weaknesses and limitations.

Improving the Design Process

Describe specific changes that you could make in the future to improve the approach you've taken to solving the problem.

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References (Use APA format):

