long
beach
unified
school
district

SCIENCE & ENGINEERING FAIR

# Reverse Engineering (5th-8th Grade)

## Rubric for School Site Fair

| | Attempted<br>1 | Proficient<br>3 | Advanced Proficient<br>5 |
|---|---|---|---|
| **Purpose & Acknowledgements** | Is unclear about their purpose for reverse engineering this device. Acknowledgements do not address the relevant skills of those who helped. | Describes the general purpose for reverse engineering this device. Acknowledges and thanks people that contributed to understanding the device and addresses some relevant skills and interests of each contributor. | Provides a clear presentation of the student's purpose for reverse engineering this device. Acknowledges and thanks each person that contributed to understanding the device and clearly explains relevant skills and interests of each contributor. |
| **Product Research** | Presents findings from fewer than three sources or cites sources that may not be reliable. Or, provides little information about the origin and development of the device over time. | Presents findings from three or more reputable sources and provides some information about the origin and development of the device over time. | Presents detailed findings from four or more reputable sources and clearly explains the origin and development of the device over time. |
| **Device Details** | Identifying information about the device may be incomplete, or description of the basic operation and purpose of the device is vague or incomplete. | Provides identifying information about the device and describes the basic operation and purpose of the device. | Provides thorough identifying information about the device. Clearly describes the operation and purpose of the device, including all multiple functions. |
| **Part / Subassembly Description & Explanation** *(Double Points)* **(x2)** | Labels and details are too limited to give the reader an understanding of each part of the device. Explains of the function or operation of a few parts or neglects to mention how they relate to the device as a whole. Does not consider what would happen if certain parts were altered or missing or explanation is not clear. | Provides labels and enough details to give the reader an adequate understanding of each part of the device. Explains of the function or operation of most parts and how they relate to the device as a whole. Considers what would happen if certain parts were altered or missing. | Provides all labels and details needed to give the reader a clear understanding of each part of the device. Gives a clear explanation of the function or operation of each part and how it relates to the device as a whole. Carefully considers what would happen if each part was altered or missing. |
| **Materials and Connections** | Recorded observations describing the types of materials are used in each part are incomplete or unclear. Attempts to explain how each part fits into the device, but labeled diagrams/photographs and explanations are unclear about how each part is connected to the device. Or, neglects to explain ***why*** certain materials were used in each part. | Writes observations describing the types of materials are used in each part. Briefly explains how each part fits into the device. Provides labeled diagrams/photographs and adequate explanations to demonstrate how each part is connected to the device. Explains ***why*** certain materials were used in each part. | Writes clear, scientific observations describing what types of materials are used in each part. Demonstrates in-depth analysis of how each part fits into the device. Provides clearly labeled diagrams/photographs and precise explanations demonstrating how each part is connected to the device. Explains ***why*** certain materials were used in each part. |
| **Professionals Involved in Design & Manufacture** *(Double Points)* **(x2)** | Identifies some professions, but the connection to the design and manufacture the device is unclear. | Identifies some professions required to design and manufacture the device. Explains some specific ways_that people (such as chemical engineers, mechanical engineers, artists, electrical engineers, software engineers, bioengineers, etc.) have contributed to the device. | Identifies the various professions required to design and manufacture the device. Explains several specific ways that people (such as chemical engineers, mechanical engineers, artists, electrical engineers, software engineers, bioengineers, etc.) have contributed to the device. |
| **Reflection & Principles** | Explanation of new things learned about the device through the reverse engineering process is vague or missing. Connections of the device design to scientific and engineering principles are unclear or missing. | Explains new things learned about the device through the reverse engineering process. Makes general connections of the device design to one or few scientific and engineering principles. | Explains new things learned about the device through the reverse engineering process. Connects the device design to various and specific scientific and engineering principles. |
| **Visual Quality of Display** | Project has limited eye appeal or is not easily readable at approximately two feet distance. The project has limited organization, or contains confusing visuals, or contains major language or spelling errors. | Project is appealing and readable at approximately 2 feet distance. It is organized and clear, uses understandable visuals and/or models, and contains few language and spelling errors. | Project is appealing and neat, and is readable at approximately 2 feet distance. It is well organized and clear, makes striking use of inventive or amusing visuals and/or models, and uses language and spelling flawlessly. |

**Projects will receive between 10 and 50 points when all rubric criteria have been addressed.**

Class grade should also include how well timelines were met and elements of the written report not found on the display board:
Title Page, Acknowledgements, Table of Contents, and Sources/Bibliography

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Purpose &** **Acknowledgements** | | | | | | | | | | | | | | | | |
| **Product Research** | | | | | | | | | | | | | | | | |
| **Device Details** | | | | | | | | | | | | | | | | |
| **Part / Subassembly**<br>*(Double Points)* **(x2)** | | | | | | | | | | | | | | | | |
| **Materials and Connections** | | | | | | | | | | | | | | | | |
| **Professionals Involved**<br>*(Double Points)* **(x2)** | | | | | | | | | | | | | | | | |
| **Reflection & Principles** | | | | | | | | | | | | | | | | |
| **Visual Quality of Display** | | | | | | | | | | | | | | | | |
| **Total Score** | | | | | | | | | | | | | | | | |
| ***Teacher:***<br>***Period:*** | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: | Student(s):<br>Project: |

# Reverse Engineering

**(5th – 8th Grade)**
**Judge's Score Sheet for**
**School Site Fairs**

**NOTES TO TEACHER**: For grading purposes, 5-10 pts = Not Proficient (1), 11-24 pts = Partially Proficient (2), 25-39 pts = Proficient (3), 40-50 pts = Advanced Proficient (4).
Complete grading should also include other details not included here as Judging Criteria: for instance, written report details, completion of deadline tasks, display guidelines, model quality, etc.

# Reverse Engineering

## Guidelines for Grades 5-8

### Select ONE device to analyze.

- Get permission from your parent or legal guardian to take apart this device. (Recognize that this may be a one-way process. The device may not go back together well!)
- Get approval from your teacher for the device.
- Have these folks sign the **Project Approval Form** and leave it with your teacher.
- Types of devices you might consider:

| | |
|---|---|
| Kitchen: | can opener, toaster, rice cooker, blender, mixer, scale, drawer, etc. |
| Office: | pen, stapler, hole punch, pencil sharpener, printer, hot glue gun, binder, etc. |
| Bathroom: | scale, toilet flushing mechanism, faucet, shower head, sink drain, blow dryer, lip balm tube, etc. |
| Garage: | vice grip pliers, clamp, drill, tape measure, vice, paint brush, etc. |
| Other: | light switch, ceiling fan, door knob, bicycle, shoe, spray bottle, valve, reading glasses, sun glasses, hat, belt, toy, container, lamp, etc. |

*Note: Try to select a device that is neither too simple nor too complicated for you.*

### Product Research

- Find a minimum of 4 resources providing information about the type of device you are going to disassemble.
- Describe the origin of your device (or type of device) and how it has developed over time.
- Explain why you have chosen to reverse engineer this device.

### Device Details

- Record the following basic information about your device:
  - Name of the device
  - Model/brand of the device
  - Year of manufacture
- Explain how the device works. (What is the purpose of the device? Exactly how does the device do that? Does the device have more than one function?)

### Disassembly and Analysis

- Before you begin to disassemble your device, make sure to take several pictures from different angles.
- Plan how you disassemble the device, consider these points:
  1. How will you organize and store the parts. Consider using re-sealable sandwich bags to keep the parts sorted and labeled.
  2. Include an index card or small slip of paper in the re-sealable sandwich bag to write the name and function of each part.
  3. Take photos to record the disassembly process.
  4. Complete a table recording the following information for each part or subassembly:

| **Part #** | **Name/Description** of Part or Subassembly | **Explanation of Function or Operation** | **Material** (color, characteristics, physical state: s, l, or g) | **How Part is Connected** | **Types of Professionals Needed to Design/Manufacture** |
|---|---|---|---|---|---|
| 1 | | | | | |

- If you have difficulty identifying the parts of your device, try looking online for manuals and diagrams. You may also want to consult a professional, if necessary. Once you identify each part, you should be able to find its function.

Adapted from Brian Tom, Rogers Middle School, 2014

long beach unified school district

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# Reverse Engineering

## Project Permission Form

We are pleased that you are interested in investigating the inner workings of a device to learn how and why people design the things we use daily. We want to make sure that your experience is a positive and safe one. To that end, please read and sign this form so that we are assured that your investigation will be properly supervised and safely pursued.

**Student Name(s) (PRINT):** ______________________________

**Device to be investigated:** ____________________ **School:** ____________________

**Only disassemble devices with the permission of your teacher and parent/guardian, recognizing that disassembly may result in the device no longer being able to function.**

Safety issues to consider:

- Be very careful to protect eyes, hands, etc., when disassembling a device, particularly if a casing or part needs to be broken.
- Use sharp tools and work with sharp device parts only under adult supervision.
- Research the composition of any fluid, crystal, or powdered chemicals to be aware of any potential hazards.
- Do not puncture or open any components containing pressurized liquids or gases. If in doubt, do not open.

Electrical devices:

- Never disassemble an electrical device that is plugged in or has been plugged within the last 30 minutes.
- Do not disassemble devices containing large capacitors or materials considered hazardous waste, including microwave ovens, computers, televisions, refrigerators, and air conditioners.
- Do not disassemble thermostats, or any fluorescent light bulb or compact fluorescent light bulb (CFL), as they contain small amounts of mercury.
- Do not disassemble any electrical motors or electrical components of a device manufactured before 1979 as many of them contain capacitors with polychlorinated biphenyls (PCBs) which were banned in 1979.
- When disposing of devices or their components, make sure you follow local regulations regarding electronic waste.

## PARENT PERMISSION

By signing below, you are affirming that you have read the precautions mentioned above and agreeing to support and, as necessary, supervise this project.

Any questions regarding this Reverse Engineering process should be referred to Eric Brundin, LBUSD Science Curriculum Leader, (562)997-8000, extension 2963 or EBrundin@lbschools.net.

***PERMISSION FOR PARTICIPANT** – Requires signature of parent or legal guardian.*

**Signature of Parent/Guardian:** ______________________________ Date: ____________________

Publication Authorized:
Pamela Seki, Assistant Superintendent
Office of Curriculum, Instruction, and Professional Development
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