

DESIGN IT!

GRADES 4-5

Instructions for Using the Oregon Grades 4-5 Engineering Design Notebook Template Draft, 12/8/2011

These instructions are for the Oregon Grades 4-5 Engineering Design Notebook template that can be found on the web at <http://www.ode.state.or.us/search/page/?=32>. The template includes a graphic of the Engineering Design Process that aligns with the 5th grade Oregon Science Content Standards. If you are using it for 4th grade science, please see the list of suggested changes at the end of this document.

Pages of the Template

First let's consider what's on each page and what the students will add to these pages.

Cover: The student should fill in the blanks. You can give specific guidance about things like semester/trimester and class section.

Inside front cover: A graphic summarizes the engineering designs assumed by the 5th grade engineering design section of the Oregon Science Content standards. You can use the glossary of terms at the end of this document to explain the steps to your students.

Table of Contents: This page lists the sections of the engineering design notebook. In most cases you will want to allow your students to decide how many pages each section should have. You may want to tell them the minimum and maximum number of pages for each section. The students should number each page and put the starting page number of each section on this page.

The Problem: You may want to assign a specific problem or you might want to assign a category of problems to be solved. An example of the former would be design a pouch that is no larger than 6 inches by 6 inches by 3 inches that can be hung from the handlebars of a bicycle to transport school supplies. An example of the latter would be design something that would be useful for students going to and from school that could be made from less than five dollars in materials. In most cases the problem should be described in terms of a human need or some other need. Once your students have had some experience with specific problems you may want to give them more latitude about the types of problems than can tackle.

Criteria and Constraints: Students should list and describe the criteria and constraints associated with the problem being solved on this page. In some cases you may provide some or all of these things and their job is to paraphrase what you have provided. In others cases

you may ask them to come up with criteria, constraints and priorities based on their experience with the category of problem you have assigned. If there is time they may also want to survey possible users of the solution to better understand their needs or do library or web research on the need.

Possible Solution: Students should describe a possible solution that uses science principles.

The Design: The student should use drawings and words to describe how what the solution looks like and how it works. Students should then build the solution or something like it, perhaps a scale model.

Analysis: The student should explain how much it would cost to build or manufacture the solution and how safe or unsafe it would be to use the solution. They should also explain how building the solution or using it might affect the environment. Most solutions don't work all the time especially if they are used in new ways so the student should describe what would happen if the solution fails. While the 5th grade standard does not mention testing the solution, any tests the student performs on the solution should be described here.

Ways of Using the Template

The template can be used in several ways.

- (1) **“Loose-leaf” individually bound notebooks:** Provide each student with copies all the pages of the template. They can use the graph paper and lined paper at the end of the template to make additional sheets to insert in the various sections or you can provide supplies of these two sheets for students who need extra pages. Notebooks may be “bound” according to your or the students’ preferences using staples, report covers, three-ring binders, or some other method.
- (2) **“Glue-stick” customization for pre-bound composition notebooks:** Provide each student with copies of all the pages of the template except the blank lined page at the end of the template. Students should glue pages onto pages in the composition book as they are completed. When students need additional pages in a section they can use the notebook pages without gluing on pages or they can glue copies of the graph paper onto composition pages. The Table of Contents Page should be updated as new sections in the notebook are started.

Alternatively, the students can use the template as guidelines for what they handwrite on the pages of the composition books.

(3) “Pre-bound” individual notebooks: Provide each student with either a full-size or half-size copy of this template, choosing the number of pages you think is appropriate for each step. Here is one possible solution that assumes half-size pages:

- 1 each – Cover
- 1 each – Inside front cover – Engineering Design Process graphic
- 1 each – Table of Contents
- 1 each – Introduction
- 1 each – The Problem
- 1 each – Criteria and Constraints
- 2 each – Possible Solution
- 3 each – The Design
- 3 each – Analysis
- 1 each – Inside back cover
- 1 each – Back cover

If you use this format you can pre-number all the pages and fill in the Table of Contents with the page numbers of the first page of each section.

Suggestions for Design Notebooks for 4th Grade

The Oregon Science Content Standards do not require coverage of criteria and constraints for 4th grade students so you may want to leave that section out of your template for those students. The Analysis section can be replaced with a Tests section where students describes the tests they performed to see how well their solutions worked.

Glossary

Appearance: What the solution looks like.

Constraints: Limits on possible solutions. When we solve a practical problem we usually have limits on how big the solution can be, how much it can cost, how much it can weigh, etc.

Cost: How much it would cost to build or manufacture the solution. Usually costs are divided into materials and labor but there may be other costs as well.

Criteria: The things your solution should do. Engineering problems are usually described in terms of a set of goals that become the criteria against which we judge possible solutions.

Environmental impact: Building and using a solution often generates wastes or otherwise affects the environment. Some solutions may actually improve the environment, however.

Need: The reason why we want to solve a problem. Most engineering problems are based on needs of people, society or the world around us.

Principle: Most engineering design solutions use scientific principles to solve the problem. One example would be that gravity causes objects to fall when another force doesn't prevent it.

Problem: The goal of an engineering design project. Most engineering projects relate to a practical problem that provides a benefit to people or improve upon an existing solution.

Prototype: A first version of a solution that may not have all the refinements of the final solution.

Safety: Whether or not a solution involves risks to people, animals, etc.

Solution: A possible way of solving a practical problem.

Test: Using a solution to determine whether how well it solves the problem or addresses the need. Testing often involves taking measurements.