**Unit Overview**

**Title of Unit: Pack it up**

**Target Grade Level(s):** 5th

**Subject(s**)**:** Math, Engineering, Art, ELA, Technology

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**Industry Partners:** Sally Chan-The Boeing Company and Michael Bravo-The Boeing Company

**Problem Statement:**

How can we create a sustainable package that delights the customer and meets the needs for both budget and specs?

From this unit, students will gain an understanding of the design process, with a specific focus on designing a package that can safely transport a product to its final destination, with consideration for how the package looks, the materials being used, and the durability of the package.

Before this unit, students should have some experience with working in small groups and whole class cooperatively. Knowledge of Design Process is not entirely necessary as it will be developed through this unit.

**Unit Overview and Table of Contents**

1. **Hook introduction lesson**
2. **Technical Drawings and Models**-How do engineers work together with tools to experiment with possible solutions to their design project?
3. **Prototyping and manufacturing**- Does your model actually work? How do you assemble the materials?
4. **Procedural Writing**-How do designers share their design ideas through technical drawings and writing for mass production?
5. **Researching sustainable resources**-How do companies decide which trade-offs are worth choosing?
6. **Budget and purchasing**-How does a budget affect material choice?
7. **Volume and surface area-**What is the difference between the volume and surface area of 3-D package?  Why do designers and engineers need to know both?
8. **Art and Design-**How do graphic design artists choose certain colors and designs on the package to excite the customer?
9. **Testing and evaluating solutions-**How do engineers test if their packages can survive the shipping process?

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| **Lessons** | **Learning Outcomes** |
| Lesson 1: Project Introduction | Students will learn about the design process and the expectations for the project.  Students will be able to verbalize and rationalize the purpose of package design. |
| Lesson 2: Technical Drawing/models/ | Students will plan a 3-dimensional package by making a drawing to meet the design requirements. |
| Lesson 3:  Prototyping and manufacturing | Students will construct a prototype of a package, by using technical drawings to create a preliminary example of our package. |
| Lesson 4: Procedural Writing | Students will write directions on how to create a package, by using the team’s technical drawing to create a manual for future use by other engineers and designers. |
| Lesson 5: Researching sustainable resources | Students will write an opinion paragraph by researching the pros and cons of using different packaging materials to demonstrate which trade-offs they believe are worth a company to use. |
| Lesson 6: Budget and purchasing | Students will do multiplication of decimals by using standard algorithm to complete a budget for their package, having taken into consideration material choices and cost. |
| Lesson 7: Volume and surface area | Students will learn the difference between volume and surface area, and why it’s important to be able to determine both. |
| Lesson 8: Art and Design | Students will create a graphic for the packaging that includes colors and a design purposefully chosen to reflect the customers’ culture and preferences. |
| Lesson 9: Testing and evaluating solutions | Students will test multiple solutions to a design problem by using a rubric to identify if the package could survive the shipping process and how it could be improved. |

**Standards (NGSS, CCSS, CTE):**

**Science Standards**

* 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
* NGSS 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
* 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

**Literacy Standards**

* [CCSS.ELA-LITERACY.W.5.2](http://www.corestandards.org/ELA-Literacy/W/5/2/)   Write informative/explanatory texts
* [CCSS.ELA-LITERACY.W.5.2.A](http://www.corestandards.org/ELA-Literacy/W/5/2/a/): Introduce a topic clearly, provide a general observation and focus, and group related information logically; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
* [CCSS.ELA-LITERACY.W.5.2.B](http://www.corestandards.org/ELA-Literacy/W/5/2/b/): Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
* [CCSS.ELA-LITERACY.W.5.2.C](http://www.corestandards.org/ELA-Literacy/W/5/2/c/): Link ideas within and across categories of information using words, phrases, and clauses (e.g., in contrast, especially).
* [CSS.ELA-LITERACY.W.5.2.D](http://www.corestandards.org/ELA-Literacy/W/5/2/d/): Use precise language and domain-specific vocabulary to inform about or explain the topic.
* CTE: 4. Communicate clearly, effectively and with reason.
* [CCSS.ELA-Literacy.RI.5.9](http://www.corestandards.org/ELA-Literacy/RI/5/9/) Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
* [CCSS.ELA-Literacy.W.5.1](http://www.corestandards.org/ELA-Literacy/W/5/1/) Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
* [CCSS.ELA-Literacy.SL.5.1.a](http://www.corestandards.org/ELA-Literacy/SL/5/1/a/) Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
* [CCSS.ELA-Literacy.SL.5.1.d](http://www.corestandards.org/ELA-Literacy/SL/5/1/d/) Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.

**Math Standards**

* [CCSS.Math.Content.5.NBT.B.7](http://www.corestandards.org/Math/Content/5/NBT/B/7/) Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

**Arts Standards**

* Visual Arts Anchor Standard 3 Refine and complete artistic work.
* Visual Arts Anchor Standard 5 Develop and refine artistic techniques and work for presentation.
* Visual Arts Anchor Standard 6 Convey meaning through the presentation of artistic work.

**Soft Skills:**

* Collaboration

-working together to research the potential materials being used.  Debating ideas before deciding on one.

-How will our team come to decisions and compromises when designing one package only?

* Critical Thinking

-Choosing which materials would be best bought eco or non-eco friendly and then defending their answer

-How will I be able to relate my product’s purpose and target audience through colors and one design only?

* Communication

-writing an opinion paper based on student’s research that effectively communicates their point of view.

-trade offs, coming to consensus on a budget decision

-How will I communicate what is inside the package through the color theory and design on the outside of the package

-Presentation Skills

* Creativity

-In considering how their design could be simplified to use the least amount of cost of materials

-What colors will make my graphic stand out?

**Locally and/or Personally Relevant for Students:**

Students are building an understanding of the decisions made by local and global companies that impact consumers as well as the communities where the companies exist (packaging plants, shipping, etc.). They are developing recognition of design and decision making processes made by the packaging industry that impact all consumers, such as decisions about design for accessibility.

**Connections to career and educational pathways:**

**Prototyping and manufacturing-** engineers, 3-D printers, data scientist, mechanical engineer, research and design, occupational therapist, sociologist, speech and hearing pathologist

**Procedural Writing-** Engineers, English majors

**Researching sustainable resources-**Sourcing and supply chain

**Budget and purchasing-**Financial officer, accountant

**Volume and surface area-** Packaging engineers,

**Art and Design-** Graphic designer, audio/video engineer, cinematography, advertisement, brand management, consumer behavior and marketing, consumer research

**Testing and evaluating solutions-**Validation engineer

**Creating an ad-**Graphic designer, audio/video engineer, cinematography, advertisement, brand management, consumer behavior and marketing, consumer research