



Drexel-SDP GK-12 LESSON

- *Packaging Spaghetti*
- *Engineering*
- Subject Area (Unit): *Engineering*
- Concept: Engineering

Objectives: This is the first engineering design exercise for the students in a sequence of design activities. It is simple, but introduces them to some basic concepts in engineering. The lesson follows the original lesson on what engineering entails but providing them with a set of constraints and materials and asking them to accomplish a task with them. Their goal is to successfully package and mail raw spaghetti through the US Postal Service. They are given 15 strands of raw spaghetti and their choice from an array of various materials for packaging. Each team is given a standard envelope and must design a way to send the spaghetti through the mail without having it break. They are evaluated on the amount of spaghetti that survives the mail as well as the weight and thickness of their envelopes. The team with the highest score from the provided scoring formula wins after the envelopes have arrived through the mail. This lesson has been modified from “Design Packing to Safely Mail Raw Spaghetti” available on www.prek-12engineering.org.

Students will be able to....

- Begin using their creative skills to engineer a solution to a problem
 - Understand the role of constraints in engineering solutions
 - Begin to understand methods for testing and ensuring their designs are optimal
- PA Academic Standards: *3.1.7AC, 3.2.7BC, 3.4.7AC, 3.6.7BC, 3.7.7E,*
 - Grade Level: **6**
 - Setting/Group Size: Classroom split into small groups or working as individuals.
 - Duration/Time Required: *1 60 minute session*

Materials List: (A wide array of different materials can be used for this project, below are listed some suggestions)

8"x11" envelopes

Raw spaghetti – preferably the more brittle type to increase the challenge

Cotton Balls

Bubble wrap

Straws

Q-tips

Rubber bands

Styrofoam plates

Paper Clips

Tape, Staples, Glue

Context: Most people think that engineering only requires skills in math and science. Many people fail to recognize the “art” in engineering and that creativity is as important if not more important in engineering as math or science skills. Engineering school teaches thinking skills, so that students learn to understand problems, recognize the tools available to them and then find a creative solution based on what is available. They have to deal with constraints, such as environmental and societal impacts of a project as well as issues related to budget and time available to complete a project.

Methods and Procedure: Being a discussion of what might happen to something that travels through the mail. What conditions might be created that could break or destroy a package that is sent.

Present the students with the task at hand. Explain the materials provided and engage in a short discussion on ideas that might be useful in their designs.

Hand out the envelopes and ask each group to write the school’s address on the front before they begin. Then ask them to sketch a few ideas that they might use in their packaging design.

Explain the scoring criteria. Their final score is based on the following:

$$Score = \frac{15}{SpaghettiPieces} \times \frac{100grams}{EnvelopWeight} \times \frac{3cm}{EnvelopThickness}$$

Tell them that the constraints are keeping the weight of the envelope as light as possible, while keeping the thickness as thin as possible. They must be able to place the spaghetti in the envelope and remove it without destroying or dismantling their design as well.

Once this has been explained, ask the students to decide in their group what materials they are going to need from the list of materials provided and then to come up to retrieve what they need for their design.

Give them sufficient time to create their packaging, while encouraging them to test their design in a manner that might reproduce what happens while the package travels through the mail.

Finally, ask them to seal their envelopes for collection.

Mail the envelopes back to the school and have them unpack them to calculate their scores.

Assessment: After scoring is finished, ask some students to comment on what techniques worked and what different. Was there anything unexpected that happened? How might they have better tested their design before they finished to get a better result?

Project Score
Science Journal Entry

- Keywords: Wireless Communication
- Author: Eric Gallo