Activity: Engineering Project

FOR THE TEACHER

Summary
In this activity, students work together in a small team in order to solve a problem and achieve a common goal. Students will need to work collaboratively in order to be successful. They will be required to communicate their ideas both verbally and in written form, assign duties, design and carry out a procedure in this activity. They will also be challenged with problem solving when/if their original plan fails.

Grade Level
Middle or High School

Objectives
By the end of this activity, students should be able to
- Work collaboratively with their peers in a cooperative manner.
- Communicate specific, reproducible steps for carrying out a procedure.
- Analyze a process and improve the design if a plan fails.
- Reflect on the process for accomplishing a task.

Chemistry Topics
This activity supports students’ understanding of
- Engineering
- Communication
- Procedures
- Collaboration

Time
Teacher Preparation: 10 minutes
Lesson: 60 minutes

Materials
- One puzzle box (30-48 pieces) for every two to three students
- Any additional problems (see below for explanation) you might choose to add in each box

Safety
- No specific safety precautions need to be observed for this activity.

Teacher Notes
- This a team building activity that I generally do on the first or second day of school. It helps to gets kids communicating and working together on a task.
- In this activity students work together in small groups of 2-4 students to put together a 30-48 piece children’s puzzle (the kind with no frame). A simple task, but students struggle with creating a specific written plan that communicates the procedure. For
example stating in the plan the need to: turn the pieces over to see the picture side, find the corners, build the edges first, match the color or pattern or shape.

- I give out a box to each group randomly through the luck of the draw; I raffle the numbers that match a labeled box.
- I purchased my puzzles at second-hand stores (ie. Salvation Army or Goodwill). Great bargains can also be found at garage sales and dollar stores.
- The role of the teacher during this activity is observe and ask questions. When asked a question my typical response is, “what does the team think you should do?”
- In order to make this task a little more challenging, and thought provoking consider some of the following suggestions depending on the age and ability of your students:
  - Remove a piece from the puzzle.
  - Add a piece from another puzzle that clearly doesn’t fit with the puzzle in the box.
  - Place more than one of the same puzzle piece in the box.
  - Remove the picture from the puzzle, so the pieces are blank, so students don’t have a guide to know what the final product should look like (or use a puzzle that doesn’t have a picture printed on it).
  - Use a puzzle that doesn’t have straight edges.
  - Give a group a 3D puzzle.
- After groups have completed their building task, I follow-up with a whole class discussion and ask students to share their answers to the questions.

FOR THE STUDENT

Lesson

Engineering Project

Background
Louis Pasteur said, “Chance favors only the prepared mind.” Engineers think about and design solutions to real-world challenges in society. Chemists and other scientists examine the physical world and attempt to explain how and why it is the way it is. Scientists and engineers need to work together. Engineering without science could be haphazard. Without engineering, scientific discovery would be a merely an academic pursuit. To be successful in chemistry you need to develop your scientific, communication and problem solving skills. Through this simple, hands-on activity you will get an idea of some of the skills needed to engage in scientific inquiry and engineering design.

Materials
- A box of pieces for your building project

Procedure
1. Read the tasks given below including the follow-up questions, and then divide the duties for your group:
   a. One report needs to be written for your engineering group.
   b. Your report should include a thoughtful, developed plan: Write and number the steps you plan to take from start to finish in constructing your project. These steps should be specific enough to be reproduced by someone else.
c. Follow your plan step by step to construct your project.
d. Record all observations and any problems or changes made to the original plan during construction.

**Follow-up Questions**

Answer the following and include your responses in your group’s engineering report:

1. How did you divide the duties to accomplish your task? Describe the role of each person in your group.
2. Did your “building project” go as planned? With what step (or steps) did you encounter a problem or need to make a change?
3. How did you resolve any problems encountered?
5. What could you have done differently to improve your design?