

PIPE CLEANER TOWERS ACTIVITY

Grade Level: 4-12+

Group Size: 3-4

Time Required: 15-20 minutes

Mess-Up Factor: 1 (Setup and Mess Factor: 1 to 10 scale – 10 being the most intense)

Expendable Cost Per Group: 1 US Dollars

Summary: Students will use simple materials to build the tallest, free standing tower within the time constraints and using the efforts of all team members.

Engineering Connection: Engineers work with many different types of materials and must design within the restrictions of a particular problem or project. Cost, type of materials available, time, and other constraints often dictate many aspects of a design. This activity helps students to appreciate the planning, resources, and constraints that often govern an engineer's work, as well as the benefits of team work and diversity.

Educational Standards: To be outlined

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Learning Objectives:

- Concept of limited resources and constraints
- Teamwork
- Project Planning

Materials: Each group will need:

- 15 Pipe Cleaners (bundles of 14 with one wrapped around to secure and separate them)

Safety: Caution students that the ends of the pipe cleaner wires may be sharp.

Introduction: Use the information from the section titled 'Engineering Connection' to introduce the activity to students. Tell them that they will be using 'high-tech' materials to build the tallest, free standing tower that they can within certain time constraints. Check for understanding on the term 'free-standing' by asking one of the students to define it for the rest of the group. Then show the students your high-tech materials: pipe cleaners!

Procedure:

1. Either break the students up into groups of 3 or 4, or give them 10 seconds to quietly and quickly choose their team members. The age of students will dictate the procedure that you use.
2. Pass out bundles of 15 pipe cleaners to each group.
3. Tell the students that they will have five to ten minutes to build. Ask for any questions and then tell them to begin.
4. After two to four minutes have passed, tell them to freeze. Tell the students that engineers often work within the restrictions of project plans and budgets and that sometimes resources become available or are eliminated after a project has begun. To symbolize this, for the next five minutes, each team member must place one arm behind her/his back. This restriction generally elicits chatter and enthusiasm amongst the group. Tell the students to continue, and that they have three minutes left to build (Modification: you may alternatively take a pipe cleaner from each group to symbolize a budget cut; however, restricting building to one hand per team member forces the students to work together to accomplish their task).

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5. After another two minutes, stop them again. Tell them that, as engineers, we work in a global marketplace. This means being able to communicate with people from many different cultures and countries. Their business has just been purchased by a company based in (insert your favorite esoteric country here— we use Eritrea). Since they do not speak any of the native languages of this country communication is difficult. To symbolize this constraint, the students may no longer talk. Tell them they have one minute to finish.
6. Count down from ten and ask all the students to stop working on their structures. Walk around the room and make note of all the different shapes and designs that the students have created. Compare the towers, commenting on the good points of their design (sometimes the only good thing is to say that they have a future in abstract art) and find the tallest, free-standing structure amongst them. Depending on the age of the students, you may make this a big production. Note: the most successful designs will generally incorporate a small base made from just one pipe cleaner.
7. Ask the students if everyone came up with the same design, and why not? They should answer that they all have different ideas, and this speaks to the importance and role of diversity in engineering and problem-solving. Discuss the different shapes that the teams used for the foundation of their structure, and how they may have used beams and columns to support their structures. Indicate that architectural/civil/mechanical engineers use these same principles, although with different materials, to construct homes, commercial buildings, bridges, and even toys. Finally, wrap up by asking the students if they could do a better job if they performed this activity again or with more time? Tell them that engineers look to improve existing designs and may try things many, many times before they find the optimal solution.
8. Cleanup – Tell students that their prize for putting together such inventive designs is that they must return the pipe cleaners to you exactly the way that they received them.

Activity/Age Scaling: As the students are working, assess how quickly they are completing the task and be flexible on time. Older students will finish this activity more quickly, while younger students may be paralyzed by the planning stage. If the groups are succeeding too fast, shorten the time between challenges. If few groups are experiencing success, give more time between challenges.

Depending on the age of the students, you may need to assist them in beginning or planning their structure. Ask any struggling individuals or groups what every building begins with – a foundation, and to consider what shape it could be. This should help to get them moving in the right direction.