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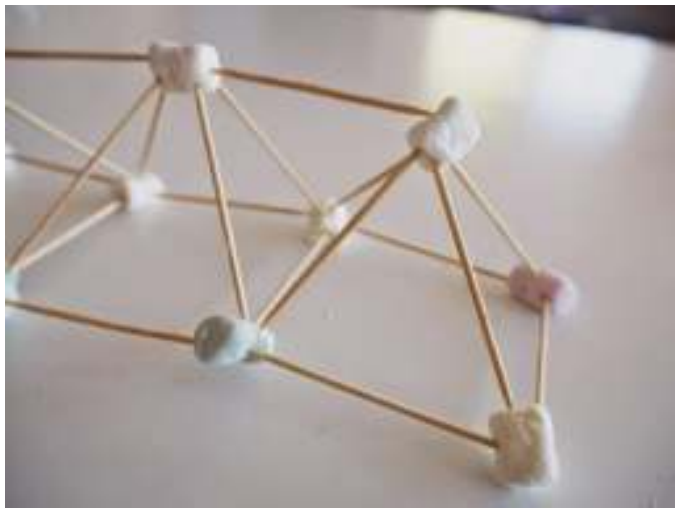
Mechanical Engineering: Build a Bridge

Activity:

Using the given materials (wooden cuticle pushers, normal-sized marshmallows, and 1 plastic knife), you and your partner build the strongest bridge you can in the given time limit! It can be any size, shape or height, it just has to withstand the test weight at the end of the challenge!



Rules and Requirements:

Two students work together to make one bridge, you have to both design and construct the bridge within the time limit given, you cannot use the plastic knife as a part of your bridge - they are meant to cut the marshmallows.

Real World Examples and Social Impacts:

This activity shows the importance of time management and working with limited materials. As you will see while attempting the activity, the construction process of a sturdy bridge is challenging given only two materials. You will also notice this challenge becomes more difficult when a time limit is enforced! Think about how difficult it must be to build a real bridge! Engineers have to learn how to overcome these challenges and think outside of the box in order to complete projects successfully, and on time.

Try it at home: Using toothpicks, pencils, pencil erasers, marshmallows, or any materials you can find at home, see if you can make a small bridge! It's supposed to be a challenge - be creative!

More Information:

Time management techniques: trainingstation.walkme.com/what-is-time-management
Activity:

www.gordiehoweinternationalbridge.com/en/build-a-bridge-challenge

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Mechanical Engineering: Communications Challenge

Communications Challenge

Materials:

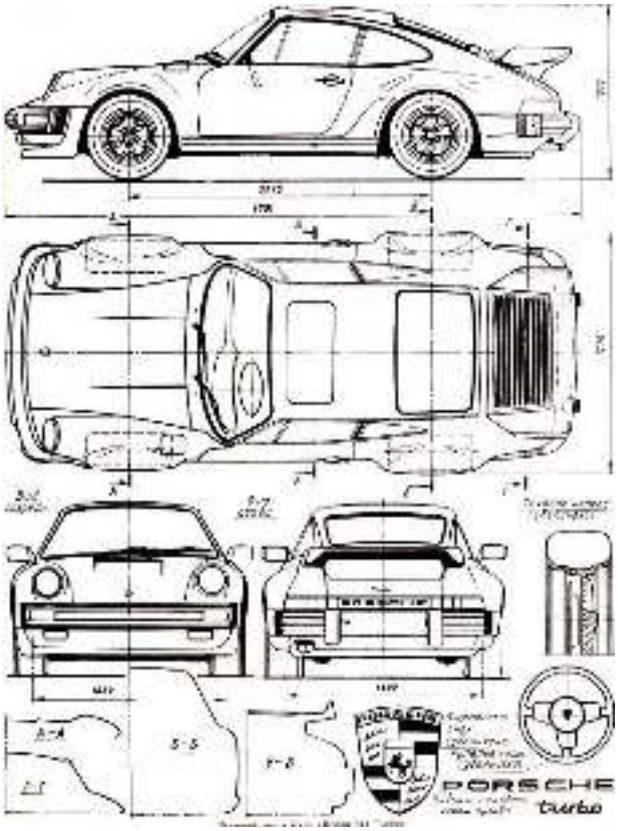
- Paper
- pens/colored pencils
- Various household objects

Activity:

Test your communication skills in this challenge!

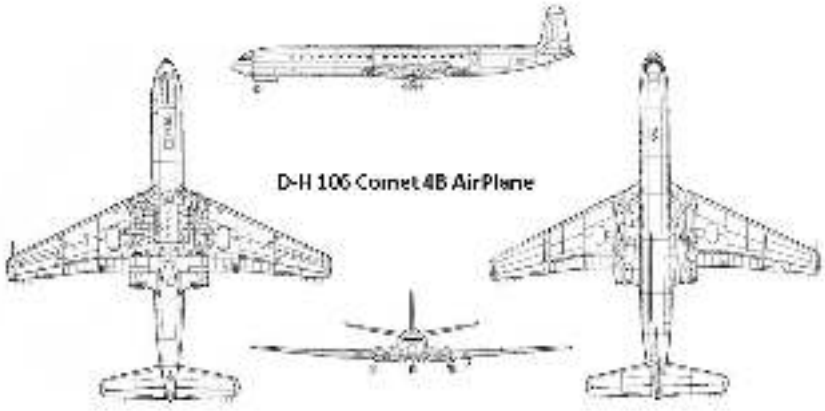
1. Split your group into two teams for this activity. One team will get a finished project and the second team will get all the objects but not be able to see the finished project.
2. The first team has to give either verbal, written or drawn instructions and help the other team build the proper structure.

For an added challenge, set a time limit on either team!



Societal Impact/Real world examples:

What makes communication effective? Each member of the team will have to interpret what they see in our example project, and relay that information effectively to the other team in order for it to be built correctly. Communication relies on teamwork, logical thinking and creativity - all skills that are used every day in both professional and social settings.



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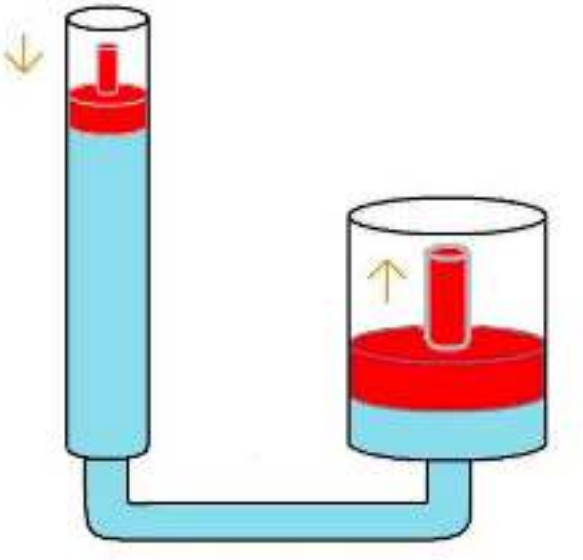
Mechanical Engineering: Dueling JudoBots

JudoBots and Hydraulics

These JudoBots use hydraulics and fluid mechanics to move. Hydraulics, as shown in the model below, is used here by applying pressure to one side of the system, the water is forced to move through the tubing to the other side. Therefore when you push down on the syringe that connects to the grappling arm (left), water is forced through and pushes out the other syringe and raises the arm.



Real world JudoBots:

Hydraulics is an old technology, dating all the way back to ancient Egypt, where they would use this power to water crops (irrigation) and create water clocks, one of the oldest methods of telling time.

Nowadays, hydraulics is mainly used to carry more weight than humans could ever have the strength to. We create fluid pressure to power:

- Crane arms
- Dump trucks
- Braking systems in cars
- And even our own bodies! Our heart pumps blood out and pulls it back in just like the syringes

Want to make your own JudoBot?

Visit https://www.instructables.com/id/Hydraulic-JudoBots/ for in depth instructions

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Mechanical Engineering: Fling-a-Mallow

Materials:

- Popsicles sticks
- Rubber bands
- Bottle caps
- Plastic spoons

Activity:

Build a working mini-catapult and aim marshmallows into the buckets! Work out the amount of pressure and angle you're using to launch them to get them to where they need to be.

Rules and Requirements:

Don't break any of the materials provided and also don't throw the marshmallow by hand!

Real World Examples and Social Impacts:

This activity aims to improve the understanding of the relationship between velocity, angle of projection and distance. Participants will get a short introduction to these concepts and will be asked to perform the tasks, which will let them experience the theories they had just learned. This will allow the participants to gain a better sense of projectile motion and gravity.

In the real world, catapults are used for many things:

- An aircraft carrier makes use of a catapult to help fly planes off the runway
- Pumpkin chunkin competitions use catapults to launch pumpkins across a field and is an autumn tradition.

More Information:

Aircraft carrier catapult:
https://science.howstuffworks.com/aircraft-carrier3.htm

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Mechanical Engineering: Float a Boat

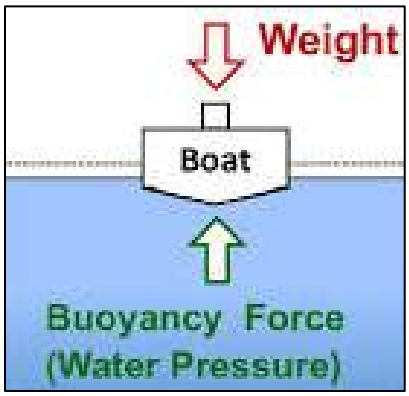
Activity

Design and build a floating object out of the materials given to you. The goal is to build the structure that can handle the most weight before it takes on water and sinks.

1. You will be given one minute to brainstorm ideas and come up with your design.
2. When brainstorming time is up, you will have four minutes to construct your creation.
3. Once the team has finished with construction, someone from the team will load the weights one by one into the boat.

Materials

Aluminum foil
Popsicle sticks
Rubber bands
Tape
Construction paper
As many weights as needed



Societal Impacts and Real-World Examples

This activity shows the importance of planning out a project before beginning the build process. It also teaches students to think about what materials make the most sense for their specific task and goals. Students will also notice that having a short build time makes it much more difficult to complete more complex designs.

A real-world example is when designing a boat, engineers have to calculate the amount of water that needs to be displaced to keep the boat afloat-it must displace its weight in water. Additionally, when designing something new, such as building or a car, the properties of the materials that are being used must be considered to make sure that the product will work properly, is structurally sound, etc.

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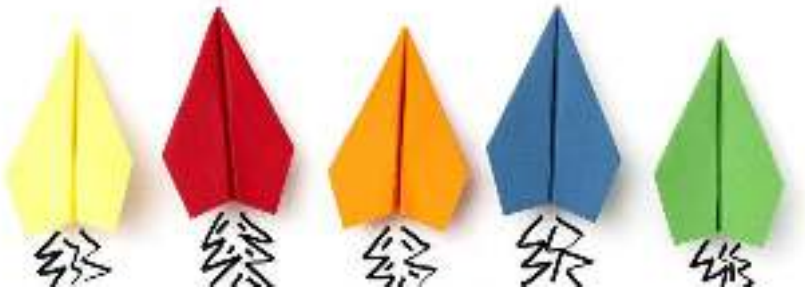
Mechanical Engineering: Flying Planes

Materials:

- Paper
- Different Colored Markers
- Masking Tape



Activity:

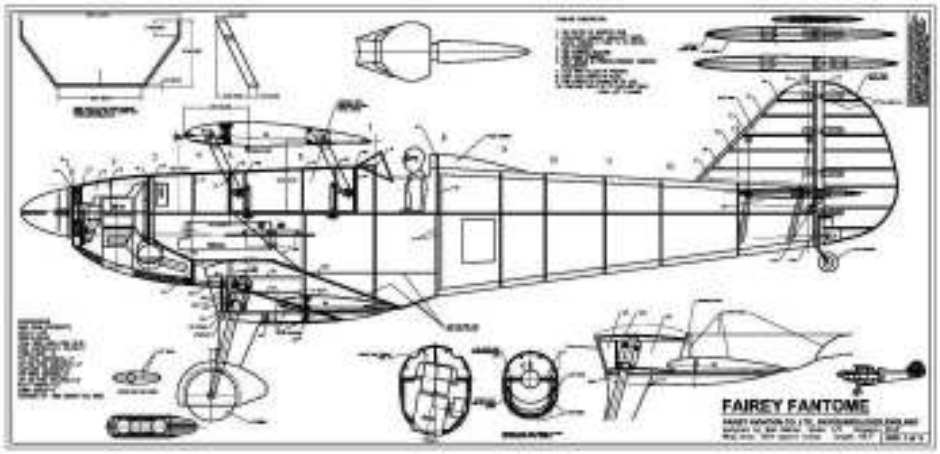
Build a plane using just some paper! You can either construct it based off of a design or make your own design. Decorate your plane with colored markers and have a flying contest! Try out different designs and see which one can fly the farthest.

Societal Impact:

Constructing a paper plane shows the importance of how the shape of the plane can impact how far in the air it can fly as well as how far it can travel in overall distance. If you're not creating a design from scratch, this can show the significance of following instructions and being able to replicate a design, like a blueprint. This can also show the different constructions of a model plane.

Real World Examples:

Some real world examples of constructing paper planes include designing and building an airplane, following a blueprint to replicate a design, and seeing the forces of thrust, drag, lift, and gravity acting on the plane.



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Mechanical Engineering: Tricky Towers

Materials:

- 10 pieces of angel hair pasta
- 5 normal/jumbo marshmallows
- 5 mini marshmallows
- A strip of masking tape

Activity:

Using the given materials, your job is to build the tallest freestanding tower!

1. Students will get into teams of 2-4.
2. Everyone will be given a minute to think of ideas and how to approach this challenge.
3. After brainstorming, you will have 4 minutes to construct your design.

Rules:

- Must take hands off the tower when the activity ends
- Tower must be free standing at time of measurement
- You can't get more tape than what was given to you

How did working in a team help you build your tower? What improvements would you make in your structure?

Real World examples and Social Impacts:

This activity aims to provide an understanding of material science and structure integrity. Participants will be able to use the materials given in any way they want, but they must use them effectively to build a well-supported structure.

As engineers, we are tasked with creating things out of materials that may have different properties and uses. Some materials may be stronger than others in one way but not others.

In the real world, knowing the strength of different materials is useful in designing strong, well supported buildings.