Becoming a Scientist

All scientists use the Scientific Method when conducting research and learning about the unknown. In this activity, participants will learn about the Scientific Method and use it to learn about density.

Time Required

20-30 minutes

Goals and Outcomes

- Understand the parts of the Scientific Method and apply it in different science situations.
- Leadership Outcomes:
  - Seek the information she needs to understand the full picture
  - Challenge herself to understand and consider different perspectives.
  - Innovate to create positive impact.

What You'll Need

- Materials for one of thet two activities listed below
- Copy of the Scientific Method Sheet for reference

Before the Activity

- Prepare materials in advance and have them ready for the group, as listed in the activity sheet.
- Participants can start by reflecting on the following questions:
  - What do you do when you have a question and don't know the answer?
  - How would you solve a problem that someone gave you?
  - How do you typically react when you don't know how to do something?

What To Do

Follow the instructions as listed in the activity of your choosing.

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After the Activity

- Participants can reflect on the experiment using the following questions:
  - Now that you have learned about the Scientific Method, where might you use the same steps?
  - What other experiments do you want to explore the “why” about and how would you use the Scientific Method to answer your questions?
  - What are some problems around the world where you could use the Scientific Method to help research?

Tips and Tricks

- Encourage participants to give the facilitator the answer first before explaining why something happens. This helps them learn about the Scientific Method and apply it at the same time.
- Age
  - With older participants, the experiment can be done in small groups.
  - With younger participants, consider having a facilitator or leader run the experiment in partnership with the participants
- Size
  - For larger groups, consider having multiple setups of the experiment for easy access and use.

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Activity #1 – Egg Density Challenge

Materials

- Salt
- Spoon
- 2 hard boiled eggs
- 2 glasses of water

What To Do

- Place each egg into each glass slowly.
- Discuss what participants see is happening to each egg. The facilitator should identify that participants have made an observation. This is the first step of the scientific method.
  - Answer: Both eggs should sink to the bottom of the glass.
- Participants will be asked: "What would happen if we added salt to one of the glasses only? What would happen to the egg?" This is identified as the question.
- Participants will brainstorm different answers to the question posed in Step 3 and that will be their hypothesis.
- Participants will remove the eggs and then add salt in one glass. Participants will write down their observations.
- Participants will repeat Step 5 until they see a change in the behaviour of the egg. This is known as the experiment.
- Participants will answer the following questions:
  - What happened to the egg? Why might the egg act like this?
  - How many spoons of salt was needed?
- Using the paragraph in tips and tricks, participants can learn more about density and why the egg floats.

After the Activity

- Think of other items in the house that might float and how that can be tested with the water.
- Think of real-life examples of density change.

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Activity #1 – Egg Density Challenge

Use the following information to help support the explanation of the experiment

For an object to float in water, it depends on the density of the object and the water. In this case, the density of the object doesn't change but the density of the water does. An object will float if it is less dense than the liquid it's in. An object is buoyant if it floats in a liquid. Liquids with higher densities have more buoyant force and it is easier for objects to float in them. Buoyant force is an "upward push" of the liquid.

Adding salt to the water means that its density and buoyant force will increase which means the egg floats. More salt means the water is denser and more buoyant force is included so that the force is greater than the weight force.

Real Life Examples:

- Dead Sea – salt levels are higher in the sea and people can float very easily.
- Cruise ships – ships might be big, but they are very hollow, which means they have low density and can float in the ocean which has higher density.

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Activity #2 – Building Quakes

Materials

- 25 mini marshmallows, small balls of clay or a material that is soft that can connect toothpicks/skewers
- 40 toothpicks, small skewers or something sharp at two ends
- 3 plates or trays (A flat surface will work as well)

Before the Activity

Based on the instructions provided below, build three different structures for the participants to analyse.

What To Do

- Display the three different structures to the participants. Ask them to describe each structure. The facilitator should identify that participants have made an observation. This is the first step of the scientific method.
- Participants will be asked: “What would happen if there was an earthquake, and the ground was shaking really hard?”. This is identified as the question.
- Participants will brainstorm different answers to the question posed in Step 2 based on the structures that they see and that will be their hypothesis.
- Participants will take turns shaking the tray back and forth, similar to an earthquake and make an observation.
- Participants will repeat Step 4 for each tray. This will be identified as the experiment.
- Participants will answer the following questions:
  - Which structure was the strongest?
  - Why was that the case?
  - What could you add to the weaker structure to ensure that it is stronger?
- Using the paragraph in tips and tricks, participants can learn more structures and how to make building stable.

Activity #2 – Building Quakes

After the Activity

- Participants can use the following questions to reflect:
  - Think of other buildings in your area. What makes them stable?
  - Can we always see how stable or how strong a building is?
  - What could you do to make a building more stable?
- If time permits and there are extra supplies, encourage the participants to take apart your designs and get them to create the tallest and strongest structure they can think of.

Use the following information to help support the explanation of the experiment

Structures are more stable when they have a wider base and are symmetrical. This is because the forces can become more easily distributed in an even manner across the bottom and they can have greater area to have the forces push on. Cross bracing is a technique used by the pyramid and the cube where there are x-shaped beams added to the initial structure. These provide more support to the building and resist any twisting of the building when the earthquake is occurring.

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The Pyramid

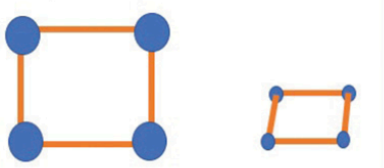
Materials

5 marshmallows 

8 toothpicks 

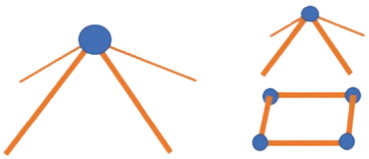
Step 1

Use 4 marshmallows and 4 toothpicks to build a square as pictured below.



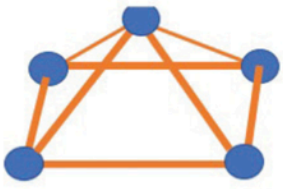
Step 2

Place the other 4 toothpicks in 1 (additional) marshmallow. Place each toothpick at a 45 degree angle from the centre of the marshmallow. Think of the marshmallow as the top of the pyramid.



Step 3

Place your pyramid top onto the square base to complete your pyramid.



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The Cross-Braced Cube

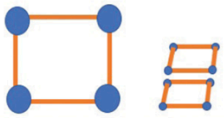
Materials

8 marshmallows 

20 toothpicks 

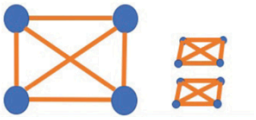
Step 1

Use 8 marshmallows and 8 toothpicks to build 2 squares.



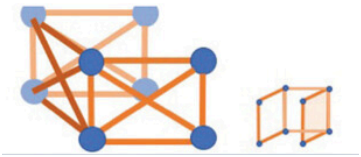
Step 2

Add diagonal cross pieces to each square, using 2 toothpicks per square (4 toothpicks total).



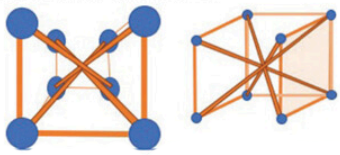
Step 3

Connect 2 of your completed squares with 2 toothpicks (one at the top and one at the top and bottom). Then, using 2 more toothpicks, add an "X" shape between them. You should now have 3 sides of a cube.



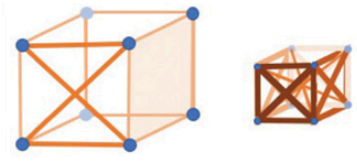
Step 4

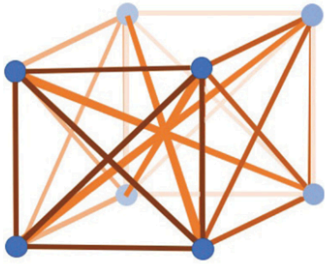
Add cross-brace to the middle by connecting diagonally opposite corners of your cube with 4 toothpicks. For example, one toothpick should connect the lower-left front corner to the upper-right rear corner.



Step 5

Using your last 4 toothpicks, connect the open corners of the front of the cube (with 2 toothpicks) and add 2 cross-braces.





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The Leaning Tower

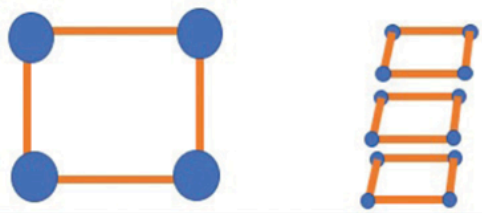
Materials

12 marshmallows 

12 toothpicks 

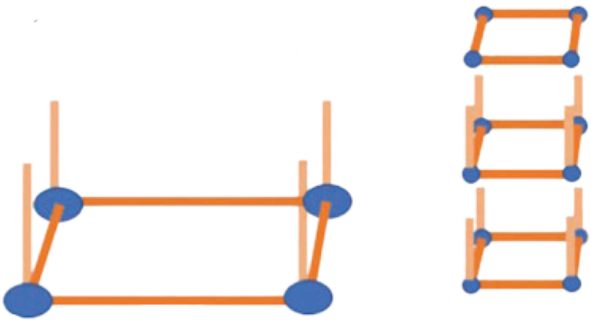
Step 1

Use 4 marshmallows and 4 toothpicks to build a square as pictured below. Repeat this for a total of 3 squares.



Step 2

In 2 of the squares, place a toothpick vertically in each marshmallow corner as pictured below. Leave the third square as it is.



Step 3

Stack your 3 squares, using the vertical toothpicks as connectors. Place the square without vertical pieces on top.