

Station 1: Are You Weak in the Knees?

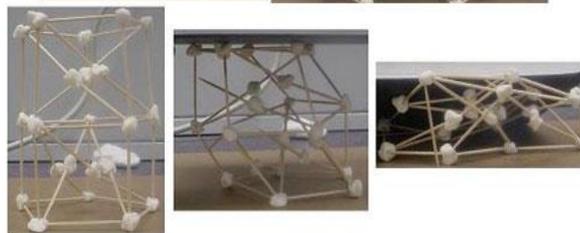
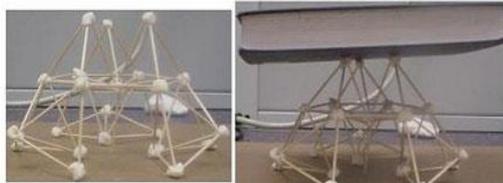


Directions:

1. Your mission: Make the strongest and tallest structure possible using only pasta and marshmallows. Just like an engineer, you will have constraints; you will only have a limited amount of materials to get the job done. Think about forces that will be acting upon your structure.

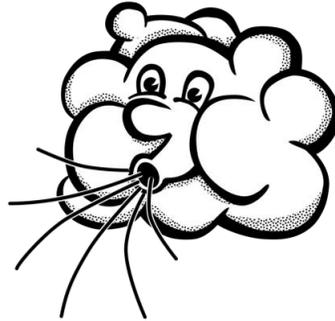
Compression - Which parts will be pushed together?

Tension - Which parts will be pulled apart?



2. Once you have built your structure, measure and record its height and weight on your Engineering notes page.
3. Then determine how much weight your structure supports by adding a cardboard table (remember to determine the weight of this as well) and slowly adding Gram Stackers. Will it hold 5 grams? 10 grams? 20 grams?
4. After determining your maximum weight held, write down what design implications this has. How will you build your skyscraper with this in mind?
5. Extension: Continue investigating structures using the "TrussMe" App.

Station 2: May the Force Be With You!



Directions:

1. Your mission: You want a structure that will stand no matter what force comes against it. To achieve this, you must create a strong frame. Create a frame using I-beams that will be strong and stable despite any loads or forces it encounters.
2. Before building your structure, research forces and how engineers have made adjustments for them using the **blue** sites on the Skyscrapers Symbaloo page. Make sure to read "High Winds Beyond This Point" on the "Science of Structures" site.

<http://www.symbaloo.com/mix/skyscrapers2>



3. Once your research is complete, practice building a strong core by creating I-beams to create a two-story frame. Follow the directions and images provided by your teacher.

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4. Once your frame is complete, shake the table. Does your structure fall down? Blow on your frame? Does it come apart? Shake your frame? Does it stay together and upright? Place a book on top. Can it withstand gravity?
 5. What design implications does this have?

Station 3: Look Out Below!



Directions:

1. Your mission: Investigate how a foundation can impact a skyscraper and what solutions can be put in place to correct a foundation problem.
2. Using the **red** site on the Skyscraper Symbaloo page, investigate how a foundation has impacted The Leaning Tower of Pisa. Then watch "The 1,000,000,000.00 Skyscraper Fail" where a skyscraper is demolished because it sank as much as 14 inches.

<http://www.symbaloo.com/mix/skyscrapers2>



3. To prepare for your investigation, use the site "Rafts and Piles" and read the "Skyscraper Cities" and "Firm Foundations" sections. Note what rafts and piles are and how engineers use these to prevent skyscrapers from sinking due to weight.
4. Investigate:
 1. Spread out a 1 inch layer of modeling clay (your soil.)
 2. Investigation 1 - Lay a piece of cardboard on it (your raft) and put a heavy book on top (your skyscraper.) Does it make a dent? Record your findings.
 3. Investigation 2- Instead of cardboard, stand a couple of toothpicks (piles) in the clay and rest the book on top. Does it keep your skyscraper standing? Record your findings.

4. Investigation 3 - Stand many toothpicks (piles) in the clay and rest the book on top. Does your skyscraper stand? Record your findings.

5. Reflect:

1. Using a raft or many piles spreads out the skyscraper's load. Foundations work by spreading the compression force from a skyscraper over a large area.
2. What design implications does this have? What would be your preference of foundations to build on?

Station 4: Going Green!



Directions:

1. Your mission: Investigate and design an environmentally friendly skyscraper.
2. Using the **yellow** links on our Skyscraper Symbaloo page, research how engineers and architects are building "green" skyscrapers and how some are dreaming of doing so in the future.

<http://www.symbaloo.com/mix/skyscrapers2>



3. Once your research is complete, plan out and draw a quick sketch of how you would incorporate environmental friendly elements into your own design.
4. Once your plan is complete, hand draw or use Google Sketchup to create your "green" skyscraper. Make sure to include an explanation of your design on your final product.