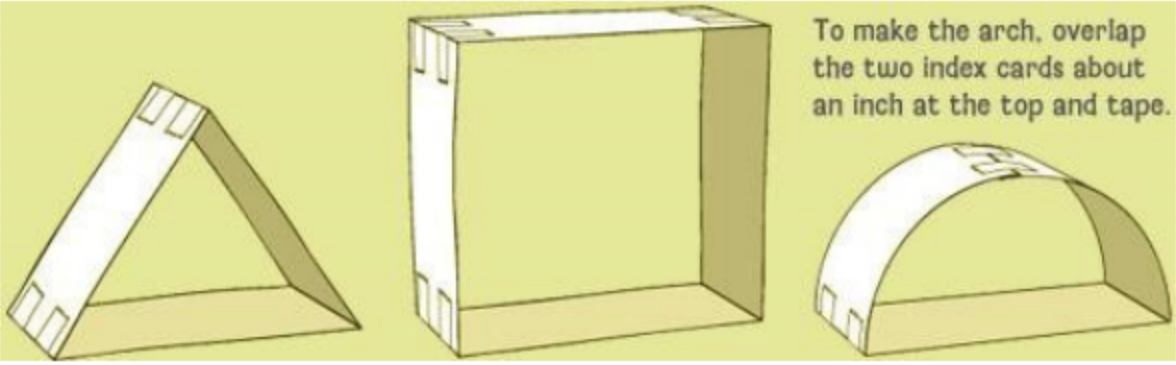
Project Build:

Span-Tastic Bridges

Activity Station Signs

STRONGEST SHAPES



- Choose **ONE** shape to use in building a bridge. *Shapes may be taped together but not taped to the table
- While it is resting flat on a table, test your bridge with toy cars to see how it holds up-- can it support one car without collapsing?
- Rest the bridge on two piles of books 8 inches apart-- can it still support **one** car without collapsing? How about two cars?

QUESTIONS TO ASK:

- What shapes did you try out in your bridge? Which one was the strongest?

- How can tape make your bridge stronger?

- What would happen if you doubled up the index cards-- would the bridge be stronger?

- How can you make your bridge look really good? Do you think that engineers care how a bridge looks?

WHAT IS THE SCIENCE?

- Building a bridge is an example of a hard problem that engineers know how to solve. They have the knowledge to plan one, design one, and build it, so that we don't have to worry about whether a bridge is strong enough for us to cross. To make a safe bridge that will last a long time, engineers often look at other bridges that are already built and try to imagine ways that they can improve on that existing design. In other words, they learn from mistakes made in the past and make old designs even better!

- If you push hard on one side of a square, pentagon, or other straight-edged shape, it will fold in on itself... except for one shape: the triangle! It is impossible to colllapse a triangle without breaking one of its sides-- for this reason, you will see triangles in lots of bridges. Triangle shapes in a bridge direct the weight of the bridge and the cars crossing it downward without bending.

SPANTASTIC BRIDGES DESIGN CHALLENGE

For this activity, you can either:

GO LONG:

- You and your partner should each use KEVA planks to build a tower at least **6" tall**, then **work together to connect your towers**.

GO HIGH:

- Use K'Nex to create a bridge **tall enough to allow a tennis ball to pass underneath**.

Please feel free to try both challenge activities!

QUESTIONS TO ASK:

- What do we use bridges for?
- How do bridges make our lives easier?
- How many different style bridges can you think of?
- What materials do we use to make bridges?

Too easy? Try adapting your challenge!

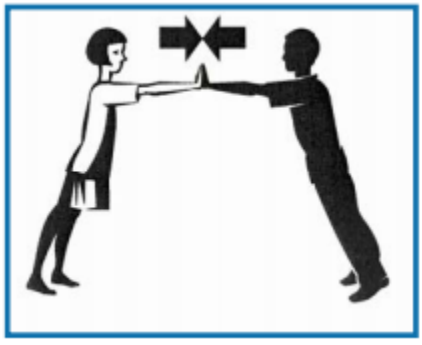
- ***GO LONG**: Move your towers further apart to have your bridge span a greater distance!*
- ***GO HIGH**: Raise your bridge even higher! Or see if you can simplify the design to use less pieces.*

HUMAN SUSPENSION BRIDGE

With a partner:

- Stand facing each other, grasp the other's forearms, and lean back.

- Stand facing each other a few feet apart, press your palms together, and lean forward.



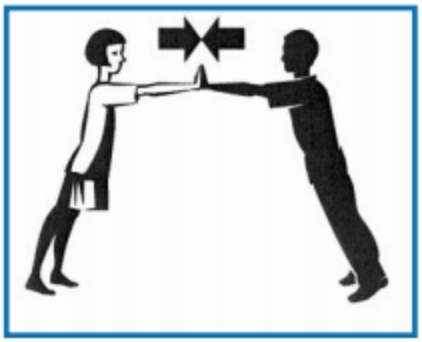
WHAT IS THE SCIENCE?

TENSION

When something pushes down on this position, it forces your arms to stretch, what we call being put into *tension*.

COMPRESSION

When something pushes down on an arch position, it forces your arms to push together, what we call being put into *compression*.



- All bridges are designed to use *compression* and *tension* forces however possible for stability, while withstanding any forces that would cause it to collapse.

STRONG PAPER STRUCTURE

Using **ONLY** newspaper and tape, build a tower that:

- stands at least **8"** tall.
- can support at least **one book**.

Pro tip: tightly roll newspapers from the corner to help distribute weight!

Too easy? Try making a tower that is at least 12" tall or can support more weight!

HAVING TROUBLE?

Try asking these guiding questions:

- What can make tubes stronger if they start to tilt or twist?
- If your structure collapses, what can you do to stabilize the base?
- If your tubes are wrinkled, lose, or dented, how will they perform in your structure?

WHAT IS THE SCIENCE?

- A piece of newspaper only weighs a gram or two, yet when it's rolled up it can support several pounds. Strength is created by rolling paper into cylinders-- cylinders are incredibly strong because they disperse stress evenly throughout their entire shape!

- Engineers think about load distribution when they build structures such as buildings and bridges. They need to make sure there are no weak sections. Engineers incorporate triangles, arches, and domes into their structures to distribute weight evenly, making them strong and stable.