STEM Activities Booklet

Activity 1:
LEGO Design Challenge

Description
One key concept in STEM is the ability to innovate to address a challenge. To do this, use 15 random LEGOs and create something (see categories) matching an assigned prompt. For example, if the category was inventions and the prompt was "outer space," someone could make a portable air machine so astronauts can breathe in space.

Materials
- Pack of cards
- 15 Unorganized LEGOs
- 1 Partner

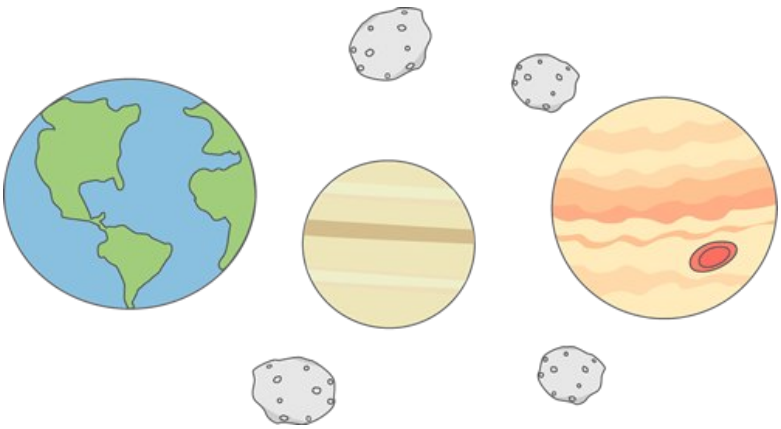
Instructions
1. **Both people:** Draw a card. The number shown is the category number corresponding with a category on the next page.
2. **Both people:** Draw another card. The number shown is the prompt number corresponding with a prompt on the next page.
3. **Individual:** Based on your category and prompt, create something using only the provided LEGOs.
4. **Both people:** After three minutes, pause.
5. **Individual (older person first):** Present what you created to partner

Activity 1:

LEGO Design Challenge Cont.

Categories:

A: Inventions
2: Tools
3: Technologies
4: Plants
5: Foods
6: Inventions
7: Tools
8: Technologies
9: Plants
10: Foods
J: Inventions
Q: Tools
K: Technologies



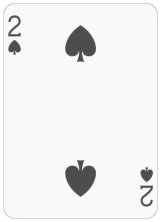
Prompts:

A: Outer Space
2: Under the Sea
3: Desert
4: Antarctica
5: Beach
6: Alien Planet
7: Superhero
8: Forest
9: River
10: Planet Jupiter
J: Planet Mars
Q: Planet Earth
K: Sports

Activity 1:

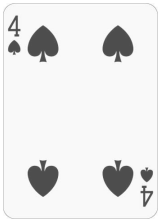
LEGO Design Challenge Example

Both people: Draw a card. The number shown is the category number…



⇦ Category 2: Tools

Both people: Draw another card. The number shown is the prompt number…



⇦ Prompt 4: Antarctica

Individual: Based on your category and prompt, create something using only the provided LEGOs.

Both people: After three minutes, pause.

Individual (older person first): Present what you created to partner

⇦ Heated shovel to remove snow faster.

Activity 2:

Paper Bridge Challenge

Description

The need to solve a problem with very limited resources comes about frequently in STEM. You will work to build a bridge using only two piece of paper that can hold as many markers as possible in three minutes or less. After the three minutes are up, bridges can be tested and modifications can be made for five more minutes.

Materials

- 2 Pieces of Printer Paper
- Markers

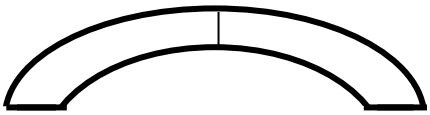
Instructions

1. Using the two pieces of paper, fold or modify it them in any way to create a bridge that can support the weight of at least one marker.
2. After three minutes, test how many markers your bridge can hold.
3. Modify your bridge as you see fit.
4. After three minutes, test your bridge again and determine if any changes in the number of markers your bridge could hold changed.
5. Consider your changes. What made the bridge stronger? What made it weaker? If you did this again, what would you change?

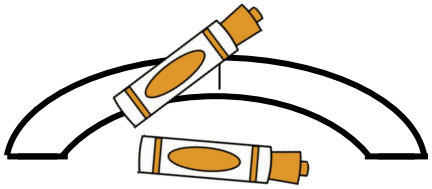
Activity 2:

Paper Bridge Challenge Example

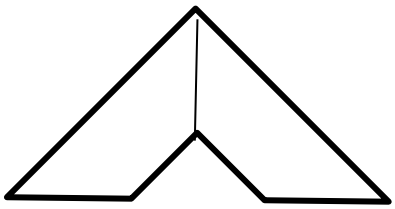
Using the two pieces of paper, fold or modify it them in any way to create a bridge that can support the weight of at least one marker.



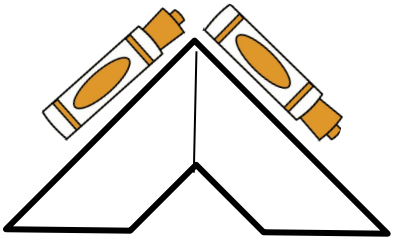
Ater three minutes, test how many markers your bridge can hold.



Modify your bridge as you see fit.



After three minutes, test your bridge again and determine if any changes in the number of markers your bridge could hold changed.



Activity 3:

Index Card Challenge

Description

One key concept in engineering is the soundness of a structure, or the ability of a structure to support its own weight. To demonstrate this, you will try to build the tallest possible tower with only ten index cards. These cards can be folded, stacked, or moved around, but there is no adhesive or tape to directly combine them.

Materials

- 10 Index Cards
- Ruler/Tape Measure

Instructions

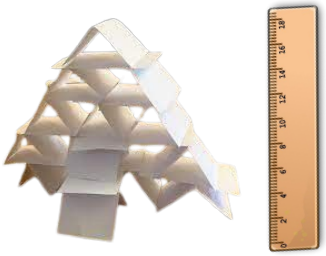
1. Combine index cards to create the tallest possible structure with no outside support (nobody holding the structure, the structure isn't leaning on anything)
2. After five minutes, measure the height of the tower.
3. Revise the tower, again aiming to increase the height of the freestanding tower.
4. After five minutes, measure the height of the tower again.

Activity 3:

Index Card Challenge Example

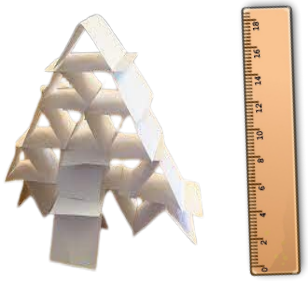
Combine index cards to create the tallest possible structure with no outside support (nobody holding the structure, the structure isn't leaning on anything)

After five minutes, measure the height of the tower.



Revise the tower, again aiming to increase the height of the freestanding tower.

After five minutes, measure the height of the tower again.



Activity 4:

Marble Track Challenge

Description

At all times, gravity is pulling on objects and bringing them to the ground. When objects move fast enough along a course, they can overcome the pull to the ground and follow a path—even upside-down! In this activity, you will create tracks for marbles to follow. As you complete each step, you can pause or move on for a greater challenge.

Materials

- Tape
- Paper
- Marble

Instructions

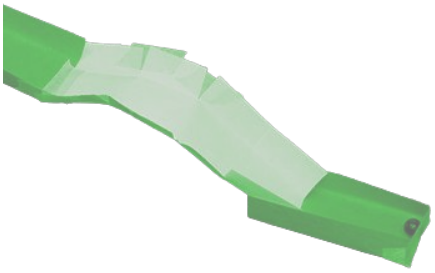
1. Using tape, attach one part of your track to a sound structure.
2. Form a shape allowing the marble to move straight down from your starting point to your ending point.
3. Test your track.
4. Make modifications if your marble does not make it from your starting point (where you release it) to your ending point (end of the track, onto a table or the ground).
5. Once your track is working, modify it to meet challenges on the next page as you're interested in doing so.

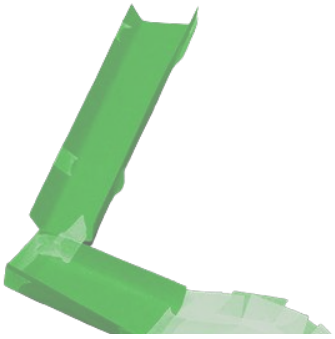
Activity 4:

Marble Track Challenge Cont.

Track Extension 1: Hill

To complete this, add some form of up and down element to your track. If your marble is not making it over the hill, consider how it gains speed and what you can change to increase its speed.





Track Extension 2: Turn

To complete this, add some form of upright twist or turn to your track. If your marble is not making it through, consider how it gains speed and what you can change to increase its speed.

Track Extension 3: Loop

To complete this, add a loop causing your marble to temporarily be upside-down. If your marble is not making it through, consider how it gains speed and what you can change to increase its speed.

Activity 5:

Paper Shapes Challenge

Description

In real-world engineering, structural integrity—the ability to hold an intended amount of weight—is a significant focus. You will use paper to create a 3D shape, which will have to hold the weight of a certain number of books. You will have ten minutes for the initial shape. After testing how many your structure can hold, you will revise for five minutes then retest.

Materials

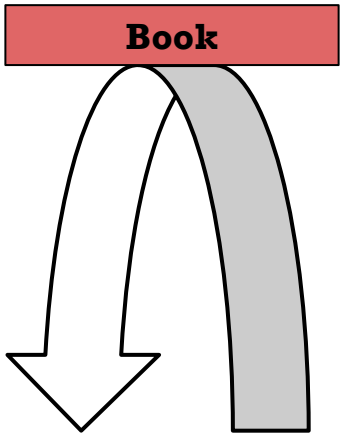
- 1 Piece of Paper
- Tape

Instructions

1. Using one piece of paper, fold it to make a 3D shape with both ends open.
2. Ensure that your shape is able to stand freely (stand with nobody holding it or helping it to stay up)
3. After ten minutes, stop.
4. Add books one-by-one to the top of your shape without any outside support in keeping it standing. Count how many it takes until your structure falls.
5. Take five minutes to modify your shape to try to hold up more books.
6. Stop and repeat Step 4.

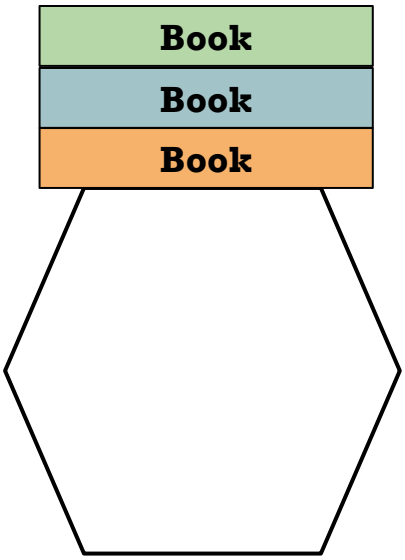
Activity 5:

Paper Shapes Example



After ten minutes, let's say someone decided to make an arrow shape and it was able to hold one book. They may want to revise this in order to ensure that their shape is able to hold more books without collapsing.

After five minutes of revising, let's say that same person decided to make a hexagon. This design may have held three books as opposed to one, which would mean they improved the structural integrity of their paper shape.



Activity 6:

Paper Chain Challenge

Description

In STEM fields, we are sometimes given specific parameters which we must meet despite constraints, or a set of limitations to what we can and cannot do. You are going to create a paper chain in which piece of paper are interlinked using only one sheet of paper. The goal is to get it as long as possible, but it must be able to hold itself together when it is held vertically.

Materials

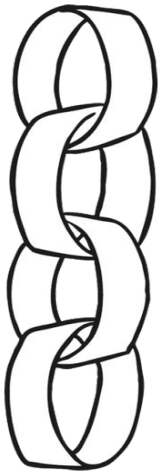
- 2 Pieces of Paper
- Tape
- Ruler (optional)

Instructions

1. Using one sheet of paper, divide it into sections.
2. Interlink these sections by having one piece of paper vertically looped through another.
3. After ten minutes, pause.
4. Test if your paper chain can withstand its weight by holding it from the top and letting it hang down. Measure the length of your paper chain.
5. For ten more minutes, use a second sheet of paper and create a new chain not using any of the previous one. Try to make this chain longer than your previous one while holding its weight..
6. Repeat Step 4.

Activity 6:

Paper Chain Example



After ten initial minutes, this is the layout for how it should be interlinked, though the length may vary depending on the size of each link. One would measure it from there.

When you are testing if it can sustain its own weight, this is the orientation it should be held in. Hold the top link and let the rest go.

After ten minutes of revising, the chain should hopefully have gotten longer. If this was someone's chain, they would remeasure and observe that it has gotten longer when compared to the initial one.

If it did get longer, consider how you were able to change this? What about the size changed in order to make it longer? If it didn't, how did it change? What could you do next to make it longer?

Great Job!