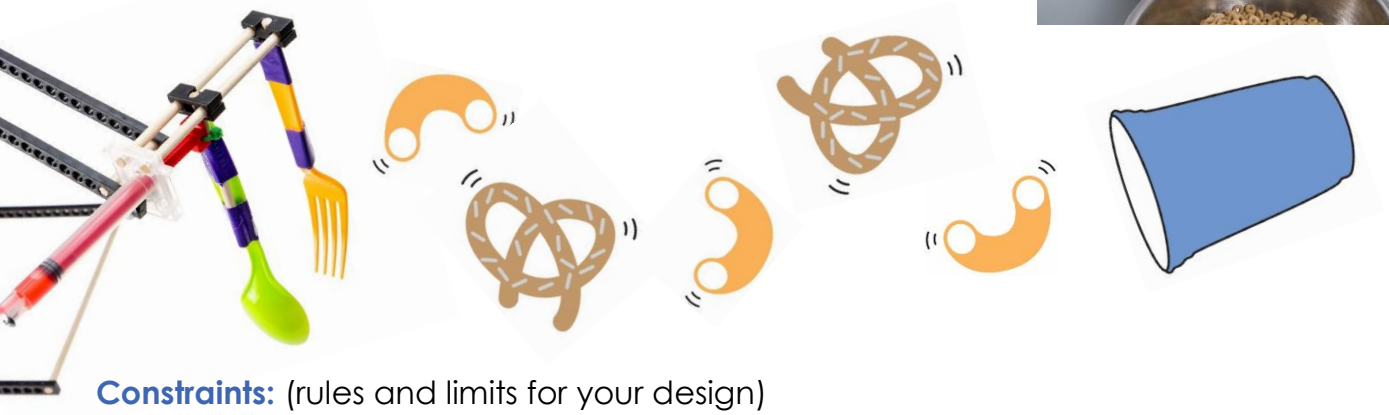
THE BIG DIG

The Challenge

Engineer your **End Effector** to dig quickly, accurately and effectively.

Before You Start… Make sure you have built a **Hydraulic Arm** for use on this challenge.



Constraints: (rules and limits for your design)

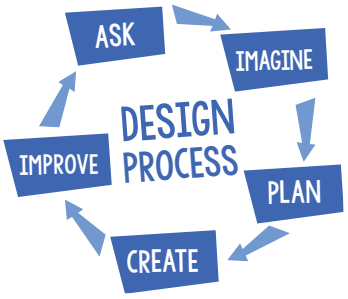
- Only use your **Hydraulic Arm** to dig or grab objects.
- Objects may be picked up only from the same surface the **Hydraulic Arm** is on.
- You may change the **End Effector** shape and material, and the arm itself.
- The **Hydraulic Arm** base and hydraulic system **must not** be altered. (they must be as shown in the **Hydraulic Arm** Example *Build Guide*).
- You may bring in materials for your **End Effector** and **Tower**, if the materials are:
  - Teacher Approved
  - Non-Hazardous (no sharp edges, harmful chemicals, etc.)
- You will have _____ to complete the challenge.
  Fill in how much time you have

Challenge Supplies:

Hydraulic Arm, material for **End Effector** (cardboard, recycled packaging), dry objects to dig in or for (cereal, gravel, jelly beans, pasta) tape, ruler, scissors, Philips screw driver, *Engineering Notebook* pages.

The Engineering Design Process:

You will be using the **Engineering Design Process**. What does that mean? Your design is never finished (it can always be improved). There is no such thing as a perfect design. Fill out a new *Engineering Notebook* page each time you design/redesign your **End Effector**.



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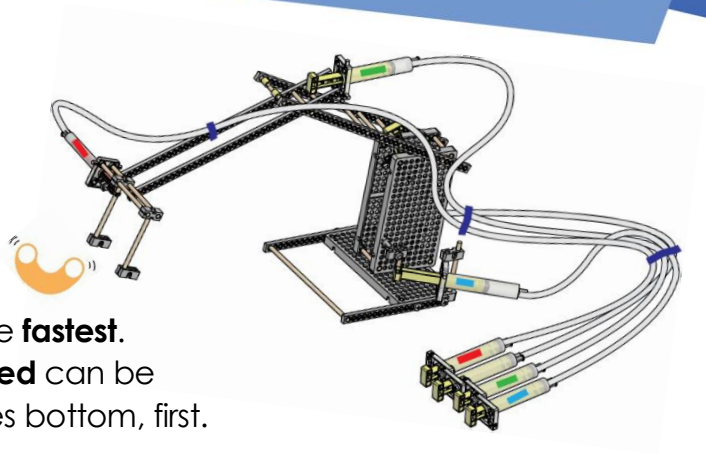
THE BIG DIG



Challenge Ideas

A The Big Dig

See who can **dig** a hole to the **bottom**, the **fastest**. Work in teams and use a stop watch. **Speed** can be determined by **size** of hole or who touches bottom, first.

B Filled to the Brim

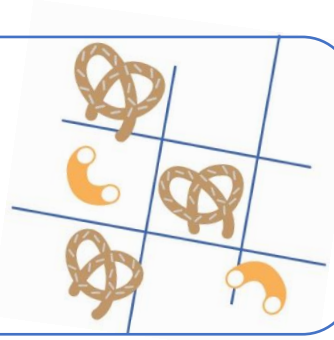
Dig through a **material** (such as pasta or rice) for "**buried treasure**" (paper clips). Use your **End Effector** design to grasp and drop objects into **separate bowls**. First team to fill it to the brim, wins! Record your results.

C Out of Sorts

Sort two mixed-up objects (e.g. pretzels and popcorn) into **separate bowls** using your chosen **End Effector**. The team with the most **accurate** sorting and **speed**, wins! Record your results.

D Tic-Tac-Tow

Use **tape** or **yarn** to make the **3 x 3 grid**. Using only your **Hydraulic Arm** and chosen **End Effector** design, place an object (such as pretzels) and make your move. You are **disqualified** if you touch your opponent's pieces or take longer than 10 seconds to complete a turn.



Fun Tip:

How can you design your **End Effector** to be more **accurate** (better for selecting one object over another)? Can you use **sticky** or **magnetic** materials to win the challenges? Can some designs hold more **weight**, while others have a better **grip**?

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Class Data

Class: _____

Set: _____ Challenge: _____

Record the results of your challenges. Print more sheets if necessary.

Group Name	Design #1	Design #2	Design #3	Design #4	Design #5	Design #6	Design #7	Design #8	Design #9	Design #10

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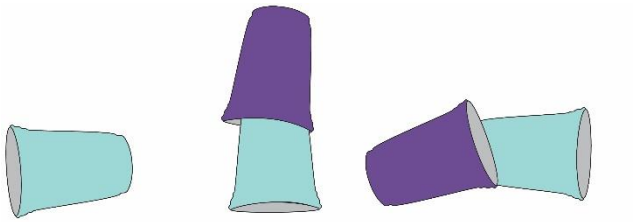
TOWER STACK

The Challenge

Design & Build an **End Effector** to best stack a tower of objects.

Before You Start… Make sure you have built a **Hydraulic Arm** for use on this challenge.



Constraints: (rules and limits for your design)

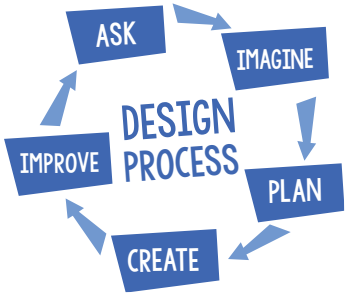
- Objects must be stacked (and remain stacked) using only your **Hydraulic Arm**.
- Objects may be picked up only from the same surface the **Hydraulic Arm** is on.
- You may change the **End Effector** shape and material, and the arm itself.
- The **Hydraulic Arm** base and hydraulic system **must not** be altered. (they must be as shown in the **Hydraulic Arm** Example *Build Guide*).
- You may bring in materials for your **End Effector** and **Tower**, if the materials are:
  - Teacher Approved
  - Non-Hazardous (no sharp edges, harmful chemicals, etc.)
- You will have _____ to complete the challenge.
  Fill in how much time you have

Challenge Supplies:

Hydraulic Arm, material for **End Effector** (cardboard, recycled packaging), objects to stack (plastic cups, milk cartons, candy) tape, ruler, scissors, Philips screw driver, *Engineering Notebook* pages.

The Engineering Design Process:

You will be using the **Engineering Design Process**. What does that mean? Your design is never finished (it can always be improved). There is no such thing as a perfect design. Fill out a new *Engineering Notebook* page each time you design/redesign your **End Effector**.



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TOWER STACK

Class Data

Class: _____

Set: _____ Record the height of each design's tower stack.

Group Name	Object(s)	Design #1	Design #2	Design #3	Design #4	Design #5	Design #6	Design #7	Design #8

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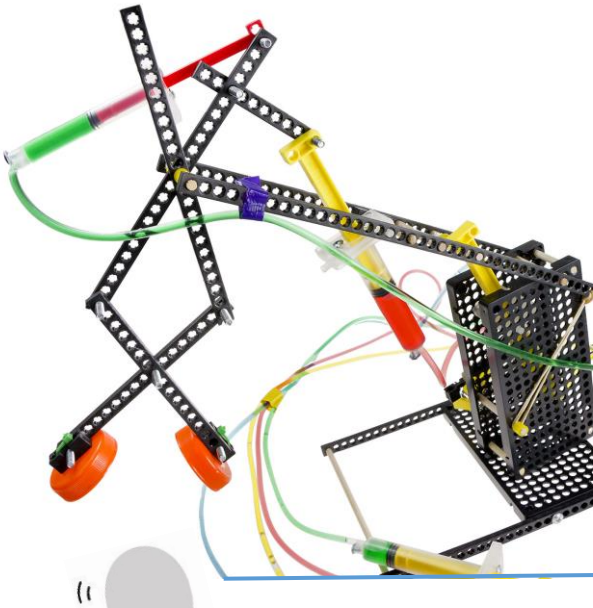
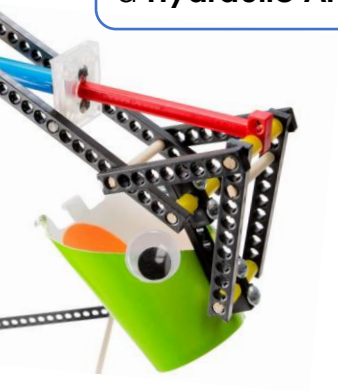
AIM FOR EGGCELLENCE

The Challenge

Engineer your **End Effector** to pick up and move an egg without breaking it.



Before You Start… Make sure you have built a **Hydraulic Arm** for use on this challenge.



Constraints: (rules and limits for your design)

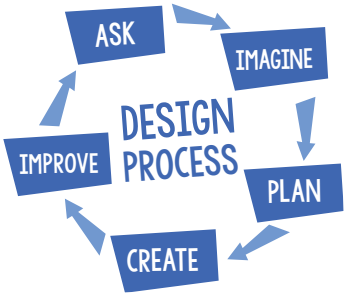
- Only use your **Hydraulic Arm** to pick up and move the egg.
- Eggs must be picked up from the same surface the **Hydraulic Arm** is on.
- You may change the **End Effector** shape and material, and the arm itself.
- The **Hydraulic Arm** base and hydraulic system **must not** be altered. (they must be as shown in the **Hydraulic Arm** Example *Build Guide*).
- You may bring in materials for your **End Effector** and **Tower**, if the materials are:
  - Teacher Approved
  - Non-Hazardous (no sharp edges, harmful chemicals, etc.)
- You will have _____ to complete the challenge.
  Fill in how much time you have

Challenge Supplies:

Hydraulic Arm, material for **End Effector** (cardboard, recycled packaging), egg, tape, ruler, scissors, Philips screw driver, *Engineering Notebook* pages.

The Engineering Design Process:

You will be using the **Engineering Design Process**. What does that mean? Your design is never finished (it can always be improved). There is no such thing as a perfect design. Fill out a new *Engineering Notebook* page each time you design/redesign your **End Effector**.



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AIM FOR EGGCELLENCE

Class Data

Class: _____

Set: _____ Record the distance of each design's egg lift.

Group Name	Design #1	Design #2	Design #3	Design #4	Design #5	Design #6	Design #7	Design #8	Design #9	Design #10

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