



## Curiosity Guide #402

### Pulleys

Accompanies Curious Crew, Season 4, Episode 2 (#402)

#### Design a Miniature Crane

STEM Challenge

##### Description

Design a working crane that when cranked could hoist a weighted container at least four inches off the table surface.

##### Materials per individual or group

- Tools such as
  - Ruler
  - Scissors
  - Tape
  - Other construction tools as needed
  
- Materials for building a miniature crane with pulley system, such as
  - Single-sheave pulleys
  - Double sheave pulleys
  - Wooden spools
  - String
  - Fishing line
  - Paper cups
  - Wooden skewers
  - Toothpicks
  - Dowels
  - Duct tape
  - Cardboard boxes
  - Shoe boxes

- Plastic containers
- Metal washers
- Paper clips
- Rubber bands
- Popsicle sticks
  
- Weight, such as a container of
  - Marbles
  - Batteries
  - Washers
  - Pennies

### Procedure

1. Look at the available materials and design a working crane that when cranked could hoist a weighted container at least 4 inches off the table surface.
2. Be sure to consider how to arrange your pulley system. Will you use one pulley or more than one?
3. How will you make the arm or lever to support the load?
4. What will you use for the body of the crane?
5. How will you counterweight the crane so that the crane does not tip over when hoisting a load?
6. Build your design.
7. Attach your crane to the weighted load and test it.
8. Redesign your crane as necessary.

Note: A good way to use the My Results section is to document materials used, results of testing, and the changes you made to improve the design after each test.

## My Results

## Explanation

A crane is a good example of a machine that combines different simple machines to provide a mechanical advantage to lift heavy things. Some of the key ingredients include a compound pulley system to increase the lifting power of the engine, a lever that serves as the arm of the crane that can be raised or lowered, and a counterweight system to prevent the crane from tipping over.

**Think about this:** Have you ever seen a large crane at a construction site? If you have, then you have seen a great example of a pulley system in action. The crane has a long arm that supports a fixed pulley, and then there is another movable pulley hanging below the arm that has a hook to connect to a load. A cable loops around the pulleys and then travels down the arm of the crane. When the load is connected to the hook, the crane operator uses an engine to wind in the cable and lift the load.

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