

A close-up photograph of a LEGO Technic pulley system. A black string is threaded through a yellow pulley wheel mounted on a blue Technic beam. The pulley is supported by a grey motor or actuator block. The background is a blurred blue Technic structure.

for grade levels 4 – 6

ACTIVITY 3: PULLEY SUPER LESSON!

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The Rube Goldberg Challenge

After viewing the second video on Rube Goldberg Machines, you can now see the importance of the pulley. Use the video as a starting point to explain pulley systems.

Objectives

(*Science*) Describe the purposes of pulley systems and gear systems

(*Science*) Distinguish between pulley systems and gear systems that increase force and those that increase speed.

Lesson Flow

1. Show your class Enable Education's E3 video about Pulleys.
2. Place a milk crate in the middle of the room and have your students fill up the milk crate, one by one, with an item they find interesting in the room.
3. Once the milk crates appear full, take a length of rope and loop it through the openings of the milk crate. Pick two students to climb a step ladder and try to lift the milk crate with the fastened rope. If this goes well, let more students attempt to lift the crate as well.

Prompts:

- Is this milk crate easy to lift with the rope?
 - Is it heavier than you expected? Is it harder to lift than you expected?
4. Take out a spring scale and measure how many Newton's of force it takes to lift the milk crate. Ask your class:
 - How can we make lifting the milk crate easier?

Materials/Preparation

- Milk crates
- Step ladder
- Long rope
- Spring scales (N)
- Scales (lbs or K)
- Pulleys
- Various lengths of rope
- Materials that can be used as weights in the milk crates (let the kids choose what they wish to put into it).
- Swing or jungle gym (or apparatus that you can attach the top pulley to)
- Art Supplies

Classroom Accommodations

Group work of this nature may be difficult for some learners. Provide these learners with a quiet area to work or work one-on-one with the student to complete the assignment. Give extra time or shorten the amount of surfaces a student needs to test to ensure a better learning experience for the student.

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5. Take out a pulley, secure to your chosen apparatus, and loop the rope around the pulley. Again, use the Newton scale to measure how much force is needed to lift the crate.
 - Has using the pulley changed the force required to lift the milk crate?
6. Add another pulley to the rope at the bottom, so the weight is suspended from the pulley (you may need to take your class to a park or play area to attach the rope and second pulley). You should now have two pulleys in your block and tackle system. Use the Newton scale to measure how much force is needed to lift the milk crate.
 - Has this changed the force required? Why?
7. Have your students go back to their desks and draw a step by step guide that explains what happened in this experiment.

What's Next?

Some students may have a hard time understanding pulley systems the first time it is taught. To add an extension activity to help explain pulley systems, use the extension lesson plan below:

1. Show your class Enable Education's E3 video about Pulleys.
2. Have a brief discussion with your class about other situations in which we could use pulley systems to make work easier (flag poles, cranes, clothes lines, sail boats).

Prompts:

- When would it be useful to have a single pulley system and when would it be useful to add a second pulley?
3. Using the knowledge they had previously learned in the first pulley lesson, have your students design a pulley that they could use to make work easier.
 4. Using their new design, have students design a blueprint with detailed explanations about which pulley they have chosen, why they have chosen that specific pulley, what materials they have used, and what materials they need to build their pulley system. Students can illustrate or produce a video and present their pulley system to your class.
 5. Once all the students have presented their pulley systems, have the class chose one of their favorite designs and see if your class can build the pulley system using objects they would find in the classroom or school.