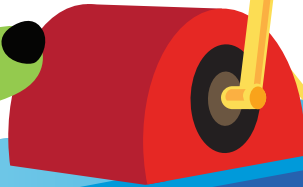


brackitz®

U3 L4
V2.3

MOATS &
CASTLES



LESSONS

PULLEYS
& CRANKS



Lesson 4: MOATS & CASTLES

Students situate their pulleys in a unique setting, continuing to practice needs-based design process.

Objectives:



Students continue building with pulleys to understand how they work and to recognize ways they can practice designing with pulleys.

Vocabulary used in this activity:

situation, solve/solution, simple machine, pulley, design, drawbridge

Standards

ECERS-R **Language-Reasoning:** Books and pictures, Encouraging children to communicate Using language to develop reasoning skills | **Activities:** Fine Motor, Art, Math/Numbers | **Program Structure:** Group time

NGSS **K-2nd Engineering Design:** K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. K-2-ETS1-1 Ask questions, make observations, gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

CCSS-Math K Practice.MP5, K Practice. MP7, 1. MD.A.1, 1.MD.A.2, 1. MP8, 1.MP.5

CCSS-ELA SL.K.1, SL.K.1.A, SL.K.1.B, SL.K.5, SL.K.6, SL.1.1, SL.1.1.A, SL.1.1.B, SL.1.5, L.1.1i, CCRA.L.6, L.1.5c

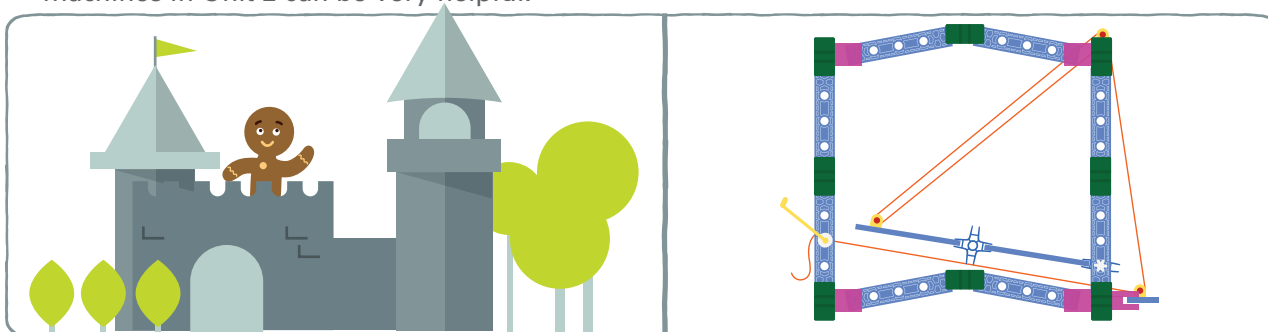
Time needed: 35-40 minutes

Materials and Supplies: Gingerbread friend, paper, pencils/crayons, simulated castle or castle tower set up. Each group will need a tray of Brackitz planks, 3 and 4 way hubs, 1-way pivoting hubs, and access to the pulley, crank, string, and pulley-wheel connectors

Resources/Optional Reading: Patrick McBriarty's [Drawbridges Open and Close](#) and this Youtube video showing a drawbridge in Chicago letting a sailboat pass: <https://www.youtube.com/watch?v=haimlez70fQ>

Set-up and Preparation: Help students cooperatively form groups of 2-3 to work together.

Background Knowledge: Prior to this lesson, students do not need special background knowledge. Introducing students to the Gingerbread friend in Unit 1 and transportation and simple machines in Unit 2 can be very helpful.



★ Lesson 4: MOATS & CASTLES ★

35-40 minutes

Whole Class

10 minutes



"We've imagined our Gingerbread friend in a lot of places, but . . . what if s/he was helping a friend and watching their castle while they were gone. S/he would still want to come to school and leave every day but . . . the castle is surrounded by water. The water is great for boats, but not great for our Gingerbread friend. What are the problems of the castle being surrounded by water for our Gingerbread friend? Let's brainstorm what the problems are together. "

Problems:

- Gingerbread can't walk through the water - s/he is made of cookie and will get soggy!
- Fish and ducks in the water could eat the Gingerbread's cookie body.
- If the water is moving fast, this could be unsafe for the Gingerbread friend.

Instructor Notes and Tips

In previous lessons, students have been involved in coming up with solutions for problems. Here, you are asking them to name the problem. Help students think of real life issues the water presents to the Gingerbread friend, specifically. A picture or model could help them think this through. This suggested video can help students who have never seen a drawbridge understand what it is and why there would be a need for it:

<https://www.youtube.com/watch?v=haimlez70fQ>

Group Exploration

10 minutes



"We know the problems of living in a castle surrounded with water. There's only one door, and stepping out of it, you would land right in the water. Can we build a special door that stays up most of the time to let boats go by, but lowers down when Gingerbread wants to leave to take a walk or go to school? Doors and bridges that move up and down are called drawbridges. How could we use a pulley to make this? Draw a basic design."

It will help to have already read the book Drawbridges Open and Close to give students context for how drawbridges can help.

Children might need to see a picture of a drawbridge to understand what one looks like and how it operates. Try modeling from the suggested reading or video or other pictures. (Try to avoid using Brackitz pieces as students will just copy the design). Discuss what parts might be used to make the drawbridge and how some of those parts might go together (particularly the pivot part for the drawbridge).



Lesson 4: MOATS & CASTLES



Group Challenge

15 minutes



"Ok, now build your drawbridge! In order for us to know it's a good design, it needs to be able to lower down for our Gingerbread friend to walk across but raise up again."

Using the pulley takes some fine-motor control and practice. Be prepared to guide students and groups to practice this until they achieve success.

Reflection



5 minutes



"Have you ever seen a drawbridge in real life? Where would it make sense to build a door or bridge that worked like this?"

Drawbridges can have one side that lifts and lowers, or two sides that lift and lower, like this bridge in Chicago. Showing this short video can help students understand how this works in real life.

<https://www.youtube.com/watch?v=haimlez70fQ>

CHALLENGE ADVANCED STUDENTS

In the group challenge, you may ask students to decide on a drawbridge that lifts and lowers from one side or two sides and to consider the benefits and drawbacks of these choices. "What would be needed to make two sides lift and lower?" (Each drawbridge would need two cranks.)

SIMPLIFY FOR YOUNGER GROUPS

In discussion and group exploration, use the suggested book, Drawbridges Open and Close to help students understand drawbridges.

If building a drawbridge is too challenging for your students, consider building one before the lesson and having them test it, and then have them "change it to make it work better for the castle!" They could also use the Brackitz pulley to raise and lower a flap on a cardboard box.

Name

★ Lesson 4: ★

Student Worksheet

Pulleys are a simple machine that help us move things: (Circle words that are true.)

Up

Down

Underneath

Between

On a road

Across

Drawbridges are bridges or walkways that move _____ and _____
(Fill in the blank.)

Draw your drawbridge design:

