

brackitz®

U2 L5a
V2.3

LESSONS

WHEELS & AXELS

Four Wheels!



★ Lesson 5: Four Wheels! ★

This lesson leads students to add a fourth wheel as they continue to experiment with mechanical advantage, transportation, and designing with constraints and criteria.

Objectives:



As students add a fourth wheel, new design choices are available. At the end of this lesson, students will design vehicles that are more related to their everyday experiences, and consider the mechanical and design advantages of four wheels.

Vocabulary used in this activity:

prediction, advantage, benefit, stability, balance, mechanical advantage, request, specific, constraint

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.CC.C.6, K.MD.A.2, K.G.A.1, K.G.B.4, 1. MD.A.1, 1.MD.A.2, 1.G.A.1, 1.G.B.5

CCSS-ELA SL.K.1, SL.K.1.A, SL.K.1.B, SL.K.5, W.K.3, CCRA.L.6, SL.1.1, SL.1.1.A, SL.1.1.B, SL.1.5, L.1.5.C

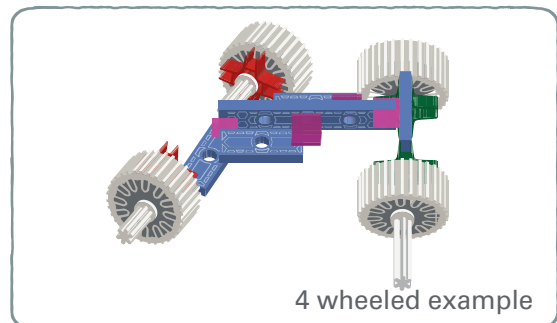
Time needed: 35-40 minutes

Materials and Supplies: Preserved three-wheeled vehicles from the previous lesson, Gingerbread friend, paper, pencils/crayons, Brackitz planks (1x1 and 1x2) and 3 and 4-way hubs, as well 1-way pivoting hubs. Give out exactly three tires, axle-splines, and lock washers to each group.

Resources/Optional Reading: Richard Scarry's Cars and Trucks and Things That Go and Gail Gibbons' Transportation: How People Get Around.

Set-up and Preparation: Prepare trays of building materials ready to be handed out; 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 from Unit 1 can help them keep a user in mind who will use their designs.



★ Lesson 5: Four Wheels! ★

35-40 minutes

Whole Class

10 minutes



Instructor Notes and Tips

"Since we've been counting up and adding a wheel every day, what's your prediction of how many wheels we'll build with today? (4!) Great counting. What vehicles do we know of that have four wheels? " Make a class list, working to get every student to participate. If several students contribute the same idea, tally how many times it came up as a show of how common these vehicles are.

Four wheels is VERY common - in this brain-storm, help each student contribute, even if they are naming something another student has mentioned. "What do you know that has four wheels?" Examples:

- Cars
- Trucks
- Busses (ignore for now that many have added wheels)
- Golf carts
- Tractors
- Wagons
- Construction vehicles
- Batmobile

Group Exploration 10 minutes



"Think about your 3-wheeled vehicles from the last class. I have them here on display. What was challenging about building with three wheels? What was better about three wheels than two wheels? Visit the 3-wheeled vehicles and think about what will get better with four wheels. Can you name the benefit in ONE WORD?"

Asking "what worked/what could be better" on the 3-wheeled vehicles can help. "Can Gingerbread use this vehicle everywhere? Where would this work best? Where would this not work? Why not?"

Ask students to name what will improve with ONE WORD if they can. Possibly:

- Safety
- Stable/Stability
- Balance

If your students don't know those words, you may hear "less wobbly" or "not falling over," and you can share how one word can help express that and practice vocabulary.

★ Lesson 5: Four Wheels! ★

Group Challenge

15 minutes



"Build a vehicle design with EXACTLY four wheels as the design constraint. How and where will Gingerbread use it? How will we know if it's a vehicle that's good for our Gingerbread friend?" (right size, is useful, is safe/stable)

This is a chance for students to begin building. Watch to make sure groups are able to share tasks and ideas functionally. Having trays with prepared Brackitz pieces and exactly two wheels and axles will help.

Students may elect to use their previous 3-wheeled vehicles and do a redesign from there to create the space for a fourth wheel.

Reflection



5 minutes



"Can each group show us their 4-wheeled design. Tell us three things about it.

1. How will Gingerbread use it?
2. What's working well on your design?
3. What is not working yet or needs improvement?"

Encourage groups to share in 30-60 seconds only and to be open about giving self-feedback. "It's ok to notice that something isn't working the way you want it to - that helps make plans for what to work on next."

CHALLENGE ADVANCED STUDENTS

In discussion, ask students to consider WHY 4-wheeled vehicles are so common. Help them think about how a vehicle that has balance may be functional in more kinds of locations. Why is it good if a vehicle works in more than one environment? You may also ask students to consider if vehicles are more useful if they have an even number of wheels or an odd number of wheels.

In the group challenge, ask students to design something other than a car since cars are so prevalent.

SIMPLIFY FOR YOUNGER GROUPS

In discussion, ask, "who came to school today in a car or bus? How many wheels brought you here on those vehicles?" You may also want to revisit the suggested books so that students have pictures from the pages to help them brainstorm 4-wheeled vehicles.

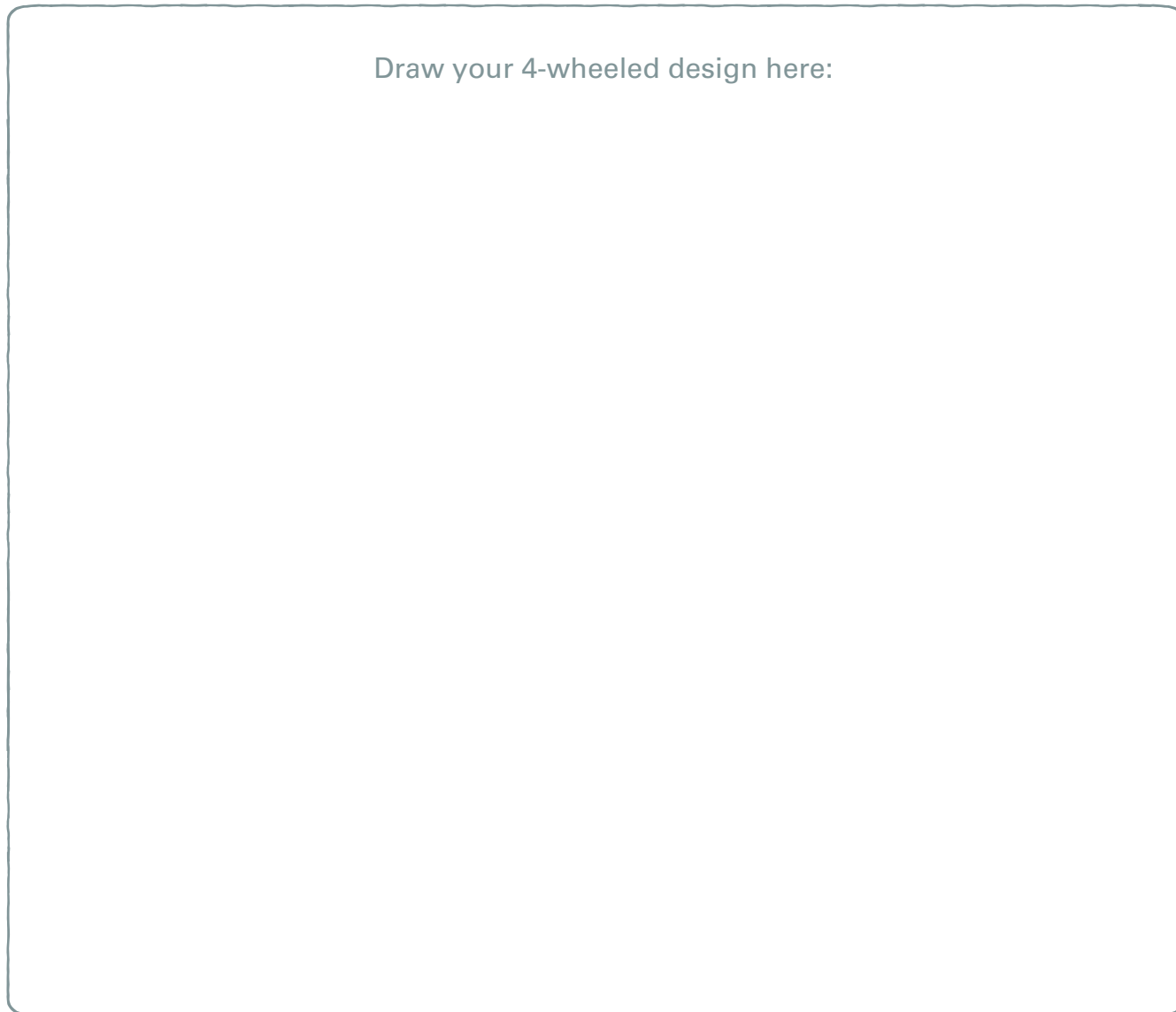
In the group challenge, encourage most groups to make a car and get it rolling with 4 wheels.

Name

★ Lesson 5: Four Wheels! ★

Student Worksheet

Draw your 4-wheeled design here:



Count how many Brackitz pieces you used today: _____

Count how many wheels you got to use in building today: _____

Name

★ Lesson 5: Four Wheels! ★

Student Worksheet

Is a four-wheeled design better than a three-wheeled design? (Circle)

YES

NO

Where do you think our Gingerbread friend will use it most? Draw that place here.