Activity 2

Pedal Power

FIND THE RIGHT GEAR TO HELP YOU SOAR ON YOUR BIKE!

Biking is fun for all ages, but can be tough unless you’re in the right gear. A bike’s gear system is designed to make pedaling more efficient on different terrains. The gear ratio measures how many times the back wheel turns for each rotation of the pedals.

SMART START:
Find a safe area where girls can ride their bikes. Determine the bike course; decide where to start and end. Try to include different features (e.g., flat surfaces, hills) and estimate the distance of the course.

Here’s how:
1. **Introduce bikes and gears.** Divide girls into small groups¹ and have them discuss how bikes work. Visit scigirlsconnect.org/page/pedalpower for background information.

   Watch SciGirls identify parts of a bike on SciGirls Invent DVD. (Select Pedal Power: Research.)

2. **Brainstorm.** Ask each group to brainstorm ways to go faster on a bike (pedal quickly, change gears, bike design). Guide girls toward thinking about how gears affect speed. Then, deliver the SciGirls Challenge: Determine which gears will help you bike a set course in the shortest amount of time. ³

3. **Calculate gear ratio.** Help each group turn their bicycle upside down on the floor. Make sure it’s stable. Use a marker to help count the teeth on the gears in the front (near the pedals) and in the back. Then, calculate each possible gear ratio. Rank them from highest to lowest and record data in a table. (See example table at scigirlsconnect.org/page/pedalpower.)

   gear ratio = \[\frac{\text{number of teeth on front gear}}{\text{number of teeth on back gear}}\]

4. **Calculate tire revolutions.** Set the bike to its lowest gear (smallest gear in the front, largest

You’ll Need:
For each small group
- bicycle with gears that can be changed
- helmet
- marker
- pencil and paper
- tape measure
- stopwatch
- chalk
- optional: calculator

2 hours

POINTER: If you only have one bike for the whole group, first calculate the gear ratio as a large group. Then, have small groups make plans for the bike course and present them. Choose two or three plans to test and discuss results.

For more activities, go to scigirlsconnect.org!
You’ll Need:
gear in the back). Mark a line on the back tire with chalk. Start with the pedal and tire marking at the 12 o’clock position as shown in the illustration below. Slowly move the pedal forward, clockwise, and make one full revolution. Count how many revolutions the back tire makes.

Record this number and compare it to the gear ratio. Try the highest gear (largest gear in front, smallest gear in back). What is the relationship between gear ratio and tire revolution? (Low gears have more tire revolutions, high gears have fewer tire revolutions.) How do tire revolutions relate to speed? (The more tire revolutions per pedal stroke, the faster you will go.) Would you want to be in a high or low gear when you go up a hill? Down a hill? Why?

5. **Plan and test.** Show the girls the course and give groups 10 minutes to decide the gears to test and who will ride. Encourage them to think about which gears will work best on the various landscapes (low gears for uphill, high gears for downhill, middle to high gears for flat stretches). Then, have groups take turns riding and recording their completion times. Each girl’s ability will be different so they should each ride the course several times.

**POINTER:** If there are girls in your group that can’t ride bikes, assign them to be recorders.

6. **Share results.** Have each group discuss what gears they used, why they used them and their various completion times. Are gears the only factor in speed? Ask girls to share other ideas for how to ride faster. 

Watch Yvonne and the SciGirls design a pedal-powered ice cream maker on the *SciGirls Invent DVD.* (Select Pedal Power: Mentor Moment.)

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**Mentor Moment**

Yvonne Ng is a mechanical engineer who began her career in automation design, creating computer systems that control equipment. She then began teaching at St. Catherine University in Minnesota and helped ramp up the school’s STEM efforts. Yvonne recently founded Engineer’s Playground to create resources that help K-12 instructors teach engineering (engineersplayground.com).

1-7 See *SciGirls Seven* strategies on page 3.