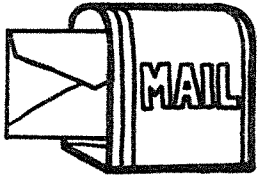
Note to Educator: In today's adventure, kids are following directions to build wheel systems. This experience of making wheels (and axles) that work will help them be successful in the next several adventures when they are asked to engineer recycled racers and wheels from a wider variety of materials.

Duo Update (5 min)



Activity (30 min)

Materials

For the entire group:

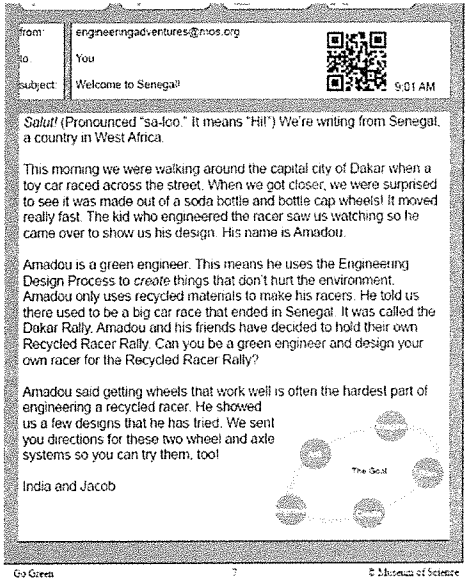
- ☐ *Message from the Duo*, track 3 or Engineering Journal, p. 7
- ☐ *Engineering Design Process* poster
- ☐ chart paper/white board
- ☐ markers
- ☐ 1 bobbin
- ☐ 1 paper cup, small
- ☐ 1 paper cup, large
- ☐ 1 straw, regular size
- ☐ 1 box lid (about 2'x3') or other flat surface to use as a ramp
- ☐ books or blocks to create a 6"-8" tall stack

For each group of 3-5 kids:

- ☐ 2 CDs
- ☐ 2 straws, jumbo size
- ☐ 1 dowel
- ☐ 2 washers, 1/4"
- ☐ 1 pipe cleaner
- ☐ 1 pair of scissors

For each kid:

- ☐ Engineering Journal



from: engineeringadventures@mos.org
to: You
subject: Welcome to Senegal! 9:01 AM

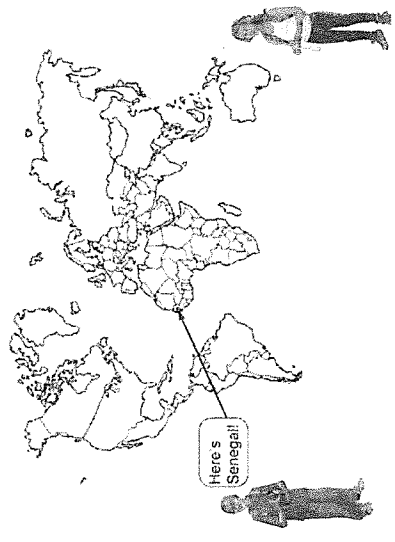
Salut! (Pronounced "sa-loo." It means "Hi!") We're writing from Senegal, a country in West Africa.

This morning we were walking around the capital city of Dakar when a toy car raced across the street. When we got closer, we were surprised to see it was made out of a soda bottle and bottle cap wheels! It moved really fast. The kid who engineered the racer saw us watching so he came over to show us his design. His name is Amadou.

Amadou is a green engineer. This means he uses the Engineering Design Process to *create* things that don't hurt the environment. Amadou only uses recycled materials to make his racers. He told us there used to be a big car race that ended in Senegal. It was called the Dakar Rally. Amadou and his friends have decided to hold their own Recycled Racer Rally. Can you be a green engineer and design your own racer for the Recycled Racer Rally?

Amadou said getting wheels that work well is often the hardest part of engineering a recycled racer. He showed us a few designs that he has tried. We sent you directions for these two wheel and axle systems so you can try them, too!

India and Jacob



Amadou's Toy Cars, p. 9

Adventure 1 **Amadou's Toy Cars**

Some of Amadou's friends used the Engineering Design Process to engineer these toy cars! Look at the cars closely. Do you recognize any of the materials?

Wheel and Axle Template 1, p. 10

Adventure 1 **Wheel and Axle Template 1**

To make one wheel and axle you need:
- ☐ 2 jumbo milkshake straws (the axle)
- ☐ 2 CDs (the wheels)

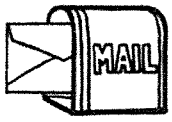
Step 1
Push two jumbo straws through the hole in the middle of the CD.

Wheel and Axle Template 2, p. 11

Adventure 1 **Wheel and Axle Template 2**

To make one wheel and axle you need:
- ☐ 1 dowel (the axle)
- ☐ 2 1/4" inch washers (the wheels)
- ☐ 1 pipe cleaner
- ☐ scissors

Step 1
Slide the two washers onto the dowel and move the washers so there is one on each end.



Present the Message from the Duo (5 min)

1. Tell kids that India and Jacob sent a message about a special kind of toy car they saw while traveling in Senegal.
2. Have kids turn to *Message from the Duo*, p. 7 in their Engineering Journals, to follow along. Play track 3.
3. To check for understanding, ask:
   - **What does Amadou want us to do?** *Be green engineers and engineer a toy car out of recycled materials to race in the Recycled Racer Rally. Today, we will make some wheel and axle systems.*
4. Have kids look at *World Map*, p. 8 in their Engineering Journals, to find Senegal. Then, have them look at *Amadou's Toy Cars,* p. 9 in their Engineering Journals. Ask:
   - **What materials do you recognize?** *Bottles, caps, tin cans, etc.*
   - **What shapes or sizes might we want our wheels to be?** *For now accept all answers. Kids might say round, large, etc.*

Making Wheels and Axles (20 min)

1. Have kids take a look at *Wheel and Axle Templates*, pp. 10-11 in their Engineering Journals. Point out that the axles are the rods or sticks in the middle and the wheels are the cylindrical objects on the ends of the axles.
2. Have kids work in small groups. Encourage some groups to build from *Template 1* and some *Template 2*. They can build both if they have time.
3. Groups should send one group member to the Materials Table to gather supplies.
4. As kids are building, guide them to think about how their wheels and axles

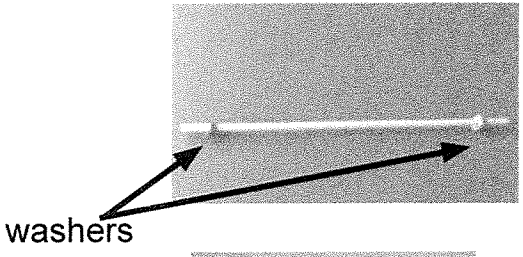
- What other materials might you want to try making wheels out of?

4. Show kids a bobbin, a paper cup, and a straw. Ask a volunteer to try rolling those materials down the ramp. Ask:
   - **What do you notice about how these wheel options roll? What is the same? What is different?** *The cups will likely not roll straight, the bobbins may roll quickly, etc.*
5. Let kids know that in the next adventure, they will be able to use more materials to engineer wheels, axles, and other parts of their racers. They will have to think about what size and material wheel they would like to use.

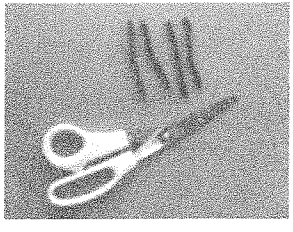
Reflect (10 min)

1. Tell kids they should take a few minutes to *imagine* what they would like to try next time. *Imagining* is an important part of the Engineering Design Process, and they will be able to *create* their ideas and test them in the next adventure.
2. Have kids work in pairs to fill in the "Think About It" section on *Template,* pp. 10-11 in their Engineering Journals. Having kids record their ideas will help them remember what they learned and apply it in the next adventure.
3. Gather kids together and ask a few volunteers to share what they *imagined.*
4. Tell kids that for the rest of this unit, they will work as teams of green engineers to engineer a racer that they can race in the Recycled Racer Rally. To engineer their racer, they will use the Engineering Design Process.
5. Have kids look at the *Engineering Design Process* poster. Ask:
   - **What steps of the Engineering Design Process did you use today?** *Common responses: We* asked *about wheels and* imagined *car designs.*

Step 1
Slide the two washers onto the dowel and move the washers so there is one on each end.

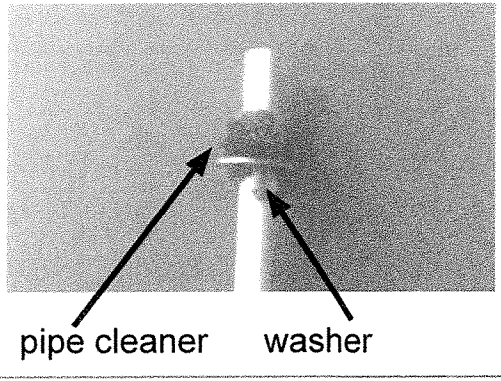


Step 2
Try rolling your wheels. What do you notice about how they roll?



Step 3
Cut your pipe cleaner into 4 pieces.

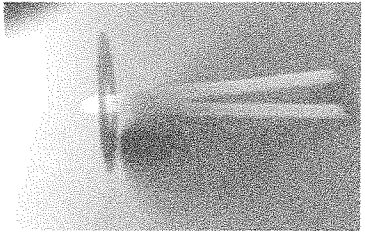
Step 4
Wrap one pipe cleaner piece around the dowel on each side of the washers. This will stop the washers from wobbling!



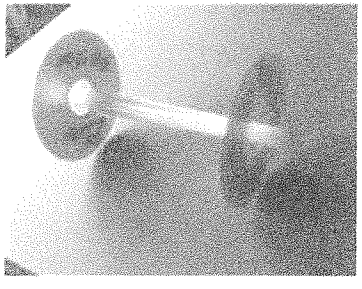
Roll your wheels!

Think About It:
What do you notice about how this wheel system rolls?

Step 1
Push two jumbo straws through the hole in the middle of the CD.



Step 2
Stick the other CD on the opposite end.



Roll your wheels!

Think About It:
What do you notice about how this wheel system rolls?
What do you think would happen if you used one straw instead of two?

Imagine: What would you try next time?