Why Is Rubber Used to Build Race Cars?

Grade Level | Topic | NGSS
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K-2 | Properties of Materials | PS1.A

**Phenomenon**

Several NASCAR car parts are made of rubber, and the rubber tires are changed during the race.

**Materials**

- Optional: Monster Energy NASCAR Cup Series video from 4:02:37 to 4:03:15 to reintroduce NASCAR racing to students
- Slideshow: Rubber Parts Used in Race Cars
- Video Clip A—Wildest Pit Stops from All-Star Race Qualifying
- Slideshow: NASCAR Rubber Tire Investigation
- Rubber Investigation Materials—Teacher Demonstration
- Investigation #1
  - 1 metal baking pan
  - 1 coin
  - 1 plastic bottle cap
  - ½ rubber eraser—smooth
- Investigation #2
  - 1 metal baking pan
  - ½ rubber eraser—smooth
  - ½ rubber eraser—cut with tread
  - 1 small cup of water
- Teacher set up will require the following:
  - 1 box cutter
  - 1 pen
- Rubber Tire Investigation Setup
- Rubber Tire Investigation Data Tables and Questions
- Slideshow: Closing: Rubber Tires
- Materials for Posters or Writing on the Board
  - Poster Paper and Markers or
  - Whiteboard and Dry Erase Markers

**Material Management Tips**

- Gather supplies for the investigation to determine the number of groups students will be divided into for Investigation #2.
- A smooth, non-stick surface pan works best to show the most differences among the materials being tested.
- Prepare poster paper or a place on the board that all students can see with the data tables to be completed as a class during the investigation.
Developing and Using Models
Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns and designed world(s).

Analyzing and Interpreting Data
- Record information (observations, thoughts, and ideas).
- Use and share pictures, drawings, and/or writings of observations.
- Use observations (firsthand or from media) to describe patterns and/or relationships in designed world(s) to answer scientific questions.

PS1.A Structure and Properties of Matter
- Different kinds of matter exist. Matter can be described and classified by its observable properties.
- Different properties are suited to different purposes.
- A great variety of objects can be built up from a small set of pieces.

Structure and Function
The shape and stability of structure of designed objects are related to their function(s).

Patterns
Patterns in the human-designed world can be observed, used to describe phenomena, and used as evidence.

NSTA encourages K–12 teachers and school leaders to promote and support the use of science activities in science instruction and work to avoid and reduce injury. Additionally, NSTA recommends teachers and school leaders visit the NSTA Safety Resource page for up-to-date information on safety issues and guidelines.
EXPERIENCE PHENOMENON

Students experience the phenomenon or problem. The teacher creates an opportunity for students to connect with this specific event or problem (through prior experience, interests, and curiosities) and raise or identify a student question to investigate.

**T** What is the teacher doing to support students’ sensemaking?

**S** What are students doing to make sense of the phenomenon? [Includes teacher look-fors]

1. **Introduce the Phenomenon—10 mins.**

Gather students and introduce NASCAR racing to students to elicit excitement and experience the phenomenon together.

Tell students you have found an interesting video about how the tires are changed during a NASCAR race.

Students watch the video clip to create a shared experience of a NASCAR race.

Optional: Say, “First, let me remind you of what a NASCAR car race looks like.” Play Monster Energy NASCAR Cup Series video from 4:02:37 to 4:03:15 to reintroduce all students to a NASCAR racing event.

Tell students, “Many smaller parts make up a NASCAR race car, and today we will be taking a closer look at some of the parts made of rubber.” Share with students the first slide of the slideshow Rubber Parts Used in Race Cars.

(Slide 2) To introduce car tires to students say, “Here is the first part that many of you have seen before on cars, buses, and other types of vehicles. Tires are made of rubber.” Ask, “What do you notice about the tires, or what do you already know about tires? Where have you seen them before?” Allow students to share their noticing and experiences with a partner or small group, then share with the whole class. Repeat this process with rubber parts found on slides 3 and 4.

Students first talk to a partner, then raise their hand to share their noticing and observations about the rubber parts.
Consider having some o-rings for students to look at, as these may be unfamiliar.

Tell students that because tires seem to be the most familiar, they will be focused on making some observations about the tires. Introduce the video that shows how the tires are changed during a NASCAR race. Say to students, “While watching the video, try to notice what the engineers or pit crew are doing.”

(Slide 5) Play Video Clip A—Wildest Pit Stops from All-Star Race Qualifying.

Students watch the video and try to notice what the engineers or pit crew are doing.

Ask, “What did you notice about the car’s tires?”

Students raise their hands to share ideas about what they think the engineers or pit crew are doing.

Ask, “What does this video make you wonder about?” Consider writing down these questions on a poster or board to help navigate to the next part of the lesson.

Allow students to talk to a partner or small group to share their questions. Then have one person from each group share at least one question with the class. Student questions will vary, but many will ask about why the tires need to be changed.

Students share and brainstorm questions with a partner or small group first. One student from each group raises their hand to share at least one of the group’s questions with the class.

Use students’ curiosity related to needing to change the rubber tires to help navigate to the next part of the lesson by saying, “I have heard several questions about changing the rubber tires. What ideas do you have about why the rubber tires might need to be changed?” Have students share their ideas with a partner for one minute. Have a few of the students share their ideas. Acknowledge that you heard many good ideas as you listened to them share. Say, “Since we don’t know why they changed the tires, we should find out more about the rubber used to make the tires. Raise your hand if you think we should take a closer look at observable properties of rubber to help us better understand rubber tires.”

Students turn and talk to a partner for one minute to share ideas about why the NASCAR teams may have needed to change the rubber tires. Students share an idea with the class.

Students raise their hands if they agree that they would like to take a closer look at the observable properties of rubber.
INVESTIGATE

Students engage in the practices of scientists and engineers to build understanding of targeted science ideas (and engineering ideas) needed to explain the phenomenon or solve the problem.

2. Conduct an investigation

Say, “To figure out why NASCAR uses rubber tires, let’s investigate some of the observable properties of rubber by comparing rubber to some other materials.”

Open the slideshow NASCAR Rubber Tire Investigation.

(Slide 2) Share the image of the two types of NASCAR tires used for racing. Ask students, “What are some things you notice that are the same with the two tires? What are some things you notice that are different with the two tires?” Students may share patterns such as these:

- They are both round.
- They are both black.
- One has grooves or cuts, and the other does not.

(Slide 3) Share with students, “We will begin by testing three types of materials using a baking tray. We will place one rubber eraser, one plastic bottle cap, and one metal coin at the top of the pan.”

Students raise their hands to share patterns they can identify.

(Slide 4) Tell students that this is a model. Remind students that a model is used to help us figure out things we cannot safely test in the classroom. Ask students what they think the different items represent. Have students share their ideas. Agree that the different types of materials represent tires and what they could be made from. The pan represents the race track. Say, “We will use these things to test how the materials slide down the baking pan.”

Students share what they think the different objects represent.
(Slide 5) Say to students, “Watch as I slowly lift the baking pan on one side to see how fast each object slides down the pan.” Demonstrate this several times by lifting one end of the pan. Ask, “What patterns do you notice?” Have students raise their hands to share what they notice. Students should notice patterns such as these:

- The metal coin always slides first.
- The plastic cap almost always slides second.
- The rubber eraser takes the longest to start sliding.
- The rubber eraser slides last.
- The rubber eraser sticks more to the pan.

If needed, deepen students’ understanding of patterns by asking them to look for which material slides down first, second, and third.

Distribute the NASCAR Rubber Tire Investigation Data Table and Questions and explain that they will be figuring out what happens together as a class. Tell students that scientists and engineers work together to figure things out all the time. Explain that as they share their observations, you will record them in the data table. Then they will need to copy the information into their own data table. This way, everyone has the same data to work with. Use a class poster or place on the whiteboard to complete the first data table for Investigation #1 and reinforce the ideas of patterns by comparing the data.

Students raise their hands to share patterns.

Students will share ideas related to the idea that rubber helps the car stick to the track and not slide around.

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Students record the class data into their data tables.

(1) Tell students that they did a great job figuring out that rubber was used to help the tires stick to the track, so the cars do not slide around. “However, we still do not know why some of the race tires are smooth, and some have cuts or grooves in them called tread.”

(1) Say to students, “I actually made models of these tires using a rubber eraser so we can now test the difference between the two in a similar investigation using the baking pan.”

(1) Tell students, “This time, we will test the two rubber erasers, one with tread marked with a T and the other does not have a tread and was left smooth.”
(Slide 10) Share with students, “We will again lift one end of
the pan slowly to collect data or information using these two
types of erasers.” Guide students to look at the NASCAR
Rubber Tire Investigation Questions handout and read
how they will complete the data table. Demonstrate this
in front of the class using the pan and the two erasers, and
have them identify which eraser slides down the pan first.
Guide students in completing the data table for 5 trials. Help
students see that we are not able to identify any consistent
patterns. Say, “Since we do not see any clear patterns, let’s
add some water to the pan to see if that makes a difference.”

(Scroll 11) Add a small cup of water to the pan, and repeat
the investigation steps by lifting the pan five times, and
guide students in completing the data table by helping
them identify which eraser slides first.

(Slides 12–16) Use the guiding questions to facilitate a
discussion around the results.

The goal of this facilitated discussion, as described in the
Rubber Tire Investigation Setup, is to help students make
sense of the idea that rubber tread is used to help cars stick
to the surface when it is wet.

Tell students to look at the bottom of their shoes to look for
evidence of rubber tread. Ask students why there might
be rubber tread on the bottom of shoes to introduce the
related phenomenon.

Students review their handouts as the teacher explains the
directions.

Students participate in the discussion and may write or
draw any answers they are able to pull from the discussion
on their handout.

Students will look at the bottom of their shoes and those
of others in the class and share ideas that the rubber tread
helps people walk on wet surfaces without slipping. The
discussions may also elicit ideas regarding safety.
REFLECT

Students use the new or revised science ideas they developed to help explain how or why the phenomenon occurs and/or to identify solutions to the problem.

3. Return to Phenomenon—10 mins.

Say to students, “You did a great job in figuring out why rubber and tread are used to build tires for racing. Remember in the video we watched at the beginning of the lesson; we saw engineers or the pit crew changing the tires in the middle of a race. I think we might now be able to figure out why they are doing this.”

(Slide 1) Open the Closing: Rubber Tires slideshow, and replay the Wildest Pit Stops from All-Start Race Qualifying video. Prompt students to look for evidence of tires sticking to the track and to raise their hand when they see it. Students may share their evidence as the video plays.

Students watch the video for the second time and look for evidence that the tires are sticking to the track. They may share the following:

• Black tire marks on the track;
• Screeching noise as cars stop; and
• Tires look worn out.

(Slide 2) Share the images and facilitate a discussion about the idea that since the rubber is sticky, some of the rubber gets left on the track, leaving the black tire marks on the track. The goal of this discussion is to guide students to the idea that since the tires stick to the track, this wears down the tires, so they need to be changed during the race to keep them sticking to the track.

Ask students, “What other examples can you think of in your lives in which rubber wears off onto another object? Allow students to share their experiences with the class. Some related phenomena shared might be these:

• when the rubber sole of your shoe leaves a mark on the floor;
• when you use a pencil with an eraser, some eraser is left on the paper that you have to brush off;
• tire skid marks on the street; and
• screeching noises as tires turn corners or use the brakes.

Tell students to continue to look for examples of rubber being used as parts for building materials around their homes, playground, or community.

Students share ideas related to tires being worn down, creating the need for them to be replaced during the race.

This lesson could be one in a series of lessons building toward the following:

2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*

[Clarification Statement: Examples of properties could include strength, flexibility, hardness, texture, and absorbency.]
[Assessment Boundary: Assessment of quantitative measurements is limited to length.] * The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

2-PS1-3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

[Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]
AT THE RACE TRACK

Find examples of rubber being used as parts for building at the race track.

- Can you find evidence of rubber tubes being used?
- Can you find evidence of rubber tire marks on the track?
- Make a list of all the places you can identify rubber being used at the track?

How many times do the engineers or pit crews change the tires on the car during a race?

- Collect data by choosing one car to follow on the track. Make a tally mark every time this car completes a lap. Draw an X between the tally marks every time the tires are changed.
- How might you figure out if they are putting treaded tires or smooth tires on the car? Look for signs of rain, and try to predict when they will switch to treaded tires, or look to see which tires they are using at the start of the race to see if the engineers think the track will get wet during the race.