Why Is Plastic Used to Build Race Cars?

Several NASCAR car parts are made of plastic, and plastic is mixed with fabric to make the front end of the car.

**Phenomenon**

**Materials**

- Optional: [Monster Energy NASCAR Cup Series video](#) from 4:02:37 to 4:03:15 to reintroduce NASCAR racing to students
- Slideshow: [Plastic Parts Used in Race Cars](#)
- Video Clip: [How It’s Made: NASCAR Car Bodies](#). Play from 0:58 minutes to 2:39 minutes.
- Slideshow: [Carbon Fiber Investigation](#)
- Carbon Fiber Investigation Materials (each station)
  - Prepared fabric on aluminum foil
- Teacher setup will require these items:
  - 4 pieces of wax paper or aluminum foil per station;
  - 7 small pieces of fabric (cotton T-shirt works fine);
  - Scissors;
- Small container for mixing glue and water;
- White School Glue;
- Water;
- Paintbrush; and
- Marker or pen-style permanent marker.
- [Carbon Fiber Investigation Setup](#)
- [Student Worksheet—Carbon Fiber Investigation Data Table and Questions](#)
- Materials for Posters or Writing on the Board
  - Poster Paper and Markers or Whiteboard and Dry Erase Markers

**Material Management Tips**

- Cue the video clips at the appropriate timestamp before class begins.
- Prepare fabric with glue mixture before the investigation and allow time to dry.
- Wax paper works well for the teacher setup preparing fabric with the glue mixture and allows students to peel off the fabric more easily when dry. Silicone mats or aluminum foil will also work.
- Consider whether to provide one copy of the Carbon Fiber Investigation Data Table and Questions per group or per student. If one is provided per group, students may decide who will serve as a recorder of everyone’s ideas to help support students who struggle with reading and writing.
- Prepare poster paper or a place on the board that all students can see with the data table to complete 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 in the designed world.

### 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.

### Safety
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.

What is the teacher doing to support students’ sensemaking?

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

1. Introduce the Phenomenon—20 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 some parts of the car are made using plastic.

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.

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

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

(Slide 2) Say to students, “Before we learn about some of the plastic parts used to make NASCAR race cars, let’s talk a little about plastics.” Share the information on the slide about how plastic is not a naturally occurring substance and is made in a laboratory by scientists and engineers.

Students may share that the milk container has a handle to help people pour milk or that the plastic baggie has a pocket to store food.

(Slide 3) Share the image of some different types of plastic objects. Reinforce the Crosscutting Concept of Structure and Function using this slide, and ask students how the shapes of the objects in the slide help the objects perform their functions. Allow students to provide a few examples.

(Slide 4) Share three different examples of how plastics are used to make everyday objects. To elicit student ideas and background knowledge, ask, “What other objects do you use every day that are made of plastic?” Allow students to talk with a partner before they share with the whole group.

Students mention other plastic objects they use every day, first with a partner, then raise their hand to share with the whole group.
Introduce the idea that foam is a type of plastic. Consider having some examples of foam for students to observe. Many students will not know what foam is but will be familiar with objects made from foam, like aerosol string, for example. Explain that foam is placed over the metal frame of a NASCAR race car near the driver. Consider eliciting student ideas about the structure and function of the foam and why it's placed in this position.

Students may respond with ideas related to foam being used to cushion or protect the driver if they hit a wall or another car.

Share that the clear window is made of a type of plastic called Lexan. This is used instead of glass. Consider eliciting student ideas about the structure and function of a plastic windshield and why it's used instead of glass.

Students may respond with ideas related to plastic being used so that glass doesn’t shatter and cut the driver when it breaks.

Share with students that sometimes plastic is mixed with other materials, like fabric such as carbon fiber. Elicit student ideas about why someone would want to mix fabric and plastic. Ask students to share their ideas about the mixing of these materials. Prompts could include these:

- What do you think the plastic does to the fabric?
- What types of objects do you think you could make with this mix of materials?

Students share their ideas about why someone would combine plastic and fabric.

Say to students, “I found a video that helps explain how carbon fiber and plastic are made into car parts. While watching this video, try to notice what the engineer is doing.”

Students watch the video and try to notice what the engineer is doing.

Play Video Clip A—How It’s Made: NASCAR Car Bodies starting at 0:58 mins and play to 2:39 mins.

Ask, “What did you notice about what the engineer was doing?”

Students raise their hands to share ideas about what they think the engineer was doing in the video.

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.

Use students’ curiosity about why plastic is added to the carbon fiber to help navigate to the next part of the lesson by saying, “I have heard several questions about why plastic is added to the carbon fiber fabric. Raise your hand if you think we should investigate these questions.” Students raise their hand if they agree that they would like to investigate this further.

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. Carbon Fiber Investigation—15 mins.

Say to students, “I was also curious about why plastic was added to the carbon fiber material, so I made a few models using an old T-shirt and some glue mixed with water. Remember that a model is a way we can represent and test science ideas.”

Open the slideshow Carbon Fiber Investigation.

(Slide 2) Say to students, “Remember that carbon fiber is a type of fabric, and the engineer added a type of liquid plastic called resin to the fabric.”

(Slide 3) Share with students a couple more examples of carbon fiber being used to make a helicopter tail for an RC Helicopter, a racing helmet, and a canoe. Ask students, “What do you see is similar among these objects? What do you see is different among these objects?” Allow a few students to share what they notice.

Students raise their hands to share patterns they can identify. Students may share patterns such as these:

- They all have a checkered look.
- They are all black and grey.
- They have different shapes.
- They have different functions.
(Slide 4) Share with students the materials you used to create the models.

(Slide 5) Explain how the glue and water represent the plastic resin they saw in the video, and the T-shirt material represents the fabric.

(Slide 6) Share that you made 3 different models. The #1 model was 1 layer of fabric with the glue mixture, the #2 model was 2 layers of fabric with the glue mixture, and #3 was 3 layers of fabric with the glue mixture.

(Slide 7) Review the steps of the investigation with students. They will begin by writing about the observable properties of a piece of fabric without any glue mixture added in small groups. This will be considered model #0.

(Slide 8) To begin their investigation, have students observe the models on the wax paper or aluminum foil. Then ask them to carefully peel the fabric and glue models off the foil/wax paper. Remind them to keep them intact. If students struggle with peeling off the fabric, observations can be made while it is still attached to the wax paper or aluminum foil.

(Slide 9) Review with students the data table that students will complete on the Carbon Fiber Investigation Data Table and Questions.

Students review their handout as the teacher explains the directions.

Divide students into groups depending on the number of stations you have prepared. Allow time for students to make observations of each model as a group.

Students move into small groups and begin making observations and completing the data table. In each group, students begin to discuss, write, or draw their ideas for answering the prompting questions.

Bring students back together to discuss the results of their data table. Ask each group to give you one observation from each model to add to a class poster data table.

Each group shares one observation for each model.
Use the guiding questions to facilitate a discussion about their results.

The goal of this facilitated discussion, as described in the Carbon Fiber Investigation Setup, is to help students figure out that the plastic is added to the fabric to make it strong. Students should conclude that the fabric gets stronger with each new layer of fabric and glue. The teacher will also use the prompting questions starting on slide 10 to try to help students make sense of the idea that objects are made from carbon fiber instead of metal because they are strong but lightweight.

Students from each group share their ideas related to the prompting questions. Some ideas may be the following:

- The 3 layers of fabric were the strongest.
- Plastic is added to fabric to make it stronger.
- Carbon fiber might be used instead of metal because it is lighter.
- A carbon fiber helmet is strong and protects the driver’s head.

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**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 plastic is added to carbon fiber. Remember that in the video, we saw the engineer using a type of mold or shape that he put the carbon fiber and plastic resin in to dry. Let’s watch the video one more time and try to figure out why he is using the mold!”

Rewatch the video *How It’s Made: NASCAR Car Bodies*, but this time you can play it to show how the car part is weighed, demonstrating that it is strong but lightweight. Play from 0:58 mins to 2:47 mins.

Facilitate a discussion about why the mold is used by asking students, “Why do you think the mold or shape was used to let the carbon fiber and plastic dry in?” Allow students to first talk to a partner, then have groups share their answers until the idea emerges that the mold allows the carbon fiber and plastic to dry in the shape of the car part. In this case, the part was the front of the car.

Students watch the video for the second time and look for reasons why the mold is used in the video.

Students may share ideas related to the following:

- The mold helps shape the car part.
- The mold helps the plastic and carbon fiber dry into a shape.
- The engineer was making the front end of the car.
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 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 plastic parts being used at the race track.

- Can you find evidence of plastic windshields?
- Can you find evidence of plastic packaging?
- Can you find evidence of carbon fiber?
- Can you find evidence of plastic stickers?
- Make a list of all the places you can identify where plastic is being used at the race track.