LESSON PLAN 2: DOWNFORCE

UNDER PRESSURE

TIME REQUIRED: 45 minutes, plus optional extension activity

MATERIALS: recycled or reused paper (1 sheet per student), straws (1 per student), spools (1 per student), index cards (1 per student), card stock (1 sheet per student), rulers, scissors, pencils, markers, completed cars *Note: Students will need one whole straw, plus the 3-inch piece of straw left over from Lesson 1. Students will reuse the card stock from Lesson 1.*

ACTIVITY AND RESOURCE SHEETS: Assembly Sheet B, Downforce Activity Sheet, Racecar Adaptations
www.scholastic.com/nascarspeed

THINK

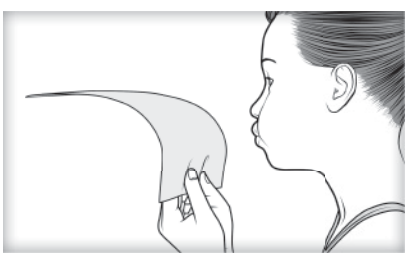
Central question:
How are the aerodynamics of racing and flight similar?

1. Explain that because NASCAR racecars can reach speeds of more than 200 miles per hour, they rely on air pressure and special racecar adaptations to stick to the track. Air pressure—a key element of aerodynamics—is a force caused by the weight of air molecules pushing against an object's surface.
2. Fast-moving air causes low air pressure, and slow-moving air creates high air pressure. **Downforce** is created when high pressure pushes down on an object from above and there is low pressure below. **Lift**—the opposite of downforce—is created when there is low pressure above an object and high pressure below.
3. Downforce pushes NASCAR racecars downward so they stay on the track. Lift pushes the wings of airplanes upward so that the planes fly.

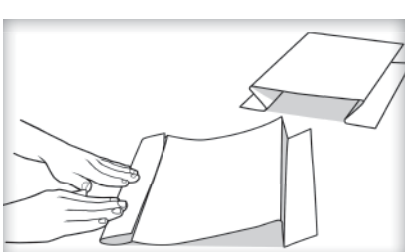
MOVE

Central question:
How does air pressure cause an object to rise or fall?

1. To demonstrate how air pressure works, have each student hold the short end of a sheet of paper with his or her hands pointing up. The paper should curve down over the back of his or her hands. Tell the students to blow forcefully over the curve of the paper. What happens? *(Faster-moving air over the top of the paper creates lower pressure above in contrast to higher pressure below. That creates lift, causing the paper to rise.)*



2. Next, have students fold 1-inch flaps along the two shorter edges of the paper. Have them turn the paper over and fold two more 1-inch flaps along those same edges. Finally, have them sit the paper on a tabletop so that there is a gap between the paper and the table. Ask them to blow forcefully through the gap. What happened this time? *(Faster-moving air below the paper creates an area of low pressure. The high pressure above pushes downward, creating downforce and causing the paper to sag.)*



BUILD

Central question:
What is the relationship between air speed and air pressure?

1. Pass out *Assembly Sheet B*, the *Downforce Activity Sheet,* and experiment materials. Have pit crews complete the experiment. If students have trouble, make sure the straws are not taped at an angle and the top of the spool is completely covered.
2. After the experiment, have groups complete the Conclusion questions. Then, challenge students to think of other objects that rely on lift or downforce to operate. *(Answers: Experiment: fast/low; slow/high; low/fast; high/slow; low/high/lift. Racecar: slow/high; fast/low; high/slow; low/fast; high/low/downforce.)*

TEAM UP

Central question:
How do racecar modifications influence downforce on the vehicle?

PIT CREW CHALLENGE [OPTIONAL]

1. Pass out copies of the *Racecar Adaptations* sheet. Point out the splitter and the skirting on the NASCAR racecar. Explain that a racecar's adaptations enhance downforce by directing fast-moving air underneath it (splitter) and preventing slow-moving air from slipping underneath its sides (skirting).
2. Pass out card stock, scissors, and the completed cars from Lesson 1. Have pit crews use the *Racecar Adaptations* sheet to guide them in adding spoilers, splitters, and other features to their cars. After they have adapted their racecars, ask students to write a paragraph or two explaining:
   - how a racecar's spoiler increases drag and creates downforce
   - how a racecar's splitter and skirting help keep the car on the track