How Do Things Make Sound?

Grade Level | Topic | NGSS
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K-2 | Properties of Materials | PS4.A

**Phenomenon**
A NASCAR racing engine makes sounds when running and doesn’t make sounds when not running.

**Materials**
- NASCAR Engine Car Cold Start VERY CLOSE [clip A, 0:00 –0:34]
- NASCAR Toyota Racing Engine on Dyno [clip B, 1:57 – 2:30]
- Is it moving when it makes a sound? formative assessment probe [per student]
- Sound station supplies [per station]
  - rubber bands;
  - metal pan or bowl;
  - wooden spoon;
  - speaker [connected to sound source];
  - small seeds such as chia seeds, flax seeds, or rice grains; and
  - drum [any type].
- Station directions
- Data table [per student]
- Compressor 2 [clip C]

**Material Management Tips**
- Set out only as many rubber bands as the number of students visiting the station at one time.
- Play low sounds through the speaker (lion roaring, music with bass notes, rumbling thunder, etc.) Test the setup to make sure the seeds move when the sounds play through the speaker.
- Consider providing multiple types of drums for students to interact with, if available.
- Set up the sound stations around the room. If you have a large class, consider creating two of each station.
- Consider cutting the data tables into strips. Students can pick up the needed strip at each station they visit. Strips can later be stapled together or pasted into students’ science notebooks.

**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.
How Do Things Make Sound?

SCIENCE AND ENGINEERING PRACTICE(S)

Analyzing and Interpreting Data
- Record information (observations, thoughts, and ideas).
- Use observations (firsthand or from media) to describe patterns in the natural and designed world(s) to answer scientific questions.

DISCIPLINARY CORE IDEAS

- Sound can make matter vibrate, and vibrating matter can make sound.

CROSSCUTTING CONCEPTS

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

Cause and Effect
- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

SUPPORTING EQUITABLE PARTICIPATION

Interactions

Modalities

How students communicate their ideas

Talk • Text • Visual: Drawing, Symbols, Table, Graph, Chart, and Gesture

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.

1. Introduce the Phenomenon

Gather students together and generate some excitement by sharing, “I am really excited to show you these videos of race car engines I found.”

Show students video clip A. Then adjust the playback speed to 0.5, and ask students to raise their hand when they notice the engine starts. Play clip A again. Ask students, “How did you know when the engine started?”

Students watch video clip A. They might turn and share noticings and/or stories while the clip plays. (Allow this behavior.)

Students watch the clip again, this time raising their hands when the engine starts. When questioned, they will likely share they heard the engine start.
Tell students the next video clip (B) shows a race car engine without the car. You may want to share that an engine is made of many parts working together. Ask students to use their senses to make observations of the engine. You might ask, “Which senses do you think we can use to make observations of the engine?”

Students watch video clip B and make observations using their eyes and ears.

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<td>Give students an opportunity to share their observations of the engine with a partner or small group. Listen for students to share observations about parts of the engine moving and the engine making loud noise. Call on these students first when you bring the class back together, and ask for students to volunteer to share their observations with the class.</td>
<td>Students share observations with a partner or small group. Students may share with the whole class their own observations or observations shared by a partner or group member.</td>
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Ask the class, “What do you think is making the sounds we hear when the engine is turned on?” Accept all ideas. Consider helping students build on one another’s ideas by providing them one or two sentence stems such as these:

- I agree/disagree because…
- I would like to add on to [student]’s idea…
- This makes me think about…

Students share ideas about what is making the sounds they hear when the engine is turned on.

Students will likely share many similar ideas about the moving parts of the engine causing the sounds they hear when the engine is turned on.

Use students’ curiosity to navigate them to the next part of the lesson. Say, “That makes me wonder if all things that make sounds are moving. Are you wondering, too?”

Students use words or gestures to respond to the question.

Some students may not yet wonder if all things that make sounds are moving, but all students may become more curious after completing the formative assessment probe (next).
2. **Administer the formative assessment probe.**

Provide each student a copy of the formative assessment probe “Is it moving when it makes a sound?”

Tell students that all of the objects on the page (student sheet) make sounds. Name each object as you associate it with the picture. Show students the actual objects you have available in the classroom (sound station materials). You can also provide other pictures that illustrate each of the objects on the page.

Give students independent thinking time to decide if each object is moving when it is making a sound. Then ask students to turn to a partner and share their ideas about which objects are moving when they are making sounds. Listen for students to share ideas about movement causing objects to make sound (even if students don’t think all of the objects are moving when they make sounds.)

Students circle the objects they think are moving when they make sounds and draw an X through objects they think are not moving.

Ask students to put their thumbs up if they circled all of the same objects as their partner (did their page match their partner’s page?), and put their thumbs down if they didn’t circle all the same objects as their partner did (their pages did not match).

Students put their thumbs up if they circled all the same objects as their partner did, and thumbs down if they did not. It is difficult to predict how students will respond; you may find students mostly agreed with their partners, but did not circle all of the objects. It is more likely that they will have some circled objects in common. Students might decide on their own to hold their thumbs sideways to communicate this with you.

Say to students, “I think most of us are now wondering if all objects are moving when they are making sounds. Let’s investigate!”
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.

3. Investigate sound at the sound stations

Introduce students to the five sound stations. Tell students that at each station, they need to create sounds with the object(s), then find out if the object is moving while it is making the sound. (The speaker station is an exception.) Ask students, “Which senses can we use to tell if an object is moving while it is making sounds?”

Students share that they can use their eyes to see if the object is moving and their hands (bodies) to feel if the object is moving.

Assign students to small groups of three or four students. Send one group to each station; distribute data tables or instruct students to pick up a data table strip set out at the station. Tell students to remain at that station until you ask them to change locations.

Students use the materials at their station to create different sounds. Students use words, pictures, and symbols to describe how they created different sounds with their object and how they stopped the object from making sounds. You will likely observe students sharing ideas with their group members using talk and gestures.

Give students time to complete the assigned task at their station. You might want to assist the group at the speaker station (get them started) before moving around the room to assist other groups.

When the allotted time is up, ask students to reset the station for the next group. Students will likely need about 5–7 minutes at each station (expect the first station to take longer). Direct students to their next location; consider asking students to point to their next station to make sure they are headed in the right direction before allowing them to move. (This reduces the amount of time needed to move between stations.) Proceed in this way until groups have visited all five sound stations.
You might ask groups some of the following questions to help move their thinking deeper:

- How did you make sound with this object?
- How is making sound with this [object at this station] the same as making sound with that [object at a prior station]? How is it different?
- Is the object [making sound] moving? How can you tell?
- How is the way this [object at this station] is moving the same as the way that [object at a prior station] moved? How is it different?

Students respond to questions using talk, gestures, words, pictures, and/or symbols. Students add to or change the way they described how they created sound with their objects/stopped their objects from making sounds.

4. Analyze data collected at sound station

Project the formative assessment probe, or post a picture of each object on the page in a space visible to all students in the room.

Point to each object and ask the class, “Was the [name of object] moving when it was making sounds?” Ask students to share their thinking using thumbs up (yes, the object was moving when making sound) or thumbs down (no, the object was not moving when making sounds). Circle the objects students agree are moving when they make sounds.

Students may not agree that an object was moving when making sounds. When this occurs, choose two or three students with their thumbs up to share their evidence (observations) with the class. Give students one minute to turn and talk with their group, then poll the class again. Most students will likely now agree the object was moving when it was making sounds. Circle the object.

Students use their observations (evidence from data) to support the claim the object was moving when making sounds. Evidence might include the following:

- They felt the object moving (buzzing/tingling/bouncing/itching) when the object was making sound. If students say they felt the object vibrating, ask them to describe what they mean using talk and/or gestures.
- They saw the object (speaker) move stuff (seeds) when it was making sounds; stuff did not move when the object was not making sound.
- They needed to make the object move by tapping, hitting, plucking, etc., to make the sound.
- They needed to make the object stop moving by holding, squeezing, unplugging, etc. to stop the sound.
Point out to students that all of the objects are circled.
Ask for one or two volunteers to share the results of the investigation in their own words.

Students might say all things are moving when they make sounds, things have to be moving to make sounds, you have to make things move to make sound, and/or moving things make sound.

Say to students, “Let me see if I’ve got your thinking right. Moving objects can make sound.” Record this idea in a space easily visible by all students.

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.

Show students video clip B (engine) again. Ask students, “What could we do to make the engine run more quietly? Why do you say so?” Emphasize that the engine can not be turned off.

Give students independent thinking time to review their sound station data tables and record their ideas.

Students review their observations and record their ideas about making the engine run more quietly. Students may use words, pictures, and symbols.

Ask students to share their ideas in a small group. (Consider assigning students to new groups to provide an opportunity for students to hear and build on the thinking of different sound-station groups.) As you move around the room, listen for students to share ideas about keeping the parts from moving so much and/or “holding” or “squeezing” the parts to keep them from shaking/bouncing/vibrating.

Students share their ideas with their small group and support their thinking with observations (evidence) from the sound-station investigation.

To facilitate student discussion, you might ask students to use the same sentence stem(s) you introduced earlier in the lesson.

Bring students back together, and ask for volunteers to share their ideas. Call on the students who shared ideas about restricting the motion of engine parts first. Ask students to support their ideas with observations (evidence) from the sound-station investigation.

Students share ideas with the class and support their ideas with observations (evidence) from their sound-station investigation.
This lesson could be one in a series of lessons building toward the following:

1-PS4-1—Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.

[Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and the plucking of a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.]

Tell students that engines are too hot to touch when they are on/running, but you have a video of someone trying to make an air compressor run more quietly by [insert students’ language here such as “holding” or “squeezing” parts and/or “keeping the parts from vibrating”]. Play video clip C. Depending on student interest, you may want to play the clip two or three times.

Students watch video clip C and make observations. Students may turn and talk and/or gesture to other students in the classroom while the video clip plays. Allow this behavior.

Say to students, “We used our knowledge about moving objects making sound to figure out how we might make an engine run more quietly. Do you think this same idea can be used to make machines/objects in our homes run more quietly?” Encourage students to share this question with their families and make a list of household items that are quieted/could be quieted using this science idea.

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

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Find objects at the track that are making sounds.

- Does the object make more than one kind of sound?
- Describe how the object moves when it is making each kind of sound.
- When the object’s movement begins to change, can you predict the sound it will make?

Draw a picture of the track (the shape).

- Where on the track do the cars make the loudest sounds? Draw X’s on the track where the car sounds are the loudest.
- Where on the track do the cars make the quietest sounds? Draw O’s on the track where the car sounds are the quietest.
- What patterns do you notice when you look at your drawing?
- Why do you think the sounds the cars make change as they move around the track?
Make some observations at the track.

- When a car collides with another car or with the wall, observe what happens to the car’s bumper and/or door.
- See how many different energy transfers and transformations you can identify during a collision. What observations can you make that could indicate the amount of kinetic energy being transferred and transformed during a collision?
- Explain to whomever you are attending with how a more damaged car might be safer for a driver during a collision.