EXPLORATION 2

HANDS-ON ACTIVITY

Engineer It • Designing a Listening Device

Activity Guide, pages 6–9

Engineer It explorations allow students to apply the engineering design process.

TIME ESTIMATE

day 1 30 min day 2 30 min

SHORT ON TIME?

The activity can be done as a whole-class activity to save the time individual groups would take to conduct it.

POSSIBLE MATERIALS

- ☐ plastic cups
- ☐ paper cups
- ☐ cloth scraps
- ☐ duct tape
- ☐ masking tape
- ☐ string
- ☐ scissors
- ☐ rubber tubing

Hands-on materials kits are available and easy to use.

PREPARATION

Rearrange the room to make space for students to spread out their designs and materials. Supply materials or have students themselves collect plastic and paper cups and cloth scraps from home for reuse in the activity.

Materials Alert Ensure that the materials students have selected are appropriate and will be used safely. Verify that students will not insert any materials into their ears, and observe head-lice precautions.

INVESTIGATIVE PHENOMENON

Engineers make and improve designs to meet needs or wants and solve problems.

Phenomenon Explained Students explore the **investigative phenomenon** by investigating how engineers design a solution to a particular problem that meets particular criteria and constraints.

Form a Question After reading the introductory paragraph about a hearing-enhancing device, students should form a question about designing such a device. If they have trouble forming a question, ask them to think about what their device needs to do. **Sample answer:** How can I make a hearing-enhancing device that satisfies the constraints and criteria?

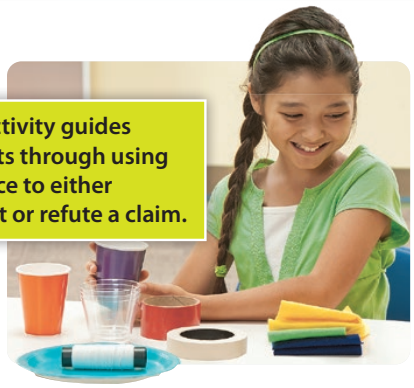
STEP 1 Have students brainstorm in a group to identify criteria and constraints but then work independently to complete their sketches. **Sample answers:** Constraints: no batteries, does not go in ear; Criteria: enhances hearing, comfortable, durable, lightweight

STEP 2 Have students work independently to identify which materials they will use and explain how those materials will help meet the criteria and constraints. **Sample answer:** I will use plastic cups because they are more durable than paper cups and lighter than cloth scraps.

STEPS 3 and 4 Circulate around the room as students test and improve their devices. Check to make sure students accurately record and explain any design changes and improvements.

STEP 5 Have students evaluate their devices and even consider making second ones. Encourage students to discuss why they chose certain materials and how the type of materials affected the way their solution functioned.

- **Make a Claim** Students make a claim about how effective their designs were at meeting the activity goals.
- **Evidence** Students should support their claim with evidence about the device's operation.
- **Reasoning** Students should explain how their devices met constraints and criteria.



Each activity guides students through using evidence to either support or refute a claim.

FORMATIVE ASSESSMENT

MAKING SENSE OF PHENOMENA

Students gain understanding that engineers can make and improve designs to meet goals as they explore the **investigative phenomenon.** They should connect this to the **anchoring phenomenon** that a lightweight, nonelectric listening device would enhance a nature walk. Students should recognize that the listening device they design meets particular constraints and criteria to enhance a nature walk.

REMEDIATION If students struggle to connect the **investigative phenomenon** back to the **anchoring phenomenon,** have them think about how they used their designs to develop a listening device that met the criteria and constraints they listed.

MAKING SENSE OF PHENOMENA IDEA ORGANIZER

After completing Exploration 2, students can fill in the **Idea Organizer** to summarize the connection between engineers making and improving designs to meet needs or solve problems and the anchoring phenomenon that a lightweight, nonelectric listening device would enhance a nature walk.

Formative assessment and remediation options are provided at point of use.

Activity Outcome

Students should follow steps of an activity to design and improve a listening device that meets particular criteria and constraints.

Performance Indicators	
	design a listening device
	make a claim about how effective the device is
	support the claim using evidence of device performance

Activity rubrics aid in grading.