Trace the Sound

Use an ear model to explain two kinds of hearing loss.

HS-AP6-3 "Make and/or use a model of the anatomy of the ear. Construct an explanation for sensorineural and conductive hearing loss using the basic structure and function of the ear."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB As you read, underline the route sound takes from the outer ear to the brain. Circle structures that help carry vibrations, then number the point where vibrations become nerve signals.

From Vibration to Signal

1. A bicycle bell rings behind you, and you turn toward it. Sound from the bell travels as vibrations through the air. The outer ear collects some of those vibrations and directs them into the ear canal. At the end of the canal, the eardrum vibrates. Three tiny bones called ossicles pass the vibrations through the middle ear to the inner ear. There, the fluid-filled cochlea contains hair cells that respond to movement. These cells help turn the movement into nerve signals. The auditory nerve carries those signals to the brain, where you perceive the bell.

2. This route helps explain conductive hearing loss. If a problem in the outer or middle ear prevents vibrations from reaching the cochlea effectively, less sound energy arrives at its hair cells. The problem lies in carrying the vibrations, not necessarily in making nerve signals. For example, an outer-ear obstruction can reduce the vibrations that reach the eardrum. A middle-ear problem can limit how well the ossicles pass vibrations along. In either case, the cochlea may still be able to respond to vibrations, but it receives less of the sound entering the ear.

3. Sensorineural hearing loss involves a different part of the route. Damage to hair cells in the cochlea can interfere with the change from movement to nerve signals. Damage to the auditory nerve can interfere with carrying those signals toward the brain. Sound may travel through the outer and middle ear, yet the brain receives an incomplete signal. Both kinds of hearing loss can make sounds harder to hear, so loudness alone does not identify the cause. To explain a hearing problem, locate the affected structure on the route and describe what that structure normally does.

2 ANSWER WITH EVIDENCE

Use the passage

1. Build a written model of the sound route. Starting at the outer ear, name the structures sound passes through before the signal reaches the brain. Where does movement become nerve signals?

2. A swimmer has an ear canal blocked by a tightly packed earplug. Use the sound route to explain which kind of hearing loss this could cause and why.

3. A person's cochlear hair cells are damaged, but the eardrum and ossicles still move normally. Which kind of hearing loss fits this model? Explain what happens to the signal.

4. Compare a torn eardrum with a damaged auditory nerve. At what point does each disrupt the sound route, and which kind of hearing loss could each cause?

3 YOUR TURN

Your own words

In two panels, sketch and label the route from outer ear to brain for a normally working ear and for an ear whose ossicles cannot move freely. Mark where the second route is disrupted, then write two sentences explaining the kind of hearing loss and which structures could still work.

ANSWER KEY

Trace the Sound

HIGH SCHOOL · HS-AP6-3

PART 1 · READ AND MARK

As you read, underline the route sound takes from the outer ear to the brain. Circle structures that help carry vibrations, then number the point where vibrations become nerve signals. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Build a written model of the sound route. Starting at the outer ear, name the structures sound passes through before the signal reaches the brain. Where does movement become nerve signals?	**Outer ear, ear canal, eardrum, ossicles, cochlea and its hair cells, auditory nerve, brain. Hair cells in the cochlea help turn movement into nerve signals.**
2	A swimmer has an ear canal blocked by a tightly packed earplug. Use the sound route to explain which kind of hearing loss this could cause and why.	**It could cause conductive hearing loss because the blockage reduces the vibrations reaching the eardrum and cochlea.**
3	A person's cochlear hair cells are damaged, but the eardrum and ossicles still move normally. Which kind of hearing loss fits this model? Explain what happens to the signal.	**Sensorineural hearing loss. Vibrations can reach the cochlea, but damaged hair cells do not turn movement into nerve signals as effectively.**
4	Compare a torn eardrum with a damaged auditory nerve. At what point does each disrupt the sound route, and which kind of hearing loss could each cause?	**A torn eardrum disrupts vibration transfer before sound reaches the cochlea and could cause conductive hearing loss. A damaged auditory nerve disrupts signals traveling from the cochlea toward the brain and could cause sensorineural hearing loss.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Panel 1: Outer ear → ear canal → eardrum → ossicles → cochlea and hair cells → auditory nerve → brain. Arrows show vibrations reaching the cochlea and signals traveling to the brain. Panel 2: The same route is labeled, with a mark at the ossicles and a thinner arrow from the ossicles to the cochlea. This is conductive hearing loss because the ossicles pass less vibration to the cochlea. The hair cells and auditory nerve could still work, but they receive less sound input.

Accept equivalent route models that distinguish vibrations from nerve signals. For the open task, the mark must be at the ossicles, and the explanation must connect reduced vibration transfer to conductive hearing loss.