Name: _____ Date: _____

How Headphones Cancel the Hum of a Plane

Circle group

On a long flight, the engines roar all the time. It can tire your ears. Some headphones can make the roar fade. They do not even need to play music. They use a clever trick with sound.

Sound travels as a wave. A wave has hills and valleys. In the hills, air is squeezed together. In the valleys, air is spread thin. Now picture two waves that meet. A hill from one wave lines up with a valley from the other. They cancel each other out. The air hardly moves at all.

Noise-canceling headphones use this idea. A tiny microphone outside listens to the sound around you. A small chip makes a new wave. It is a mirror image of the noise, with hills where the noise has valleys. The speaker plays this wave into your ear. The two sounds nearly erase each other.

This works best on steady, low sounds, like an engine drone. They are easy to predict. It works less well on sudden sounds, like a dropped tray or a person talking. The chip cannot match them fast enough. So you can still hear a flight attendant. Thick padding around the ear blocks some of the rest.

Questions

1. What do the hills and valleys of a sound wave stand for?

_____

_____

2. What does the tiny microphone outside the headphones do?

_____

_____

3. What kind of wave does the chip make?

_____

_____

4. Which sounds do these headphones handle best?

_____

_____

5. Why can you still hear a flight attendant talking?

_____

_____

6. What would happen if the hills of the new wave lined up with the hills of the noise?

_____

_____

Words to know

wave: a pattern of up and down movement that carries energy
valley: the low part of a wave
cancel: to remove or wipe out the effect of something
microphone: a device that picks up sound
drone: a low sound that keeps going and going

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

How Headphones Cancel the Hum of a Plane

Triangle group

On a long flight, the engines make a steady roar that tires your ears. Some headphones can make that roar fade without playing any music at all. They do it with a clever trick that uses the nature of sound.

Sound travels as a wave. You can picture a wave as a row of hills and valleys, where the air is squeezed together and then spread thin. Now imagine two waves meeting. If a hill from one wave lines up with a valley from the other, they cancel each other out, and the air barely moves at all.

Noise-canceling headphones use this idea. A tiny microphone on the outside listens to the sound around you. A small computer chip then makes a new wave that is the mirror image of the incoming one, with its hills where the noise has valleys. The speaker plays that mirror wave into your ear, and the two sounds nearly erase each other.

The trick works best on steady, low sounds like an engine drone, because they are easy to predict. It works less well on sudden noises, such as a dropped tray or a person talking, because the chip cannot match them quickly enough. That is why you can still hear a flight attendant over the hum. Thick padding around the ear helps block some of the rest.

Questions

1. What do the hills and valleys of a sound wave stand for?

_____

_____

2. What does the tiny microphone on the outside of the headphones do?

_____

_____

3. What kind of wave does the computer chip make?

_____

_____

4. Which kinds of sounds do these headphones handle best?

_____

_____

5. Why can a person still hear a flight attendant talking while wearing them?

_____

_____

6. What would happen if the hills of the second wave lined up with the hills of the noise instead?

_____

_____

Words to know

wave: a pattern of up and down movement that carries energy
valley: the low part of a wave
cancel: to remove or wipe out the effect of something
microphone: a device that picks up sound
drone: a low sound that keeps going and going

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

How Headphones Cancel the Hum of a Plane

Square group

On a long flight, the engines produce a steady roar that gradually wears out your ears. Some headphones can make that roar fade into the background without playing any music at all. They accomplish this with a clever trick that takes advantage of the basic nature of sound.

Sound travels through the air as a wave. You can picture a wave as a row of hills and valleys, where the air is alternately squeezed together and then spread thin. Now imagine two waves meeting each other. If a hill from one wave lines up exactly with a valley from the other, they cancel each other out, and the air barely moves at all.

Noise-canceling headphones put this idea to work. A tiny microphone on the outside of the ear cup continually listens to the sound around you. A small computer chip then builds a new wave that is the mirror image of the incoming one, with its hills positioned where the noise has valleys. The speaker plays that mirror wave into your ear, and the two sounds nearly erase each other.

The technique works best on steady, low sounds such as an engine drone, because they are easy for the chip to predict. It works far less well on sudden noises, like a dropped tray or a person talking, because the chip cannot match them quickly enough. That is why you can still hear a flight attendant speaking over the hum. Thick padding around the ear also helps to block some of the remaining sound.

Questions

1. What do the hills and valleys of a sound wave represent?

_____

_____

2. What does the tiny microphone on the outside of the ear cup do?

_____

_____

3. What sort of wave does the computer chip build?

_____

_____

4. For which kinds of sounds does this technique work best?

_____

_____

5. Why can a person still hear a flight attendant speaking while wearing the headphones?

_____

_____

6. What would happen if the hills of the second wave lined up with the hills of the noise instead?

_____

_____

Words to know

wave: a pattern of up and down movement that carries energy
valley: the low part of a wave
cancel: to remove or wipe out the effect of something
microphone: a device that picks up sound
drone: a low sound that keeps going and going

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

For the teacher: How Headphones Cancel the Hum of a Plane

Each student sheet carries a shape, not a level. The same topic and facts, written three ways.

Circle: How Headphones Cancel the Hum of a Plane

Easier · 201 words · Flesch-Kincaid grade 2.1

1. Places where air is squeezed together and places where it is spread thin.
2. It listens to the sound around you.
3. A mirror image of the noise, with hills where the noise has valleys.
4. Steady, low sounds like an engine drone.
5. The chip cannot match sudden sounds like talking fast enough.
6. The sounds would add up and get louder instead of canceling.

Triangle: How Headphones Cancel the Hum of a Plane

This passage · 225 words · Flesch-Kincaid grade 5.4

1. Places where the air is squeezed together and places where it is spread thin.
2. It listens to the sound around you.
3. A mirror image of the incoming wave, with hills where the noise has valleys.
4. Steady, low sounds like an engine drone.
5. The chip cannot match sudden sounds like talking quickly enough.
6. The sounds would add together and get louder instead of canceling.

Square: How Headphones Cancel the Hum of a Plane

Harder · 256 words · Flesch-Kincaid grade 7.1

1. Places where the air is squeezed together and places where it is spread thin.
2. It continually listens to the sound around you.
3. A mirror image of the incoming wave, with hills where the noise has valleys.
4. Steady, low sounds such as an engine drone.
5. The chip cannot match sudden sounds like speech quickly enough.
6. The sounds would add together and become louder instead of canceling.