Name: _____ Date: _____

The Train Horn That Changes Its Tune

Circle group

Stand by a railroad crossing when a train rushes past. The train blows its horn. As the train comes close, the horn sounds high. Once the engine passes, the sound gets lower. It stays low as the train goes away. But the engineer in the cab hears the same note all the time. How can one horn sound two ways?

Sound moves through the air in waves. The pitch of a sound is how high or low it seems. It depends on how many waves reach your ear each second. More waves each second make a higher pitch. Fewer waves make a lower pitch.

When the train comes toward you, each wave starts a bit closer to you than the last one. The waves get squeezed together. More of them reach you each second. You hear a higher pitch. After the train passes, each new wave starts farther away. The waves are stretched out. Fewer of them reach you, and the pitch drops.

This is called the Doppler effect. It is named for an Austrian scientist. You can hear it from a race car or a siren on a truck. The horn does not change. Only the way the waves reach you changes.

Questions

1. What happens to the horn's sound after the engine passes you?

_____

_____

2. What does the engineer in the cab hear?

_____

_____

3. What does pitch depend on?

_____

_____

4. Why is the horn higher when the train comes toward you?

_____

_____

5. Why does the pitch drop after the train goes by?

_____

_____

6. What is this change in sound called?

_____

_____

Words to know

pitch: how high or low a sound seems
crossing: a place where a road goes over train tracks
engineer: the person who drives a train
squeeze: to press close together

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: _____

The Train Horn That Changes Its Tune

Triangle group

Stand beside a railroad crossing as a train rushes by blowing its horn. As the train comes closer, the horn sounds high. The moment the engine passes, the sound slides lower, and it stays low as the train moves away. Yet the engineer in the cab hears the same steady note the whole time. How can one horn make two different sounds?

Sound travels through the air as waves. The pitch of a sound, which means how high or low it seems, depends on how many waves reach your ear each second. More waves per second make a higher pitch, and fewer waves make a lower pitch.

When the train is coming toward you, each wave starts a little closer to you than the one before it. The waves get squeezed together, so more of them arrive each second. Your ears hear a higher pitch. After the train passes, each new wave begins farther away. The waves are stretched out, fewer of them arrive each second, and the pitch drops.

This is called the Doppler effect, after an Austrian scientist who described the idea long ago. You can hear it from a passing race car, a speeding motorcycle, or a siren on a truck. The horn itself never changes. Only the way the waves reach you changes.

Questions

1. What happens to the sound of the horn after the engine passes you?

_____

_____

2. What does the engineer in the cab hear?

_____

_____

3. What does pitch depend on?

_____

_____

4. Why does the horn sound higher while the train comes toward you?

_____

_____

5. Why does the pitch drop once the train moves away?

_____

_____

6. What is this change in sound called?

_____

_____

Words to know

pitch: how high or low a sound seems
crossing: a place where a road goes over train tracks
engineer: the person who drives a train
squeeze: to press close together
steady: staying the same without changing

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: _____

The Train Horn That Changes Its Tune

Square group

Imagine standing beside a railroad crossing as a locomotive thunders past with its horn blaring. While the train approaches, the horn sounds shrill and high. The instant the engine goes by, the sound slides downward, and it remains low as the train recedes into the distance. Meanwhile, the engineer sitting in the cab hears one unchanging note throughout. How can a single horn produce two different sounds?

Sound travels through the air in the form of waves. The pitch of a sound, meaning how high or low it seems to a listener, depends on how many of those waves reach your ear every second. A larger number of waves per second produces a higher pitch, and a smaller number produces a lower pitch.

When the train is rushing toward you, each wave begins a little closer to you than the wave before it, so the waves become squeezed together and more of them arrive each second. Your ears therefore detect a higher pitch. Once the train has passed, each new wave begins farther away, the waves are stretched out, fewer of them arrive each second, and the pitch falls.

This phenomenon is known as the Doppler effect, named after an Austrian scientist who described the idea long ago. You can hear it from a passing race car, a speeding motorcycle, or a siren on a truck. The horn itself never changes. Only the manner in which the waves reach you is different.

Questions

1. What happens to the horn's sound the instant the engine goes by?

_____

_____

2. What does the engineer in the cab hear throughout?

_____

_____

3. What does the pitch of a sound depend on?

_____

_____

4. Why does the horn seem higher while the train is rushing toward you?

_____

_____

5. Why does the pitch fall once the train has passed?

_____

_____

6. After whom is this phenomenon named, and what is it called?

_____

_____

Words to know

pitch: how high or low a sound seems
crossing: a place where a road goes over train tracks
engineer: the person who drives a train
squeeze: to press close together

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: The Train Horn That Changes Its Tune

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

Circle: The Train Horn That Changes Its Tune

Easier · 203 words · Flesch-Kincaid grade 1.5

1. It gets lower.
2. The same note all the time.
3. How many waves reach your ear each second.
4. The waves are squeezed together, so more of them reach you each second.
5. The waves are stretched out, so fewer of them reach you.
6. The Doppler effect.

Triangle: The Train Horn That Changes Its Tune

This passage · 217 words · Flesch-Kincaid grade 4.6

1. It slides lower.
2. The same steady note the whole time.
3. How many waves reach your ear each second.
4. The waves are squeezed together, so more of them arrive each second.
5. The waves are stretched out, so fewer arrive each second.
6. The Doppler effect.

Square: The Train Horn That Changes Its Tune

Harder · 242 words · Flesch-Kincaid grade 7.3

1. It slides downward and stays low.
2. One unchanging note.
3. How many waves reach your ear every second.
4. The waves are squeezed together, so more of them arrive each second.
5. The waves are stretched out, so fewer of them arrive each second.
6. It is named after an Austrian scientist and is called the Doppler effect.