

ScienceNews

EDUCATOR GUIDE



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December 18, 2021 & January 1, 2022
Camera Captures Physics in a Snap



About this Guide

In this Guide, based on the online *Science News* article "[New high-speed video reveals the physics of a finger snap](#)," students will learn about an experiment, inspired by the movie *Avengers: Infinity War*, that investigates the role of friction in a successful finger snap. Students will then apply their scientific knowledge to assess scientific accuracy in movies and other media.

This Guide includes:

Article-based Comprehension Q&A — Students will answer questions about the online *Science News* article "[New high-speed video reveals the physics of a finger snap](#)," which details scientists' exploration of the friction required for finger snapping. A version of the article, "Camera captures physics in a snap," appears in the December 18, 2021 & January 1, 2022 issue of *Science News*. Related standards include NGSS-DCI: HS-PS2; HS-PS3.

Student Comprehension Worksheet — These questions are formatted so it's easy to print them out as a worksheet.

Cross-curricular Discussion Q&A — Students will discuss the physics of finger snapping and apply their scientific knowledge to think critically about the scientific accuracy of movies and online demonstrations. Related standards include NGSS-DCI: HS-PS2; HS-PS3.

Student Discussion Worksheet — These questions are formatted so it's easy to print them out as a worksheet.

Article-based Comprehension, Q&A

Directions for teachers: Ask students to read the online *Science News* article "[New high-speed video reveals the physics of a finger snap](#)," which details scientists' exploration of the friction required for finger snapping, and answer the following questions. A version of the article, "Camera captures physics in a snap," appears in the December 18, 2021 & January 1, 2022 issue of *Science News*. If students read the version of the article that appears in print, have them skip question No. 2.

1. What is needed for a successful finger snap? Explain the physics of a finger snap.

Friction plus the compressibility of the finger pads are necessary for a successful finger snap. When the middle finger and thumb come together in a normal snap, the finger pads compress, increasing surface area and friction between them. That friction allows energy to be stored before it's suddenly released.

2. What is the duration, rotational rate and acceleration of a finger snap? Why might the article's author compare those measurements with a blinking eye and a baseball pitcher's arm?

Finger snaps last about seven milliseconds. As the middle finger moves from the thumb to the palm, it rotates up to 7.8 degrees per millisecond and accelerates nearly three times as fast as a baseball pitcher's arm. Comparing the measurements with those of a blinking eye and a pitcher's arm gives readers a frame of reference to help them better comprehend the results.

3. What equipment did scientists use to study finger snapping, and what variables did they test?

Scientists used high-speed cameras and force sensors to study finger snaps under various conditions. The scientists studied bare snapping fingers, snapping fingers covered in lubricant and snapping fingers covered in rigid thimbles.

4. What did scientists learn from studying snapping fingers covered in lubricant?

Lubricated snaps were duds. That's because the slick thumb and middle finger can't produce enough friction, which means less stored energy and a slower snap.

5. What did scientists learn from studying snapping fingers covered in high-friction rubber?

High-friction snaps also were duds. That's because the friction delays the fingers' release, leading to a slower snap.

6. Based on the researchers' findings, would Thanos — the villain in the movie *Avengers: Infinity War* — have been able to snap his fingers while wearing a metal glove? Explain.

No. A metal glove's fingers would probably be too rigid to properly compress and create enough friction.

Student Comprehension Worksheet

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1. What is needed for a successful finger snap? Explain the physics of a finger snap.
2. What is the duration, rotational rate and acceleration of a finger snap? Why might the article's author compare those measurements with a blinking eye and a baseball pitcher's arm?
3. What equipment did scientists use to study finger snapping, and what variables did they test?
4. What did scientists learn from studying snapping fingers covered in lubricant?
5. What did scientists learn from studying snapping fingers covered in high-friction rubber?
6. Based on the researchers' findings, would Thanos — the villain in the movie *Avengers: Infinity War* — have been able to snap his fingers while wearing a metal glove? Explain.

Cross-curricular Discussion, Q&A

Directions for teachers:

Ask students to read the online *Science News* article "[New high-speed video reveals the physics of a finger snap](#)" and [watch a video interview](#) with a scientist that did the research. Then, direct students to answer the first set of questions with a partner. Students should answer the second set of questions alone before discussing their answers with a partner. If time and resources allow, encourage students to try the demo they choose in the final question. A version of the *Science News* article, "Camera captures physics in a snap," appears in the December 18, 2021 & January 1, 2022 issue.

Want to make it a virtual lesson? Post the online *Science News* article and video link to your virtual classroom. Discuss the article and questions with your class on your virtual platform.

Sounding off on a snap

1. Explain the physics behind snapping your fingers to create a sound.

When preparing to snap, fingers bend and finger pads compress, creating surface area between the pads that increases friction. The friction between bare fingers stores energy that is released all at once to accelerate the middle finger. The middle finger hits the palm at a high velocity, sending out shock waves that make the "snap" sound.

2. How does friction impact a finger snap?

If there is too little friction between the thumb and middle finger, not enough energy is stored between them. That means the middle finger can't accelerate to the velocity needed to impact the palm with enough force to create a sound. If there is too much friction between the fingers, too much energy builds up, delaying the middle finger's release and slowing acceleration.

3. List conditions that make finger snaps fall flat. Explain why snaps don't make much sound under such conditions.

If the fingers are too rigid (like they could be in a tight glove) or too slippery (like they could be when covered in soap or some other lubricant), they may not be able to compress enough to create the amount of friction needed for an audible snap.

4. What popular film inspired the study described in the article? What procedure did the researchers follow to assess the scientific accuracy of a scene in the film? Is the scene scientifically accurate? Explain.

*Scientists were inspired by a scene in the film *Avengers: Infinity War* in which the villain Thanos wipes out half of all life in the universe by snapping his fingers while wearing a supernatural metal glove. To test*

whether snapping fingers that are covered in metal is possible, the scientists first determined the conditions required to generate a normal finger snap using high-speed cameras and force sensors. Then scientists tried to mimic Thanos' snap in the film by observing snapping fingers covered by rigid thimbles. Coupled with the newfound understanding of the necessity of finger compressibility and friction to generate a snap, the scientists determined that the scene is not scientifically accurate — Thanos' gloved hand would not have produced an audible snap.

5. How would the scene have to be adjusted to be scientifically accurate?

The glove's metal would likely have to be compressible and not too slick to create the friction needed to create a snapping sound.

Fact or fiction?

1. Think of a scene in a movie or TV show that features a scientific concept you learned this semester. Using your scientific knowledge, discuss whether or not the scene is scientifically accurate.

Student answers will vary. Students might analyze another scene in Avengers: Infinity War, a scene from a disaster movie or the scene from the movie Up in which helium-filled balloons lift and carry a house.

2. If the scene is not scientifically accurate or not as accurate as it could be, what conditions or adjustments could make it so? Explain.

Student answers will vary. Students should explore whether or not conditions other than those depicted on-screen could produce the observed phenomenon.

3. There are many online videos of science demonstrations, and some may show outcomes that cannot be reproduced. Find a video of a science demonstration that you would be interested in re-creating. Name scientific principles and concepts you would need to know to verify whether or not the outcome of the demonstration is scientifically possible. What conditions would have to exist for the outcome shown in the video to occur?

Student answers will vary.

Student Discussion Worksheet

Directions: Read the online *Science News* article "[New high-speed video reveals the physics of a finger snap](#)" and [watch this video](#) before answering the following questions as directed by your teacher. A version of the article, "Camera captures physics in a snap," appears in the December 18, 2021 & January 1, 2022 issue of *Science News*.

Sounding off on a snap

1. Explain the physics behind snapping your fingers to create a sound.
2. How does friction impact a finger snap?
3. List conditions that make finger snaps fall flat. Explain why snaps don't make much sound under such conditions.
4. What popular film inspired the study described in the article? What procedure did the researchers follow to assess the scientific accuracy of a scene in the film? Is the scene scientifically accurate? Explain.
5. How would the scene have to be adjusted to be scientifically accurate?

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