Required Annotations Student-Created Annotat	ions	Summary /	Questions
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Student-created

Required (bold)

/ Reflection

In 2016, the youth of America were obsessed with this one cool trick: the water bottle challenge. The concept is simple, but it's easier said than done. Just flip a full or half-empty plastic water bottle so it lands upright. Kids around the country **chronicled** their successes and failures on YouTube while the crinkling of tossed water bottles drove their parents crazy. The craze may have faded, but the physics still remains. That's why, reports Mindy Weisberger at LiveScience, a group of young researchers recently published an article demonstrating how to land a water bottle every single time.

According to a press release, five first-year students at the University of Twente in Netherlands decided to unravel the physics of the water bottle challenge for a class on dynamics and relativity. Using a high-resolution camera, they filmed flip after flip of full and partially full water bottles as well as bottles containing two tennis balls. They then analyzed the videos and boiled the movements down to physical formulas. What they found is that a flip that causes the greatest decrease in **angular velocity** was most likely to stick the landing.

In practical terms, the team found that the best flipping bottle is one between 20 and 41 percent full. According to the study, landing a full bottle is almost impossible because the **rotational** speed of the bottle doesn't change. With a partially full bottle, however, the water spreads out as it spins, changing the rotational speed.

"We didn't look at the water in the bottle as fluid, but instead assumed it to behave as something <u>rigid</u>," one of the student researchers, Pim Dekker, told Michaela Nesvarova at U Today earlier this year. In fact, the water bottles and tennis balls behaved the same way.

"Based on our experiments, we showed that the mass of a rotating object spreads throughout the object, reducing the velocity. That means that the distribution of mass makes the bottle slow down and increases the chances of a successful landing," says Dekker.

The research appears in the American Journal of Physics, a pretty impressive publishing credit for undergrads. The team didn't initially intend to wind up in a **prestigious** journal. "It started as a regular project for our dynamics course," Mees Flapper, one of the authors, told Nesvarova. "We could choose any topic we liked and the water bottle flipping challenge was a big hit online at the time. As far as we know, there were no publications dedicated to the phenomenon. Our teachers Alvaro Marin and Jacco Snoeijer really liked the topic and later asked us to help them write a paper on it. That surprised us, but of course we agreed."

The paper may be too late to save humanity from the constant crunch of flipping water bottles that made 2016 and 2017 a living nightmare for many, but Flapper tells Weisberger at LiveScience that the research has a bigger point.

"You shouldn't be afraid to think outside the box — even in an abstract, theoretical field [such] as physics," he says.

However, it will take some seriously out-of-the-box thinking to explain other more recent YouTube sensations like the disturbing 100-layer challenge or the Fortnite dance challenge.

Questions (On the back)

1. Read the selections from the article.

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Which of the following can be inferred from these selections?

- a) The students used the strategy of trial and error in their research.
- b) The students wanted to start a new viral challenge involving tennis balls.
- c) The students predicted the outcome of their research correctly.
- d) The students wanted to record their research to upload it on YouTube.
- 2. Read the following sentences from the article.

Kids around the country chronicled their successes and failures on YouTube while the crinkling of tossed water bottles drove their parents crazy.

However, it will take some seriously out-of-the-box thinking to explain other more recent YouTube sensations like the disturbing 100-layer challenge or the Fortnite dance challenge.

Which idea is BEST supported by these sentences?

- a) Kids hope to become famous by winning different YouTube challenges.
- b) YouTube challenges generally focus on popular video games.
- c) Parents like to get involved in their kids' YouTube challenges.
- d) Viral YouTube challenges do not always appeal to everyone.
- 3. Read the analysis of how the central idea was introduced.

The central idea was introduced with a description of the water bottle challenge in order to provide readers with context about the topic. The author then transitioned to the subject of the students who decided to research the physics behind the water bottle challenge.

How was the central idea developed further?

- a) The author summarized the procedures the students followed as they conducted their research and detailed the results of the study.
- b) The author interviewed the students about their collaboration and shared each student's role in their research of the water bottle challenge.
- c) The author introduced the American Journal of Physics and emphasized its influence in encouraging the students to seek publication for the study.
- d) The author indicated that the students completed their project and predicted that they would soon research another popular challenge.
- 4. Which option provides an accurate and objective summary of the article?
  - a) The obsession over the water bottle challenge reached its peak in 2016 and has steadily declined since then. Students at the University of Twente in Netherlands decided to investigate YouTube's role in promoting viral challenges like the water bottle challenge.
  - b) The popularity of the water bottle challenge led students at the University of Twente in Netherlands to investigate how to successfully flip and land a water bottle every time. The students found that the amount of water in the bottle affected its landing.
  - c) As frustrated parents and teachers can attest, it is impossible to land a water bottle upright one hundred percent of the time. University of Twente students developed a foolproof formula that will prevent mishaps and annoying sounds during the challenge.
  - d) The water bottle challenge started in America in 2016 and slowly spread around the world. By the time it reached Netherlands, students at University of Twente had watched enough YouTube videos to get the flip right nearly one hundred percent of the time.
- 5. Does the article's title accurately reflect the contents? (In other words, would you be able to flip a bottle better

after reading this article?