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**Popcorn Physics: Why it explodes, jumps and makes the pop sound**

Close Reading Questions

1. Fill out the table below by answering the following:
	1. From the title, determine the three questions the scientists wanted to answer.
	2. What were their hypotheses for the three questions?
	3. What answers did the scientists discover through the study?

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| A) Questions | 1- | 2- | 3- |
| B) Hypotheses |   |  |  |
| C) Answers |  |  |  |

1. From which point of view is the article written?
	1. 1st person
	2. 2nd person
	3. 3rd person objective
	4. 3rd person limited
	5. 3rd person omniscient
2. On what three aspects of popping corn did previous research focus?
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	3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Using text evidence, explain how the new study by Virot and Ponomarenko is different than previous studies.

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1. What information from the previous studies was necessary to Virot and Ponomarenko’s current study? (Circle all that apply.)
	1. Optimum internal moisture level is 13.5-14%
	2. The ideal shape for a kernel is a sphere
	3. The hull of the Zea mays everta kernel is thicker
	4. 100 Celsius is the vapor point for internal moisture
	5. A kernel has a starchy matrix called endosperm inside
2. How did the information from question 5 benefit their study? Write in complete sentences.

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1. In complete sentences, use your own words to explain the scientific process or chain of events that take place when popping a kernel.

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1. What can you infer was one of the researchers’ hypotheses from the sentence below?

 *“The steam has no role in powering the jump, according to the study. ‘No rocket effect,’ they wrote.”*

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1. What three characteristics of the Zea may averta kernel make it the only corn kernel that pops?
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	3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Why does a kernel need a thick hull in order to “pop”? Write in complete sentences.

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1. Biological fracture mechanics is the study of:
2. the break up of tectonic plates in the earth’s crust
3. plants and fungi that use pressure fracturing to reproduce
4. how bones and other organic material break under pressure
5. Which sentence helps explain why it took "hundreds of trials" to figure out why popcorn jumps?
6. After being compressed on the ground, the leg is released, causing the popcorn to somersault like a gymnast.
7. All of this happens in just one-fifteenth of a second.
8. Popcorn locomotion bears some resemblance to the biological fracture mechanics that allow fungi and some plants to disperse their spores and seeds, the researchers added.
9. The steam has no role in powering the jump, according to the study.
10. Which of the following matters is left uncertain in the article?
11. Why popcorn pops
12. Why other types of corn don't pop
13. How the researchers identified the reason why popcorn pops
14. How the researchers identified the reason why popcorn jumps
15. If this article were to be rewritten to focus on research methods, which paragraph would be MOST useful?
16. Their investigations were inspired by colleagues in the hydrodynamics laboratory at Ecole Polytechnique in Palaiseau, where Virot is working on his doctorate degree and Ponomarenko got his in 2012. (Ponomarenko is now doing a postdoctoral fellowship at a French government agency for agronomical research.) Their fellow scientists were using a high-speed camera to take 2,900 pictures per second of physical phenomena, like a drop landing on the surface of water.
17. After hundreds of trials, they discovered that the popcorn gets kicked a few millimeters to a few centimeters into the air by a starch “leg” that emerges from the broken hull. After being compressed on the ground, the leg is released, causing the popcorn to somersault like a gymnast. All of this happens in just one-fifteenth of a second.
18. They identified three possibilities: the fracture of the hull, the rebound on the ground, and the release of pressurized water vapor. To figure out which was responsible, they placed a high-end microphone 30 centimeters away from the hot plate and synchronized it with the high-speed camera. There was no sound when the popcorn first opened, so the cracking of the hull was not the culprit. A second fracture was observed 100 milliseconds later — 6 milliseconds after that the pop sound began.
19. For instance, a Jamaican fungus that lives on banana leaves uses gas-bubble explosions to break from its stalks. Another fungal species uses pressure to rupture a plug at the tip of a miniature squirt gun to blast its spores into the air at 100 kilometers per hour.
20. Each of these sentences contains an important detail from the article. Which sentence would make the BEST summary of the article?
21. Most popcorn lovers take for granted that a simple kernel of corn can metamorphose into a fluffy treat.
22. Their investigations were inspired by colleagues in the hydrodynamics laboratory at Ecole Polytechnique in Palaiseau, where Virot is working on his doctorate degree and Ponomarenko got his in 2012.
23. Known scientifically as Zea mays everta, popcorn is the only type of corn that pops.
24. But to a pair of French researchers, the popping of corn presents a powerful demonstration of how the laws of physics apply to everything — even a snack food.