READERS' GUIDE
1. **When Izzy plays her flute to calm her fears** about the first day of school, her granddad can tell just from the sound of her playing that she’s worried. He comes to her room to talk. How does connecting with a friend or family member help when you—or they—are feeling troubled? What do you do to calm yourself when you are stressed or anxious? What can you do to help someone else feel less stressed or anxious?

2. **Izzy is worried about being perceived as quiet**, but her granddad reminds her that quiet, introspective people have a lot to contribute. Do you think our culture values introversion as much as extroversion? Why or why not? What might we be missing out on if we value one over the other? Can you think of a few ways in which quiet, shy Izzy makes significant contributions throughout the story—in ways she might not if she was very extroverted?

3. **Izzy’s granddad teaches her about Occam’s razor**, stating that “you should not make more assumptions than the minimum needed.” In other words, the simplest answer is usually the best one. How can Izzy apply this to her friend Marie Curie? Think of a situation in which you could apply the principle of Occam’s razor in your life—in other words, what’s something you may be making too complicated that could benefit from simplification?

4. **When Izzy, Allie, and Charlie enter middle school on the first day**, they are so cold that Izzy jokes it feels like absolute zero, the scientifically coldest possible temperature. Since they are all nervous and excited about their new school, Charlie reminds Izzy of the influence that emotion has on body temperature. What influence does emotion have on body temperature? Can you think of an example of when you’ve experienced this effect yourself?

5. **One of the laws of physics is that every action has an equal and opposite reaction.** The law is typically applied to physical phenomenon, but in this case, how does it apply to their first encounter with their old friend Marie? Did the warmth of their outreach match Marie’s response?

6. **Izzy is assigned to a forensics class**, in which she assumes she will use the scientific method to solve crimes. She looks forward to collecting samples, like hair and fingernails, and performing DNA tests. She’s disappointed to learn from Allie that forensics, in this case, means debate and public discussion. She is terrified of public speaking. Her forensics teacher, Ms. Martinez, tells the class, “You can’t speak with conviction unless you care about your topic.” What is Izzy passionate about? What would you choose to speak about if you had to deliver a speech in Ms. Martinez’s class?

7. **Izzy has a lot of worries**: forensics, the way Marie is treating her, and tryouts. Though she is surrounded by other kids at school, she feels alone in her worry. She compares herself to the center of a black hole, which is known as a singularity. Black holes are so dense, with so much mass that not even light can escape their warp. Does a singularity sound lonely to you? Why or why not?
8. **Izzy’s locker combination is really easy** for her to remember because the number is a really famous number in mathematics. What is this number and what is its significance?

9. **Ms. Okeke, the school librarian and media specialist,** wears her hair in a traditional head scarf known as a gele, commonly worn in parts of Africa. Have you ever worn a gele? What elements of dress or fashion are part of your ethnic heritage (or one that you admire) and what purpose or significance do they have? Do you ever wear them? If so, for what occasions?

10. **Izzy finds an article about a science team,** named the “Hoppers” after Grace Hopper—a computer scientist, U.S. Navy admiral, and pioneer in early computer programming. Do you have a favorite scientist? Of the scientists mentioned in this book, which is your favorite and why?

11. **Allie suggests the best way to deal with awkward interactions with Marie is to avoid her.** Allie compares this avoidance plan with “skew lines”—a mathematical concept in which two lines never intersect, “not ever, not even to infinity.” Does that sound like a reasonable plan—can the friends be like skew lines with Marie? Why or why not?

12. **When attempting to solve the problem** of the malfunctioning heating and cooling system, Izzy uses the steps of the Scientific Method. Make an observation, form a question, form a hypothesis, conduct an experiment, analyze the data, and draw a conclusion. See if you can summarize what she wrote for each of these. Look back at the story if you get stuck.

13. **Sir Isaac Newton’s first law of motion** is that an object at rest tends to stay at rest and an object in motion tends to stay in motion. Izzy’s granddad uses this to try to motivate Izzy but it doesn’t seem to work. According to the law itself, why doesn’t his pep talk achieve the results he’s looking for? Later, when she’s working her way through the scientific method to solve the air-conditioning mystery, her friends joke that she’s “unstoppable.” How does Izzy use Newton’s law to explain her momentum?

14. **The three friends venture up onto the roof of the school** to locate the air-conditioner condenser and exhaust fans. Do you know where the air-conditioner condenser and exhaust fans are in your school or home? If not, ask an adult to show you.

15. **Charlie sees grounded bees on the roof** and knows that they aren’t dead, just too cold to fly. When the air temperature falls below fifty-five degrees, bees can’t fly. Why can’t they fly at that temperature? If their body temperature falls to 41 degrees, they die. How does living in a hive protect bees in winter months?
16. Allie and her little sister live with her grandmother, Bubbie. Bubbie tells the girls, “Well-behaved women seldom make history.” What does she mean by this? When is it worth it to be well-behaved versus subversive?

17. In France (and many other countries), dates are written with the number of the day first, then the month. So when Marie told her friends she’d call them on 12/10, what date did she mean? What date did her friends think she meant?

18. Gina’s room is huge and crammed with all kinds of things for her experiments and projects. She has a poster of Katherine Johnson, a brilliant mathematician who was first hired by NASA in the 1950s as a “computer.” There were no real computers at that time, so women who were gifted at math used to do the computations themselves. Johnson later worked on NASA’s space projects, using geometry to calculate the orbital paths that eventually allowed astronauts to land on the moon. She’s been the subject of books and a blockbuster movie, Hidden Figures. Based on what we learn about Gina in this story, what may be some reasons she has this particular poster on her wall?

19. Light-emitting diode (LED) bulbs do not give off heat, in contrast to older and more common incandescent bulbs. Incandescent bulbs do not use energy as efficiently, so they burn out more quickly but they are much less expensive. Why does Izzy hypothesize that the principal’s lightbulb is causing the AC to malfunction? How does she decide to test her hypothesis?

20. Izzy conducts an experiment, with the help of her friends. Combining their strengths, they able to complete the experiment in ways they would not have individually. In what ways is it important to recognize team efforts as well as individual accomplishments? Can you think of a time when you accomplished something as a part of a group or team that you would not have achieved on your own? What strength(s) did you contribute to the effort?

21. When the air-conditioning shuts off and stays off, Izzy makes a note of their analysis of the data and conclusion. She shares the completed notes with Allie, Charlie, Marie, and Gina. How did following the steps of the scientific process help Izzy and her friends solve the problem? Could they have solved it without using the scientific method? In what ways might their approach and results have differed?