Isaac Newton

The Secret of the Apple

Author: Nick Quark · Recommended age: 7–12 · 9 chapters (seven of story, one of experiments, one of fun facts)

Name: _____ Date: _____

1. Before you read

1. Why do you think things fall down to the ground, and not up or sideways?
2. The title talks about "the secret of the apple." What secret could an apple be hiding?
3. Have you ever seen a rainbow? Where do you imagine its colors come from?

2. Comprehension questions

*Keep the book in front of you: look things up, reread, and answer in your own words. The labels tell you what kind of question it is: **fact** (it's written in the book), **why** (you have to explain a cause), and **opinion** (there's no single right answer).*

Chapter 1 · The Boy Who Built Worlds

1. Baby Isaac was so tiny that people said afterward he could have fit inside what? FACT

2. What was the "secret engine" of the miniature windmill Isaac built? FACT

3. Why did Isaac start studying "furiously" until he was top of the school? WHY

Chapter 2 · The Castle of Books and the Servant's Secret

4. What was a "subsizar"? Name two jobs Isaac had to do at Cambridge. FACT

5. Years later Isaac wrote: "If I have seen further, it is by standing on the shoulders of giants." What do you think he meant? Whose shoulders do you stand on? OPINION

Chapter 3 · The Magic Year and the Rebel Apple

6. Why did Isaac have to go back to the farm at Woolsthorpe? WHY

7. In the dark room, why did Isaac set up a second prism the other way around? What happened? WHY

8. According to the cannon idea, the Moon is falling toward the Earth. Why does it never crash into us? WHY

Chapter 4 · The Toy That Caught the Stars

9. What was wrong with telescopes made with glass lenses, and what did Isaac use instead? FACT

10. To make his mirror, Isaac used arsenic, knowing it was a poison. What do you think of what he did? OPINION

Chapter 5 · The Most Important Book in the World

11. What prize did Christopher Wren offer to whoever brought him the proof about the shape of the planets' orbits? FACT

12. Why couldn't the Royal Society pay to print the *Principia*? Who paid instead? WHY

You may print and photocopy this guide freely for use at home or in the classroom.

Chapter 6 · The Great Mathematics War

13. Why was the Royal Society committee that decided who invented calculus not fair? WHY

14. Newton kept his discovery in a drawer for twenty years. Would you have shared the idea right away or kept it to yourself? Why? OPINION

Chapter 7 · The Coin Detective and the Ocean of Truth

15. Thieves were clipping the edges off silver coins. What did Newton do about it? Did he invent the ridged edge on coins? FACT

16. Near the end of his life, what did Newton compare himself to? FACT

3. Timeline

Every date comes from the book. There are three blanks, marked ✎: find the year and write it in.

1642	Isaac is born at Christmas, so small and weak that nobody thinks he will live, on a little farm at Woolsthorpe, England.
✎ _____	At eighteen, he arrives at Trinity College, Cambridge, as a subsizar.
1669	At twenty-six, he becomes Lucasian Professor of Mathematics.
1672	His telescope is shown to the Royal Society and he is elected a Fellow.
1684	The coffeehouse bet; in August, Halley visits Isaac in Cambridge.
✎ _____	Thanks to Halley, the *Principia* is published.
1696	He leaves Cambridge to become Warden of the Royal Mint, in London.
✎ _____	Queen Anne knights him: from that day on he is Sir Isaac Newton.
1727	He dies at eighty-four and is buried in Westminster Abbey.

4. Science vocabulary

Prism
A triangular piece of glass that splits white light into its colors.

Spectrum
The band of colors that appears when white light passes through a prism: red, orange, yellow, green, blue, indigo, violet. Those colors were inside the white light all along.

Fluxions
Isaac's name for his new mathematics, the kind that measures speed and change. Today we call it calculus.

Gravity
The pull between all objects that have mass. The same force that makes the apple fall keeps the Moon going around the Earth.

Orbit
The curved path an object follows around another because of gravity, like the Moon around the Earth.

Inertia
Things like to keep doing what they're already doing. If they're still, they want to stay still; if they're moving, they want to keep moving.

Chromatic aberration
The halo of colors around the images in lens telescopes, because glass splits light into colors.

Reflecting telescope
A telescope that uses a curved mirror instead of lenses. Because the light bounces instead of passing through glass, the image comes out sharp.

You may print and photocopy this guide freely for use at home or in the classroom.

5. Try it at home: a rainbow in a glass

This is the first experiment in Chapter 8 of the book. With a glass of water, you'll do what Isaac did with his prism.

You need

- A clear glass full of water (plastic is best, in case it falls).
- A sunny day and a window (or a flashlight).
- A sheet of white paper.

Steps

1. On a sunny day, set the glass of water at the edge of a table, near the window.
2. Put the white paper on the floor, below the glass.
3. Adjust the angle of the glass until sunlight shines through it.
4. Look for the patch of light on the paper, the floor, or the wall.

What to look for

Which colors appear? In what order? Do they change if you move the glass?

What it has to do with the story

As it passes through the water, light bends, and each color bends a little differently: that's why they separate. It's what Isaac saw in his dark room at Woolsthorpe: white light isn't pure, it's a mix of all the colors. And it's also why glass telescopes gave blurry images, and why he invented his own with a mirror.

Safety: never look straight at the Sun. Isaac did, and had to shut himself in a dark room for three days until his eyes recovered.

6. Talk or write about it

Class discussion

The book says science isn't a race to see who gets there first, but a tower we all build together. Newton won the fight against Leibniz in his lifetime, but today we use Leibniz's symbols. Who really won the calculus war?

Writing (half a page)

Isaac kept a notebook of questions, like "Why doesn't the Moon fall on us?" Write three questions of your own that nobody has been able to answer for you. Pick one and explain how you would try to find the answer.

You may print and photocopy this guide freely for use at home or in the classroom.

Answers for grown-ups

*The **opinion** questions (5, 10, and 14) have no set answer: any well-reasoned response is fine. For the **why** questions we give the explanation the book offers, as a guide.*

Comprehension questions

1. A quart pot: a jug that would hold about four cups of water.
2. A mouse, which Isaac called "the miller": it ran inside a wheel to reach its food and turned the mill.
3. Because a bully kicked him in the stomach. Isaac won the fight in the schoolyard, and then decided to beat him at schoolwork too.
4. A second-class student who works to earn the right to study. He served meals to the other students, cleaned the mud off their boots, made their beds, and emptied their chamber pots (any two).
5. *Opinion: no set answer.*
6. Because of the Great Plague: the university closed and sent everyone home.
7. To check that the glass hadn't "painted" the light. The colors went into the second prism and came out as white light again.
8. Because it is moving sideways very fast: it falls toward the Earth, like the apple, but never hits it.
9. Glass split light into colors and the images came out blurry, with a colored halo (chromatic aberration). Isaac used a curved metal mirror instead.
10. *Opinion: no set answer.*
11. A book worth forty shillings, an expensive book.
12. Because it had spent all its money printing a hugely expensive book about the history of fishes. Edmond Halley paid out of his own pocket.
13. Because Newton, who was president, picked his own friends as judges, and secretly wrote the final report himself, publishing it as though it came from somebody else.
14. *Opinion: no set answer.*
15. He took charge of the Great Recoinage: millions of old, clipped coins were called in and melted down to strike new ones with protected, ridged edges. He did not invent the ridged edge; English mints had started using it a generation earlier. He also hunted down counterfeiters such as William Chaloner.
16. To a boy playing on the seashore, finding now and then a smoother pebble or a prettier shell, while the great ocean of truth lay all undiscovered before him.

Timeline blanks

- **1661** — arrives at Trinity College, Cambridge.
- **1687** — the *Principia* is published.
- **1705** — Queen Anne knights him.

Before you read and Talk or write about it

No set answers: these are for sparking ideas and conversation.

You may print and photocopy this guide freely for use at home or in the classroom.