NICK QUARK · READING GUIDE

Galileo Galilei

The Starry Messenger

Author: Nick Quark · Recommended age: 7–12 · 11 chapters

Name: _____ Date: _____

1. Before you read

1. Tonight, look at the Moon. What do you see on its surface? Draw it as best you can and keep the drawing until you finish the book.
2. If you drop a big stone and a small stone at the same time, which do you think will hit the ground first? Write down your answer before you read.
3. Has anyone ever told you something was true "just because" or "because the book says so"? Did that convince you?

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).*

Chapters 1 and 2 · The musician's son and the lamp

1. What did Vincenzo, Galileo's father, do with strings and weights, and what did he discover? FACT

2. What excuse did his father use to take him out of the monastery at Vallombrosa? FACT

3. There were no clocks with second hands in Pisa Cathedral. What did Galileo use to time the swinging lamp? FACT

Chapters 3 and 4 · Pisa and Padua

4. Explain in your own words Galileo's reasoning about two stones tied together with a string. What did it show? WHY

5. Why does the book say the story of the Tower of Pisa probably never happened? WHY

6. Things fall too fast to measure. What did Galileo do so he could study them, and how did he measure time? FACT

Chapters 5 and 6 · The Dutch toy and the four moons

7. Why did the senators of Venice think the spyglass was a treasure? WHY

8. What did Galileo see along the line between the lit and dark parts of the Moon, and what did he conclude? FACT

9. Why were Jupiter's four moons "a bombshell" in 1610? WHY

10. Cesare Cremonini refused to look through the telescope. What would you say to him if you were Galileo? OPINION

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

Chapters 7 and 8 · Venus, the Sun, and the first warning

11. What did Galileo see that Venus and the Moon have in common, and what did that prove? FACT

12. How did Galileo and Castelli observe the Sun without hurting their eyes? FACT

13. What did Cardinal Bellarmine tell Galileo in 1616? FACT

Chapters 9 and 10 · The book that angered the pope and the trial

14. Why did Pope Urban VIII feel betrayed when he read the *Dialogue*? WHY

15. Why does the book say Galileo most likely never said "And yet it moves"? WHY

16. Galileo read the recantation to save his life. Did he do the right thing? What would you have done? OPINION

Chapter 11 and the end · Arcetri and the feather on the Moon

17. What did Sister Maria Celeste do to help her father after he was sentenced? FACT

18. What did astronaut David Scott drop on the Moon in 1971, what happened, and why? WHY

3. Timeline

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

1564	Galileo is born in Pisa on February 15.
1589	He gets his first job: professor of mathematics at the University of Pisa.
1592	He moves to the University of Padua, where he will spend eighteen years.
1609	He improves the Dutch spyglass and shows it off from the bell tower of St. Mark's.
✎ _____	On January 7 he sees three little points of light beside Jupiter, and he publishes *The Starry Messenger*.
1616	The Church forbids defending Copernicus's idea.
1623	His friend Maffeo Barberini is elected pope: Urban VIII.
✎ _____	On June 22, in Rome, he has to kneel before the cardinals and renounce his ideas.
1638	*Two New Sciences* is published in Holland. He is now blind.
✎ _____	He dies in Arcetri on January 8. That same year, Isaac Newton is born.

4. Science vocabulary

Pendulum
A weight hanging from a string that swings back and forth. Galileo saw that it takes the same time to swing there and back, whether the swings are big or small.

Acceleration
What happens to something that goes faster and faster, like the bronze balls Galileo rolled down his ramp.

Lens
A piece of polished, curved glass that bends light. Galileo's spyglass had one bulging outward at the front and one curved inward by the eye.

Telescope
A tube with lenses for seeing faraway things up close. Its name, meaning "seeing far," was invented at a dinner in Galileo's honor.

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

Satellite
A body that goes around a planet. The four moons Galileo discovered are satellites of Jupiter.

Phases
The different shapes we see of the Moon or Venus, depending on how much of the lit side faces us.

Hypothesis
An idea that hasn't been proved yet and needs to be tested. The pope asked Galileo to present Copernicus's idea that way.

Supernova
The gigantic explosion of a star. The one in 1604 showed that the heavens do change, contrary to what Aristotle taught.

5. Try it at home: the pendulum that's never in a hurry

Galileo discovered that a pendulum takes the same time to swing there and back whether it swings a lot or a little. You're going to test it with a string and a nut.

You need

- A piece of string about three feet long.
- A nut, a key, or an eraser.
- Tape.
- A clock with a second hand or the stopwatch on a phone.

Steps

1. Tie the nut to one end of the string and tape the other end to the edge of a table, so the nut hangs without touching the floor.
2. Pull the nut a hand's width to one side and let go. Count how many swings there and back it makes in 30 seconds.
3. Now pull it much farther, almost level with the table, and count for 30 seconds again.
4. Finally, shorten the string by half and try again.

What to look for

Do you get the same number of swings with the small arc and the big one? What happens when the string is shorter? Write down all three numbers.

What it has to do with the story

It's what Galileo saw in the lamp in Pisa Cathedral, in Chapter 2, timing it with his pulse. Thanks to that property, the first pendulum clocks could be built much later.

Safety: do the experiment away from anything breakable, and don't stand on chairs.

6. Talk or write about it

Class discussion

Galileo quoted the idea that the Bible teaches "how one goes to heaven, not how heaven goes." Can science and beliefs live side by side? What should happen when what we observe doesn't match what the books say?

Writing (half a page)

Write the letter Sister Maria Celeste might have sent her father while he waited for his trial in Rome.

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

Answers for grown-ups

*The **opinion** questions (10 and 16) 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. He hung weights from different strings, stretched them, plucked them, and measured. He found that some of the ancient Greek rules about which notes sound good together didn't hold up.
2. He said the boy had an eye infection that needed to be treated at home.
3. His own pulse: he counted his heartbeats for each swing of the lamp.
4. If the slower small stone held back the big one, the pair would fall more slowly; but together they weigh more, so they should fall faster. Both can't be true at once: with no air to slow them down, everything falls equally fast.
5. Because Galileo, who wrote a lot and loved showing off his experiments, never mentions it in his books or letters: it's most likely one of Viviani's legends.
6. He made them fall more slowly by rolling bronze balls down a tilted wooden ramp. He timed them with the water that ran out of a bucket with a tiny hole, and then weighed the water.
7. Because they could see ships so far away they were invisible to the naked eye: for a city that lived from the sea and trade, seeing ships two hours before anyone else was an enormous advantage.
8. Little points of light in the middle of the dark area. He realized they were mountaintops lit by the Sun before the valleys below: the Moon was neither smooth nor perfect.
9. Because Jupiter moved across the sky taking its moons with it: a planet could move and have moons, and there were things in the universe that didn't go around the Earth. It took away one of the best arguments of Copernicus's opponents.
10. *Opinion: no set answer.*
11. Both have phases. Seeing Venus sometimes round and small and sometimes as a thin, large fingernail proved that Venus goes around the Sun.
12. They projected the Sun's image onto a sheet of white paper behind the telescope (Castelli's idea).
13. That from then on he could not hold or defend the idea that the Earth goes around the Sun.
14. Because Galileo put the pope's favorite argument in the mouth of Simplicio, the character who was wrong about everything and whose name sounded like "simpleton."
15. Because it doesn't appear in any record of the trial or any letter from the time, it first appeared in print more than a hundred years later, and saying it in front of the court would have been madness.
16. *Opinion: no set answer.*
17. She asked permission to recite in his place the seven psalms a week he had been ordered to say as punishment, and she did it every week.
18. A hammer and a falcon feather, at the same time. They hit the ground at exactly the same moment, because on the Moon there is no air to slow the feather down. "How about that! Mr. Galileo was correct in his findings."

Timeline blanks

- **1610** — Jupiter's moons and *The Starry Messenger*.
- **1633** — the recantation before the cardinals.
- **1642** — he dies in Arcetri.

Before you read and Talk or write about it

No set answers: these are for sparking ideas and conversation. It's worth coming back to question 2 of "Before you read" after Chapter 3.

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