Instructor's Guide Quick Start

The BookShark™ Instructor's Guide (IG) is designed to make your educational experience as easy as possible. We have carefully organized the materials to help you and your children get the most out of the subjects covered. If you need help reading your schedule, see "How to Use the Schedule" in **Section Four**.

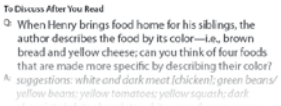
This IG includes a 36-week schedule, notes, assignments, readings, and other educational activities. See **Section Three** for specific organizational tips, topics and skills addressed, the timeline figure schedule, and other suggestions for the parent/teacher. Here are some helpful features that you can expect from your IG.

Easy to use
Everything you need is located right after the schedule each week. If a note appears about a concept in a book, it's easy to find it right after the schedule based on the day the relevant reading is scheduled.

Maps
Colorful map answer keys, which double as bookmarks, will help you easily find relevant map locations. You will find the coordinates and the location name in your notes.

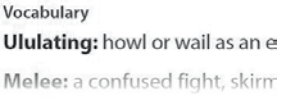
4-Day Schedule
Designed to save one day a week for music lessons, sports, field trips, co-ops or other extra-curricular activities.

To Discuss After You Read
These sections help you hone in on the basics of a book so you can easily know if your children comprehend the material.


To Discuss After You Read

Q: When Henry brings food home for his siblings, the author describes the food by its color—i.e., brown bread and yellow cheese; can you think of four foods that are made more specific by describing their color?

A: *suggestions: white and dark meat [chicken]; green beans/yellow beans; yellow tomatoes; yellow squash; dark*


Vocabulary

Ululating: howl or wail as an e

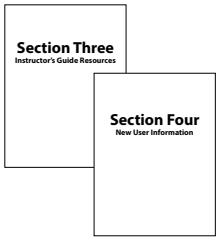
Melee: a confused fight, skirm

Vocabulary
This section includes terms related to cultural literacy and general vocabulary words in one easy-to-find place.

Notes
When relevant, you'll find notes about specific books to help you know why we've selected a particular resource and what we hope your children will learn from reading it. Keep an eye on these notes to also provide you with insights on more difficult concepts or content (look for "Note to Mom or Dad").


Note: The Yangtze River is the third longest river in the world. The author talks about "the yellow waters of the Yangtze river." The river carries an enormous amount of silt from higher elevation in Western China. It drops the silt on the central plains which creates good soil for rice planting.

In 2010, the Chinese government completed the Three Gorges Dam across the Yangtze, the world's largest dam. It generates electricity and will hopefully cut down on flood-



Instructor's Guide Resources and **New User Information**
Don't forget to familiarize yourself with some of the great helps in **Section Three** and **Section Four** so you'll know what's there and can turn to it when needed.

How to Use the Schedule

More notes with important information about specific books.

The [N] symbol provides you with a heads-up about difficult content. We tell you what to expect and often suggest how to talk about it with your kids.

4-Day Schedule:

This entire schedule is for a 4-Day program. We provide a blank cell on Day 5 to allow for your own activities and topics that you would like to teach your children.

Write in the week's date for your records.

The ◷ symbol indicates there is a timeline suggestion in the notes for that day.

The 🌍 symbol indicates you will find a map assignment in the notes for that day.

The ◷🧍 symbol indicates there is a figure for you to place on the timeline.

Use the extra rows to schedule additional assignments or activities.

Additional space for your record keeping.

HISTORY E — **WEEK 1** — **SCHEDULE**

Date:	Day 1 1	Day 2 2	Day 3 3	Day 4 4	Day 5 5
History/Geography					
William Wilberfoce	chaps. 1–2	chaps. 3–4 [N]	chaps. 5–6 ◷🧍	chaps. 7–8	
Wee Sing America	(re-)learn "The Star Spangled Banner" pp. 8–9.				
Readers					
By the Great Horn Spoon!	chap. 1 ◷ 🌍	chaps. 2–3 🌍	chaps. 4–5 🌍	chap. 6–mid p. 76 🌍	
Read-Alouds					
Moccasin Trail	chap. 1 🌍	chap. 2 🌍	chap. 3 🌍	chap. 4 🌍	
Oxford Illustrated Book of American Children's Poems		p. 8		p. 9	
Electives					

Other Notes

[N] Special Note to Mom or Dad 🌍 Map Point ◷🧍 Timeline Figure ◷ Timeline Suggestion

Date:	Day 1 1	Day 2 2	Day 3 3	Day 4 4	Day 5 5
History/Geography					
The Story of Science: Aristotle Leads the Way	chap. 1	chap. 2	chap. 3 pp. 20–28 (mid-page)	chap. 3 pp. 28–33	
String, Straightedge, and Shadow	Prologue	chap. 1	chap. 2	chap. 3	
Current Events	Use the following box to record when you have completed the activity. **Sixth Grade:** one report; at least one of international concern every other week. **Seventh Grade:** two reports; at least one of international concern. **Eighth & Ninth Grade:** three reports; at least two of international concern.				

Other Notes

Day 1

History & Geography

The Story of Science: Aristotle Leads the Way | Chapter 1

To Discuss After You Read

1. What was the difference between the ancient Sumerian and Egyptian calendars? What inspired the difference? ➡ *the Sumerian calendar was based on the lunar (moon-based)cycle. The Egyptians developed a solar (sun-based)calendar. Each was based on the god that they worshipped (Summerians had a moon god; Egyptions had a sun god)*

Timeline and Map Activities

- **Sumerian civilization (ca. 3000 BCE)**
- **Ziggurat of Ur (ca. 2100 BCE)**
- **Babylonian Empire (1750–539 BCE)**
- **Assyrian Empire (950–612 BCE)**
- *Iraq (Mesopotamia); Egypt* (use the map on page 5 in your book)

String, Straightedge, and Shadow | Prologue

To Discuss After You Read

The author mentions "the huge telescope at Mount Palomar." This 200 inch diameter Hale telescope is the earliest of its kind, though in the years since this book was published, the world has 18 telescopes larger in size, including single mirrors 323" in diameter, and segmented mirrors up to 409".

N Special Note to Mom or Dad Map Point Timeline Suggestion

2. Where does the word "geometry" come from? ➡ *"geo" is earth and "metry" (metria) is measurement*
3. What three tools did the ancient people use to make mathematical discoveries? ➡ *string, straightedge, and shadow*

Current Events | Two to three reports

A Rationale for Studying Current Events

Why study current events? There are many reasons. One is to help students become familiar with the names and events that are in the news. When kids become familiar with these names and events, they are better able in the future to read articles about the same people or the same or related events.

Another reason: by reading news from other parts of the world, we get to see our local situation in a broader context. It's similar to what we gain by studying history. We see, for instance, that we are not alone in some of our experiences: "We don't have it so bad." Finally, a study of current events—as a study of history in general—can give us the opportunity to learn from other people's mistakes.

Imagine. Are you likely to go someplace you've never heard of? Hardly! Nor are you likely to try a new idea if you've never heard of anyone else doing the same thing before.

By becoming informed about other people in other places, we broaden our horizons and open our minds to all manner of options we would otherwise never consider.

Parents: How to "Teach" (or Learn!) Current Events

If your students are unfamiliar with key people, dates, events, and terms, read together! Browse through a current news magazine together; choose an appropriate-looking article, then start reading. *If it helps, read the article out loud*. There should be no shame in this. If our students need our help, then we should give it to them. By helping them now, we reduce the need for us to help them later.

As you read, ask your students if they understand what the author is talking about. If you come across an uncommon or unfamiliar term, explain it or look it up. Try to give your students whatever historical, cultural, and other background you can. In addition, talk about what appear to be parallel situations with which they might be familiar from their studies of history or other cultures.

This process may be rather slow at the start, but it will enable your students to understand what they would have otherwise never understood. It will give them a wealth of information they would otherwise know nothing about.

After you finish reading, have your students try to summarize what you just read. We have found that the best time to hold current event discussions is either over the dinner table or, for older students, during your daily student-teacher time.

Note to Student or Parent: Though you may make these written assignments, it is not *our* expectation that you or your students will be required to write these reports. We recommend *oral* presentations only.

Seventh Grade: Two reports; at least one of international concern.

Eighth and Ninth Grade: Three reports; at least two of international concern.

Day 2

History & Geography

The Story of Science: Aristotle Leads the Way | Chapter 2

To Discuss After You Read

4. How is science different from myth? How did myths help form science? ➡ *myths explain the unexplainable through imagination and emotion; science is about proof; science starts with a question, and scientists search for answers; they sought to explain the unexplained*
5. What is a hypothesis? ➡ *an untested answer or an idea or a possibility*
6. When does a hypothesis become a theory? ➡ *after testing a possibility, if it survives the tests, it becomes a theory*
7. What do you need to be a scientific thinker? ➡ *"staying awake and keeping your mind open": basically, be observant and willing to investigate new ideas*
8. What two questions have scientists asked from the beginning? ➡ *"What is this universe of ours all about?" and "What is life?"*
9. How do numbers and math intersect with science? ➡ *"Physical laws should have mathematical beauty." Basically, the universe seems to work in ways that can be precisely explained in numbers, ratios, and mathematical equations*
10. What does it mean that "It's the average pattern of a large sample of roses or sunflowers or elephant tusks that is predictable. You can never be sure how any single one may turn out"? ➡ *a single rose may not look like the established pattern, even though most roses look like the average; births follow a general progression, but any single birth may not look like that progression*

Timeline and Map Activities

- *Egypt* (D4), *India* (D8), *China* (D10) (map 2)
- *Greece* (H7), *Peru* (G4) (map 3)

String, Straightedge, and Shadow | Chapter 1

To Discuss After You Read

11. Summarize this chapter. ➡ *Animals have an inherent understanding of the mathematical order of the universe (spiders' webs, bees' comb). Humans, too, have an inherent understanding, to greater or lesser extent, of rhythm, harmony, symmetry, direction, mass and weight. We, too, have a sixth sense of mathematics*

Current Events | Two to three reports

Day 3

History & Geography

The Story of Science: Aristotle Leads the Way | Chapter 3, pp. 20–28 (mid page)

To Discuss After You Read

12. What makes the seasons? ➡ *the tilt of the earth (not the distance from the sun!)*
13. What fixed event helped the Egyptians determine the length of a solar year? ➡ *Sirius's reappearance at the start of the Nile flooding*
14. What is the summer solstice? The winter solstice? ➡ *June 20 or 21, when the sun appears at its highest point in the sky (apex), the day lasts the longest, the first day of summer (or, in the southern hemisphere, winter; December 20 or 21, the shortest day of the year)*
15. What are equinoxes? ➡ *In spring and fall, March 20 or 21 and September 22 or 23, when day and night are about the same length*
16. What is the analemma? ➡ *the figure-eight pattern that the rising sun makes during the year, or, more accurately, "a diagram showing the deviation of the Sun from its mean motion in the sky, as viewed from a fixed location on the Earth"*
17. Why does the moon dazzle and disappear? ➡ *the moon travels around the earth, and depending on where it is in its orbit, people on earth see more or less of it*

Timeline and Map Activities

- **Emperor Yao (ca. 2357 BCE)**
- *Mesopotamia, Egypt* (use the map located on page 5 in the book)
- *Swaziland* (I4), *China* (D4) (map 2)

String, Straightedge, and Shadow | Chapter 2

Today, the proper descriptor is no longer "Primitive people" (p. 16). Wikipedia explains:

> In older anthropology texts and discussions, the term "primitive culture" refers to a society believed to lack cultural, technological, or economic sophistication or development. For instance, a culture that lacks a written language might be considered less culturally sophisticated than cultures with writing systems; or a hunter-gatherer society might be considered less developed than an industrial capitalist society. While becoming less politically correct, some Western authors, such as anthropologists and historians, used it to describe pre-industrial indigenous cultures. Historically, assigning "primitive" to other people has been used to justify conquering them

To Discuss After You Read

18. Summarize this chapter. ➡ *In the art gallery of the universe, nature shows shapes such as circles and spirals, and geometric shapes with three, four, five, and six sides. Today, we are removed from nature, but for the earliest peoples, even the sun fading in the west, or the turning of the seasons, would be stressful and filled with fear*

Current Events | Two to three reports

Day 4

History & Geography

The Story of Science: Aristotle Leads the Way | Chapter 3, pp. 28–33

Vocabulary

Rationale: Knowing definitions is critical to understanding. That's why we've included important vocabulary terms in your Instructor's Guide. More common terms that your students may not know are listed first, followed by, where applicable, cultural literacy terms that provide depth to stories but may not be commonly known. Read the vocabulary sections aloud to your student, then have them guess the meanings of the ***bold italic*** words. Or have them look up the definitions as they read through their assignments. We provide the answers in this Parent Guide.

waft: to pass smoothly through the air or over water.

To Discuss After You Read

19. How does clock time and calendar time differ? [p. 29] ➡ *clock time is cyclical, morning and evening, again and again; calendar time is linear: it goes on a timeline, and 1000 BCE is earlier than 1 CE which is earlier than 1982*

20. Who came up with a 24-hour day? ➡ *the Egyptians, perhaps thinking that the sun could visit the 12 constellations during the day and the 12 regions of the underworld at night*

21. Where did the seven day week come from? [p. 30] ➡ *the Babylonians observed five "stars" (really planets) plus the sun and moon, and came up with a seven day week*

22. Is time absolute or relative? ➡ *relative: it is a bit different for a person on earth and for an astronaut in space; the speed of light is different as well*

23. What is the difference between arithmetic and geometry? [p. 32] ➡ *arithmetic is addition, subtraction, multiplication and division; geometry is about shapes, space, and measuring*

Timeline and Map Activities

- **Palenque astronomical center (600–800 CE)**
- **Stonehenge (ca. 3000–1500 BCE)**
- *Palenque, Mexico* (D3) (map 3)
- *Stonehenge, England* (E2) (map 1)
- *Babylon, Mesopotamia* (use the map located on page 5 in the book)
- *India* (D8) (map 2)

String, Straightedge, and Shadow | Chapter 3

To Discuss After You Read

24. In what two ways did the Stone Age men use geometry? ➡ *in technics, to make life easier (it was easier to push a rock down an incline than up; three sticks tied together were more stable than one), and in art, to make life more pleasant (curves and patterns are more aesthetically pleasing)*

25. What was probably the first geometric form to be admired? ➡ *the circle: as in the sun, the eye, and raindrops in a pond*

26. How were the first circles probably made? ➡ *an animal tethered might press down or graze all the grass in the circle; children might run at the end of a vine, circumscribing the full circle*

Current Events | Two to three reports ■

Date:	Day 1 6	Day 2 7	Day 3 8	Day 4 9	Day 5 10
History/Geography					
The Story of Science: Aristotle Leads the Way	chap. 4	chap. 5	chap. 6	chap. 7	
String, Straightedge, and Shadow	chap. 4	chap. 5	chap. 6	chap. 7	
Current Events	**Seventh Grade:** two reports; at least one of international concern. **Eighth & Ninth Grade:** three reports; at least two of international concern.				

Other Notes

Day 1

History & Geography

The Story of Science: Aristotle Leads the Way | Chapter 4

To Discuss After You Read

1. Why is Thales noteworthy? [p. 36] ➡ *living in the 6th century BCE, he "is said to be the world's first philosopher-scientiest-mathematician; the first to look for explanations in observed facts, not myths; the first scientist to leave his name on his ideas"*
2. How could Thales easily measure the height of a pyramid? ➡ *when the length of a shadow is the same length as the height of a stick, the length of the shadow of the pyramid would also be the same as the height of the pyramid; he used ratios*
3. What is an axiom? ➡ *a generally accepted rule*
4. Why is Thales seen as one of the founders of "Western civilization"? ➡ *he rejected the old supernatural religions and incantations, and looked at the natural world for answers*

N Special Note to Mom or Dad Map Point Timeline Suggestion

5. Thales thought that all things in nature are made of water. Although that isn't correct, why was that hypothesis interesting? [p. 40] ➡ *he wondered, "What is the nature of matter? What are we made of? What is the world made of?"; because of the idea that all things in nature come from one basic unit of life; today, we have about a hundred atoms, but perhaps the subatomic particles are actually all the same thing*

6. Thales wondered if the earth floats on water. Was he correct in that hypothesis? ➡ *almost; the theory of plate tectonics shows that molten rock underlies large pieces of the earth's crust; the crust pieces slide and glide together*

7. Are most ratios constant? ➡ *no; if 24 rowers can row at 15 mph, no matter how many rowers join them, they will not break the speed of sound; most ratios are variable*

Timeline and Map Activities

- **Thales, the founder of Geometry (ca. 624–546 BCE)**
- *Aegean Sea, Ionia* (see the map on page 35 of the book)

String, Straightedge, and Shadow | Chapter 4

To Discuss After You Read

8. How did early mathematicians use shadows? ➡ *as a measurement of time*

Timeline and Map Activities

- *Nile, Tigris, Euphrates River valleys* (use the map on page 122 of *The Story of Science* book)

Current Events | Two to three reports

Day 2

History & Geography

The Story of Science: Aristotle Leads the Way | Chapter 5

To Discuss After You Read

9. What were some of Anaximander's new ideas? ➡ *that there were many inhabited worlds (that possibility is under investigation now); that the first animals came out of the water and evolved into more complicated forms of life; he tried to picture the whole earth and its place in the cosmos, hypothesizing that the earth was curved, and unsupported, and that the heavens were a transparent sphere that moves*

10. What were some of Anaximenes's new ideas? ➡ *that air is the single element that makes up everything in the universe, and that different mathematical qualities of air produce the different forms of matter (which approaches the idea of atoms and their different mathematical quantities); he recognized that Venus and Mars are not stars (they are planets); he recognized that rainbows are a natural phenomenon and not a goddess; he also said that earth is a flat disc*

11. Why is Anaxagoras important beyond his scientific ideas? ➡ *he influenced the most important generation in Greek history, which influenced world history*

12. Who were Pericles, Euripides, and Socrates? ➡ *Pericles: a great military and political leader who built the Parthenon and promoted democracy; Euripides: a famous playwright; Socrates: a wise man, teacher of Plato, who taught Aristotle*

13. What does it mean that "reason rules the world"? ➡ *the mind can understand the world around us; the world can be explained rationally*

14. What were some of Anaxagoras's new ideas? ➡ *that matter existed as tiny particles initially; that the moon is made up of ordinary matter, and has mountains, and that it shines because of reflected light; that the sun was not a god but made of fiery matter*

15. What are meteors? ➡ *space rocks that are burning up in earth's atmosphere*

16. Why is base 60 a reasonable way to use numbers? ➡ *it can be evenly divided by 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, and 30, which allowed remainders to not be much of an issue*

Timeline and Map Activities

- **Anaximander (ca. 611–547 BCE)**
- **Anaximenes (ca. 570–500 BCE)**
- **Anaxagoras (ca. 500–428 BCE)**
- *Athens, Greece* (H7) (map 1)

String, Straightedge, and Shadow | Chapter 5

To Discuss After You Read

17. What did rope-stretchers do? ➡ *they were the surveyors of the ancient river valley civilizations (the Nile, Tigris, and Euphrates), the men who divided land into right angles and who helped ensure irrigation ditches were dug appropriately*

18. What does "3-4-5" have to do with swift surveying? ➡ *a right-angle triangle has sides of, say, 3', 4', and 5'; once the surveyors realized that, it was easy to accurately check the boundary markers: a pre-measured set of ropes in the 3-4-5 dimension could quickly lay out accurate angles*

19. How did the rope stretchers determine whether the canals were dimensionally sound? ➡ *they made a level out of a wooden A, with a weighted string hanging down, and they used a plumb line on the edges of the canals*

20. How could rope-stretchers determine length? ➡ *using standardized ropes, they could measure a distance: double the rope for twice the distance, fold it in half for half the distance—they used body parts as units of measure*

Timeline and Map Activities

- **Pyramid at Saqqara—oldest man-made structure (2730 BCE)**
- **Jarmo, Syria—oldest known village (5000 BCE)**

Current Events | Two to three reports

Day 3

History & Geography

The Story of Science: Aristotle Leads the Way | Chapter 6

To Discuss After You Read

21. Empedocles believed there were four elements that made up the world, and two forces. What were they? ➡ *earth, air, fire, water, with love and strife (or attraction and repulsion, or push and pull)*

22. What are the four states of matter? ➡ *solid, liquid, gas, plasma*

Wikipedia offers a brief introduction to plasma:

> A plasma can be created by heating a gas or subjecting it to a strong electromagnetic field applied with a laser or microwave generator. This decreases or increases the number of electrons, creating positive or negative charged particles called ions, and is accompanied by the dissociation of molecular bonds, if present.
>
> The presence of a significant number of charge carriers makes plasma electrically conductive so that it responds strongly to electromagnetic fields. Like gas, plasma does not have a definite shape or a definite volume unless enclosed in a container. Unlike gas, under the influence of a magnetic field, it may form structures such as filaments, beams and double layers.
>
> Plasma is the most abundant form of ordinary matter in the Universe (the only matter known to exist for sure, the more abundant dark matter is hypothetical and may or may not be explained by ordinary matter), most of which is in the rarefied intergalactic regions, particularly the intracluster medium, and in stars, including the Sun. A common form of plasmas on Earth is seen in neon signs.

23. Rewrite Empedocles' paragraph on p. 57. ➡ *Come and listen. The more you learn, the more your mind grows. Previously I explained my basic point: once, there were many things that combined into one. The one then separated into many: fire, water, earth, and air. Destructive strife is present, but not one of them. Strife keeps the four in proportion, and love is there, too, equal in dimension to them.*

24. Empedocles' statement was the first (as far as we know) to declare what? [p.57] ➡ *"that matter and its interactions make up all the world and determine how it changes"*

Timeline and Map Activities

- **Empedocles (ca. 495–435 BCE)**
- *Athens, Greece* (use the map on page 59 of the book)

String, Straightedge, and Shadow | Chapter 6

To Discuss After You Read

25. Why were the stars important for the people of Mesopotamia? ➡ *since the plain and the surrounding area were so devoid of landmarks, they needed the stars to determine direction for trading, and they beleived the stars directed the affairs of men*

26. How did the stargazers measure an angle? [p. 51] ➡ *by dividing a circle into six parts; the circle was eventually broken into 360 parts; now angles between stars could be made*

"East" is where the sun rises on the spring and fall equinoxes. Directions are angles from that point.

27. Besides astronomy, what two other inventions did the Mesopotamians leave us? ➡ *the wheel and the arch, both useful for creating strong, light structures*

28. What modern everyday item has come to us from the Babylonian astronomers' discovery? ➡ *the clock, divided into 12 hours, each with 60 minutes, each with 60 seconds*

Timeline and Map Activities

- **More than 300 years of astronomical observations begins (747 BCE)**

Current Events | Two to three reports

Day 4

History & Geography

The Story of Science: Aristotle Leads the Way | Chapter 7

To Discuss After You Read

29. Are the skies the same in the northern and southern hemispheres? ➡ *no; the noonday sun appears in the northern part of the sky instead of the southern; the constellations that are visible in both hemispheres appear upside-down*

30. What was the Phoenicians' greatest contribution to the world? ➡ *the alphabet*

31. What two unlike things did Pytheas connect? ➡ *the tides to the moon: as Newton showed, years later, the moon's gravity pulls the ocean waters*

32. Has Polaris always been the North Star? ➡ *no; the earth wobbles because of the torque, or twisting force, on the earth caused by the uneven tug of the sun and moon; one full wobble takes 25,800 years, so 2500 years ago, Kochab was the North Star, and 5000 years ago, Thuban was the North Star*

Timeline and Map Activities

- **Herodotus the first historian (ca. 484–425 BCE)**
- *Greece, Phoenicia (Lebanon), Carthage* (use the map on page 59 of the book)

String, Straightedge, and Shadow | Chapter 7

To Discuss After You Read

33. Besides the Ionian philosophers, what other famous people were living near Miletus in the 6th century BCE? [p.61] ➡ *Aesop, who told fables; Pythagoras, on the island of Samos, credited with inventing the multiplication tables*

34. What new kind of thinking did the Greeks develop? ➡ *rational thought; while the Babylonians discovered new ways of doing things, the Greeks found new ways of thinking about things: observation, ordering the observations, trying to find abstract rules*

Timeline and Map Activities

- **Thales (ca. 624–546 BCE)**
- *Ninevah, Babylon* (use the map on page 5 of *The Story of Science* book)
- *Aegean Sea, Miletus, Greece* (use the map on page 35 of *The Story of Science* book)
- *Black Sea* (use the map on page 59 of *The Story of Science* book)

Current Events | Two to three reports ■

Date:	Day 1 11	Day 2 12	Day 3 13	Day 4 14	Day 5 15
History/Geography					
The Story of Science: Aristotle Leads the Way	chap. 8	chap. 9 pp. 72–81	chap. 9 pp. 82–85	chap.10 & pp. 92–93	
String, Straightedge, and Shadow	chap. 8	chap. 9	chap. 10 pp. 70–85	chap. 10 pp. 86–91	
Current Events	**Seventh Grade:** two reports; at least one of international concern. **Eighth & Ninth Grade:** three reports; at least two of international concern.				

Other Notes

Day 1

History & Geography

The Story of Science: Aristotle Leads the Way | Chapter 8

To Discuss After You Read

1. How did the Babylonians use numbers? ➡ *for commercial purposes: trading, keeping records, dividing land and work*
2. How did the Egyptians use numbers? ➡ *for measuring; geometry allowed them to build pyramids and temples*
3. Explain the difference between concrete and abstract math. ➡ *concrete uses things you can touch: counting pennies one by one to figure out how many there are; abstract math uses symbols to stand for something*
4. Who was Pythagoras? ➡ *the world's first great mathematician*
5. Worldwide, who else lived concurrently with Pythagoras? ➡ *besides Thales and the A-team (Mander, Menes, Goras, as Hakim says), Confucius, Lao-tzu, Pharaoh Necho, Zoroaster, Jewish prophets, Gautama Buddha*
6. What is pi? ➡ *the ratio between the circumference of a circle and the diameter, an irrational number that begins 3.1415....*

N Special Note to Mom or Dad Map Point Timeline Suggestion

Timeline and Map Activities

- **Pythagoras, the world's first great mathematician (ca. 582–507 BCE)**
- *Samos* (use the map on page 35 of the book)
- *Delphi* (use the map on page 65 of the book)

String, Straightedge, and Shadow | Chapter 8

To Discuss After You Read

7. What were some of the things Thales learned about? ➡ *magnetism ("the magnet has a soul because it moves the iron") and static electricity from a piece of amber*
8. How did Thales earn money quickly? ➡ *by observation, he determined a large olive harvest would soon happen, and bought all the olive presses and cornered the market*
9. What story does Aesop tell about Thales? ➡ *after his donkey dissolves salt in a stream and so relieves itself of burden, Thales loads down the donkey with sponges, which became far heavier after his plunge into the creek*
10. What did Thales learn in his travels? ➡ *sky measurement and circle geometry in Babylon, surveying in Egypt*

Timeline and Map Activities

- *Mesopotamia, Egypt* (use the map on page 5 of *The Story of Science* book)

Current Events | Two to three reports

Day 2

History & Geography

The Story of Science: Aristotle Leads the Way | Chapter 9, pp. 72–81

To Discuss After You Read

11. What is the difference between an Ionian thinker and Pythagoras? ➡ *the Ionians observed and added block after block of information, one after the next; Pythagoras believed in an orderly creation, and came up with mathematical formulas (today, the scientific method uses both thinking and observation and adds experimentation)*
12. Why were numbers important for Pythagoras? ➡ *they were the way to understand the universe, by searching for things that are absolutely true; he said, "All is number," and he believed they were the expression of God's mind*
13. What is an irrational number? ➡ *one that cannot be turned into a ratio of two integers; pi, for example, is not quite one-seventh*
14. How did Pythagoras affect our understanding of sound? ➡ *music can be explained mathematically: in musical strings of identical tension when one is twice as long they produce sounds an octave apart; he also believed that the cosmos was like an orchestra, playing mathematical and musical harmony (and since modern astronomers think they have heard a B flat, 57 octaves below middle C, coming from a black hole, he might be right)*
15. What is the Pythagorean Theorem? ➡ *the square of the hypotenuse of a right triangle equals the sum of the squares of the other two sides*
16. What were some of Pythagoras's other breakthroughs? ➡ *he taught that earth is a sphere, that the earth moves, that earth is not the center of the universe, that the morning and evening star are the same (today we know that is the planet Venus); he made mathematics the language of Western science*

Timeline and Map Activities

- **Great Pyramids built (ca. 2550 BCE)**

String, Straightedge, and Shadow | Chapter 9

To Discuss After You Read

17. How did Thales astound the Egyptians? ➡ *he calculated the height of the Great Pyramid, based on a proportion calculation between the height of a man and half the base of the pyramid plus the shadow*
18. What did Thales notice about shadows? ➡ *shadows changed proportionally; he pictured vertical items, like men and trees, as the vertical in a right triangle; the shape of the triangle changed as time passed, but the shape of them all changed proportionally*

Timeline and Map Activities

- *Giza, Egypt* (D4) (map 2)

Current Events | Two to three reports

Day 3

History & Geography

The Story of Science: Aristotle Leads the Way | Chapter 9, pp. 82–85

To Discuss After You Read

19. Is *one-third* an irrational number? ➡ *no, because although it goes on forever, it repeats; irrational numbers do not repeat*
20. Do irrational numbers have a place on a number line? ➡ *they do, and can be used for calculations, but can't be used exactly*
21. What is phi? Why is it significant? ➡ *the Golden Ratio, 1.618..., found regularly in nature (the spacing of rose petals, the swirls on pineapples and pinecones) although an irregular number, the ratio creates beautiful forms*

Visit our IG links page for a link to a YouTube movie by Vi Hart, that goes further into pineapple and pinecone structure 💻. Or look up "Doodling in Math: Spirals, Fibonacci, and Being a Plant."

String, Straightedge, and Shadow | Chapter 10, pp. 70–85

To Discuss After You Read

22. Whether Thales actually predicted the solar eclipse or not, why was the experience significant? ➡ *the Greeks believed such a prediction was possible, that an eclipse was not a random occurrence but one that could be understood based on calculation*
23. How was Thales' thinking different from what the Babylonians and Egyptians had done before? ➡ *the Babylonians and Egyptians had used right angles, levels, divided circles, geometric designs, but Thales was thinking about them in the abstract and could create the rules of geometry*

Current Events | Two to three reports

Day 4

History & Geography

The Story of Science: Aristotle Leads the Way | Chapter 10 & pp. 92–93

To Discuss After You Read

24. Did Democritus agree with the idea that the four basic elements were the basis of all things? ➡ *no; he believed there was something more basic, that unified all, that was the smallest substance in the universe and that unified all; this he called the "atom," from the Greek meaning "something that cannot be cut"; he believed there was nothing but atoms and the void*
25. What did Leucippus teach about atoms? ➡ *they are solid and indestructible, that they assume geometric forms, and that they are perpetually in motion*
26. What is the difference between fission and fusion? ➡ *fission splits the nucleus of a heavy atom into light atoms, and fusion joins light atoms into a heavy atom; they both create energy*
27. Why did science stall after Democritus? ➡ *he and the other ancients could hypothesize about the nature of things, but they couldn't prove anything, or do experiments, so there was really nowhere for science to go*

Timeline and Map Activities

- **Democritus proposes atoms as basic units (ca. 460–370 BCE)**
- *Thrace* (use the map on page 87 of the book)

String, Straightedge, and Shadow | Chapter 10, pp. 86–91

To Discuss After You Read

28. How could you sum up Thales' contribution to world understanding? ➡ *he made geometry abstract and started deductive reasoning; he formulated the first geometry rules or theorems*

Current Events | Two to three reports ■

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History J—Scope and Sequence: Schedule for Topics and Skills

Week	History/Social Studies	Geography	Biography
1	Ancient Sumerians, Ancient Egyptians, Ancient Civilizations; Science, and the beginnings of Mathematical thought; Space and lunar observations; clocks and time; the Stone Age	*Iraq; Egypt; Mesopotamia; India; China; Greece; Peru*	
2	Thales and Geometry; Pericles, Euripides, and Socrates; astronomical observations; Babylonians; Greeks and rational thought	*Athens; Ionia; Aegean Sea*	Thales; Anaximander; Anaximenes; Anaxagoras; Empedocles; Herodotus; Aesop
3	Numbers; Abstract and Concrete Math; Pythagoras/Pythagorean Theorem; Irrational numbers; phi; Democritus	*Mesopotamia; Giza, Egypt; Thrace*	Pythagoras; Democritus; Thales
4	Perfect numbers; Principles of logic; regular solids	*Athens; Samos; Italy; Alexandria*	Plato; Aristotle; Socrates; Alexander the Great; Artistarchus
5	Hero and the area of a triangle; mechanical ingenuity in Alexandria; Euclid and division; geometry; Archimedes and inventions	*Alexandria; Cairo; Carthage; Rome*	Hero; Eudoxus; Euclid; Apollonius; Archimedes; Eratosthenes
6	Mathematics and logical thought; Roman Architecture; Earth proportions and scale; Astronomy; star classification; Trigonometry; map-making; Mechanics/Force/Work	*Alexandria; Syracuse; Sicily; Rome; Rhodes*	Julius Caesar; Augustus Caesar; Archimedes; Hipparchus; Eudoxus; Ptolemy
7	Fall of Rome; gravity and specific gravity; Middle Ages; Astronomers and mapmakers in China; Math and Astronomy around the globe; Fibonacci sequence and the Golden Ratio/Pi	*Hippo; Cordoba, Spain; Poland; Hungary; Pisa, Italy; India; Iraq; Morocco; Zanzibar*	Augustine; Kublai Khan; Adelard of Bath; Pope Sylvester II; Aryabhata
8	Renaissance; moveable type and the printing press; plane and solid figures; theories and proofs/explorations and methods of discovery	*Paris; Naples; Seville, Spain; Philippines; Rome; Carthage; Samarkland; Syracuse*	Thomas Aquinas; Roger Bacon; Johannes Gutenberg; Vasco Nunez de Balboa; Ferdinand Magellan
9	Scientific Revolution; the Hundred Years' War; Fall of Constantinople; Thirty Years War; England's Civil War; the Plague	*Constantinople; Holland; Florence; Rome; Italy*	Leonardo da Vinci; Nicholaus Copernicus
10	London's Great Fire; the rotation of the Earth and its three motions; Greek's abstract mathematics; supernovas; Newton	*London; Copenhagen Sweden; Prague*	Johannes Kepler; Tycho Brache; Martin Luther; Vesalius
11	The 'Advancement of Experiments;' mathematics and motion; friction/inertia; Galileo's Principle of Relativity	*Pisa*	Galileo Galilei; Giordano Bruno; Christopher Marlowe; William Shakespeare; Christiaan Huygens; Galen of Pergamon
12	Telescopes and microscopes; nature and mathematics; the study of light and vision		Hans Lippershey; Antonie van Leeuwenhoek; Robert Hooke
13	Light and travel; Newton's Laws; mathematical proof; Calculus	*Holland; Sweden*	Rene Descartes; Isaac Newton
14	Spectroscopy; planetary orbit; cycles of eclipses; invention of the pendulum clock; time and the world; projectile motion	*Holland; Copenhagen*	Robert Hooke; Edmond Hailey; Olaus Christensen Huygens; John Harrison; Isaac Newton

(continued on the following page)

History J—Scope and Sequence: Schedule for Topics and Skills

Week	History/Social Studies	Geography	Biography
15	Advancements in Chemistry; element discoveries; the ideas behind 'Infinity'; Boyle's Law; Barometers; mathematics and probability; gas and kinetics; atoms and molecules; conservation law	*Vienna; Rhodes; Poland; Hamburg, Germany; Ireland; Belgium; Switzerland; Geneva; Netherlands; Russia*	Jabir ibn Hayyan; Albertus Magnus; Johann Friedrich Bottger; Franz Deleboe; Hennig Brandt; Robert Boyle; Blaise Pascal; Evangelista Torricelli; Daniel Bernoulli
16	Mathematics and Physics; Element discoveries; Fahrenheit and Celsius; average density of the Earth; instantaneous speed; Galileo's law of falling bodies	*France; Scotland; Poland; Holland*	Emilie du Chatelet; Voltaire; John Locke; Louis XIV; John Bunyan; Joseph Black; Henry Cavendish; Karle Scheele; Joseph Priestley; Daniel Fahrenheit; Anders Celsius; James Watt; Antoine-Laurent; Lavoisier
17	French Revolution and Lavoisier; systems of chemical nomenclature; meteorology, atoms, bonding and Law of Definite Proportions; Avogradro's number	*England*	William Herschel; Baruch Spinoza; Napoleon Bonaparte; John Dalton; Thomas Harriot; Amedeo Avogradro; Edward Frankland; Friedrich Kekule
18	Molecules and atomic masses/weights; *Principia*; the Periodic Table of Elements; Newton's theory of gravitation; static electricity/the study of electricity and movement	*Russia*	Dimitri Ivanovich Mendeleyev; Robert Bunsen; Niels Bohr; Benjamin Thompson; William Gilbert; Benjamin Frankin; Jean Theophilus Desaguliers
19	Longitude and latitude; Tropic of Cancer/Tropic of Capricorn; Longitude Act; kinds of electricity; Iodine; magnetic fields and gravitational fields; "the whole universe is tied through energy"; light waves and colors	*Rome; Copenhagen; Russia; Italy; London; Canary Islands; Madera Islands; Tropic of Cancer; Tropic of Capricorn; Jerusalem; Philadelphia; Scillies; Portugal; Carribean; Scotland*	Alessandro Volta; Humphry Davy; Hans Christian Oersted; Andre-Marie Ampere; Jeaen-Bernard-Leon-Foucault; William Sturgeon
20	Radio waves discovered; Longitude Act; molecules and the universal laws of physics; grandfather clocks; the definition of heat; basics of atomic theory; the definition of work, power, Joules, watts; kinetic and potential energy	*Austria; England; Portugal; West Indies;*	Heinrich Rudolf Hertz; Ludwig Boltzmann; John Harrison; James Joule; Charles Babbage; George Boole
21	Laws of thermodynamics; Harrison's H-4 watch; Kelvin Scale; probability	*Indonesia; Ireland; Newfoundland*	Julius Robert von Mayer; James Joule; William Thompson; James Cook
22	Nitroglycerine; the Nobel Peace Prize; x-rays; Harrison's watch and sea travel; Ockham's Razor; atoms	*Italy; Sweden*	Alfred Bernhard Nobel; Wilhelm Conrad Roentgen; Antoine-Henri Becquerel; Albert Michelson; Joseph John Thompson; Albert Einstein; William Gilbert

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History J—Scope and Sequence: Schedule for Topics and Skills

Week	History/Social Studies	Geography	Biography
23	Electromagnetism; Coulomb's Law; Morse code; Thomas Edison and Nikola Tesla; electrons and atoms and matter		Michael Faraday; Charles-Augustin de Coulomb; Samuel Morse; Thomas Edison; Nikola Tesla; Albert Abraham Michelson; Edward Williams Morley; J.J. Thompson; Hermann von Helmholtz; William Crookes; Robert Andrews Millikan
24	Thompson's model of the atom; Radium; alpha and beta rays; Marie Curie and pitchblende; cosmic radiation; speed of a wave; blackbodies; mathematical constants; Planck's equation; Einstein and atoms and molecules; Special Theory of Relativity	*Poland; France; Montreal;*	Marie Curie; Pierre Curie; Ernest Rutherford; Victor Hess; Max Planck
25	Photons and properties; Einstein and Brownian motion; Speed of Light	*Denmark; Norway*	Lord Rayleigh; Thomas Young; Robert Milikan; Satyendra Nath Bose; Robert Brown; Ernest Rutherford; Niels Bohr
26	Bohr's picture of an atom; electromagnetic energy; hydrogen nuclei; protons, electrons, and neutrons; quantum mechanics; light as a particle	*Germany; Ukraine; Russia; Norway*	James Chadwick; George Gamoff; James Franck; Arthur Compton; Louis-Victor de Brolie
27	The Uncertainty Principle; complementarity; matrix mechanics; Schrodinger's experiments; particles and antiparticles; the "atom smasher" and giant accelerators; neutrino; inert and reactive atoms; the formation of molecules; DNA uncovered		Werner Heisenberg; Max Born; Erwin Schrodinger; Ernest Solvay; Paul Adrien Marice Dirac; Enrico Fermi; Wolfgang Pauli; Linus Carl Pauling; Watson and Crick
28	Covalent bonding; World War II; uranium and production of energy; uranium bomb; critical mass; the Manhattan Project	*California; Norway; Canada; Hungary; Italy*	Gilbert Lewis; J. Robert Openheimer; Otto Hahn; Knut Haukelid; Leo Szilard; Edward Teller; Irene and Frederic Joliot-Curie; Enrico Fermi
29	Weak force; nuclear fusion and fission; nuclear power and weapons; heavy water; nuclear research	*Sweden; New Mexico; Norway; Russia*	Enrico Fermi; Fritz Strassman; Lise Meitner; Klaus Fuchs; Richard Feynman; Robert Serber; Edward Teller; Stanislaw Ulam
30	U-235; Plutonium; Quantum Electrodynamics; Law of Physics; relative motion; invariant motion; time and space		Richard Feynman; Paul Dirac; Julian Schwinger; Sin'ichiro Tomonaga; Freeman Dyson; Paul Tibbets; Theodore Hall
31	Distance = velocity x time; Lorentz transformations; further bomb testing in New Mexico; Hiroshima; fourth dimension; mass and motion; the nuclear arms race	*Germany; Switzerland; Czech Republic; Belgium; Hiroshima; New Mexico*	Hendrik Lorentz; Hermann Minkowski

(continued on the following page)

History J—Scope and Sequence: Schedule for Topics and Skills			
Week	**History/Social Studies**	**Geography**	**Biography**
32	General relativity; psychophysics; spacetime; gravitation; metals and crystals; space and the Milky Way; the Doppler effect; redshift; Hubble telescope; communication	*Italy; Siberia; Brazil; Belgium; Ireland; Bosnia; Afghanistan*	Walther Nernst; Arthur Stanly Eddington; Edwin Powell Hubble; Harlow Shapley; Willem de Sitter; Annie J. Cannon; Aleksandr Friedmann; Georges Lemaitre; Christian Doppler
33	Galaxies and growth; stars; white dwarfs; concrete; pulsars; giant stars, neutron stars, massive stars, and black holes; space race	*California; India; Bulgaria;*	henrietta Leavitt; Subrahmanyan Chandrasekhar; Fritz Zwicky; Lev Landau; George Gamow; John Archibald Wheeler
34	Event horizons and black holes; gravitational and electromagnetic waves; meteorites and space dust; four forces of the universe; the cosmic microwave background	*Belarus; Italy; Germany; Japan; Australia; Washington; Louisiana*	Stephen Hawking; Yakov Zel'dovich
35	Multiverse; the Theory of Everything; supernovas and repulsive force; diamonds, carbon fiber, and dense materials	*Czech Republic; Chile; Hawaii*	Alan Guth
36	Dark energy; ceramics and terra cotta; quantum information theory; NASA and space exploration	*Switzerland; Arizona; Michigan; Argentina; West Virginia;*	Claude Shannon; Carl Sagan