

# Teacher's Guide for CALLIOPE: *The World's Firsts*

May 2008

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## **"Ingenious But Little-Known Inventors," page 1**

1. Around the year 1602, what did Galileo discover?

Now think . . .

2. How has the invention of the clock changed throughout the ages?
3. Name as many inventions as you can think of that have clocks built into them.

## **"Breakthrough!," pages 2–4**

• Reread the five key strategies for inventive thinking on page 4. Use these steps to make a better . . .

(circle one) eraser / lunch bag / coat rack / skateboard / bathtub / phone /

\_\_\_\_\_.  
(use your own idea)

Brainstorm your improvement ideas. Generate as many ideas as you can before deciding on the best solution.

Draw a picture of your invention.

Come up with a catchy name for your invention.

Explain the problem your invention solves and describe how it works.

## **"Why Thumbs Matter," pages 5–8**

1. Using the chronological, or time order, text structure of this article, create a timeline that shows the evolution of early tools.

2. Match these tools with their uses or descriptions. Put the correct letter on the line.

- |                      |       |  |
|----------------------|-------|--|
| A. scraper           | _____ | used to pound open nuts and plants             |
| B. double-purpose ax | _____ | used to hack through brush and to skin animals |
| C. pebble tool       | _____ | a flake with a "bulb of percussion"            |
| D. stone sickle      | _____ | a flake twice as long as it is wide            |
| E. hand ax           | _____ | a cutting edge on one end, hammer on the other |
| F. blade             | _____ | used to cut wild grains                        |

## **"Moving Life Forward," pages 9–11**

1. What did ancient civilizations need to have for wheels to become important?

2. What can you infer about why the people of ancient Mexico used wheels only in toys?

3. How did early wagons change farming and commerce?

4. What was the first high-speed vehicle, what was it used for, and what made it so speedy?

## **"That Which Is Brilliant'," pages 12–14**

Mark the following statements true (T) or false (F). If false, provide the necessary correction.

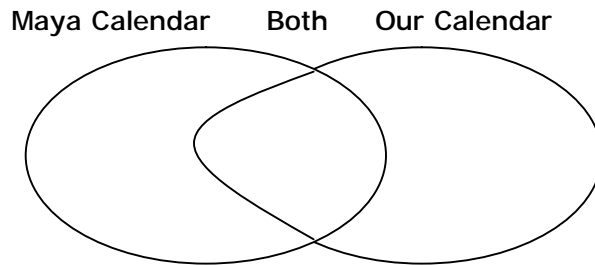
- \_\_\_ 1. Faience is a fragile substance and few artifacts of it have been discovered.
- \_\_\_ 2. Egyptians believed blue-green to be the color of life and often tinted their faience glaze to give that color.
- \_\_\_ 3. Heat-based technologies include pottery, faience, basic metallurgy, and glass.
- \_\_\_ 4. Egyptian glass workers manufactured glass by blowing through a rod with molten glass on the end.

**“Archimedes and the Siege of Syracuse,” pages 15–20**

- Divide students into small groups, assign roles, and have students read aloud the play or parts of the play. One of the group members can be the narrator, reading the introduction and introductions to acts and scenes. Discuss with students the importance of reading with expression to show the characters’ feelings. Model for students how to read with expression by reading aloud a selection of lines. Remind students that good expression involves noting punctuation, pausing and speeding up where necessary to show certain emotions, and speaking clearly by enunciating each word.

**“Maya Creativity,” pages 21–23**

1. The Maya called a single day a \_\_\_\_\_.
  2. In the Maya calendar, 20 \_\_\_\_\_ made up a month, known as a \_\_\_\_\_.
  3. The Maya year of 360 days, called the \_\_\_\_\_, consisted of 18 \_\_\_\_\_.
  4. In the Maya calendar, 20 \_\_\_\_\_, or years, made the \_\_\_\_\_, which was 7,200 days long.
  5. In the Maya calendar, 20 \_\_\_\_\_ composed the great period know as the \_\_\_\_\_, which lasted 144,000 days, or about 400 years.
6. Using a Venn diagram, compare and contrast the Maya calendar to the calendar we use today.



**“Bridging the Gap,” pages 25–27**

- Chose two of the bridges described in this article, such as the flat beam bridge, the stone arch bridge, or the different varieties of the suspension bridge, and sketch them. Label the materials and support systems necessary for the bridge to span a body of water and carry weight. Use as many details from the text as you can.

**“A Man for All Time,” pages 30–33**

- Imagine you are Italian artist and master scientist Leonardo da Vinci being interviewed about your two-level bridge. Using the descriptions of Leonardo’s inventions and specifically the description of the bridge found on page 32, answer the following interview questions as though you were Leonardo.

**Question:** Mr. da Vinci, you are one of the world’s greatest inventors. What are some of the inventions you have come up with?

Answer: \_\_\_\_\_  
Q: What is the purpose of a two-level bridge? What does it accommodate for?  
A: \_\_\_\_\_  
Q: Is it possible for this bridge to collapse?  
A: \_\_\_\_\_  
Q: What material is the bridge made out of?  
A: \_\_\_\_\_  
Q: From your sketch, I can see that the beams form triangles. Why did you choose this construction?  
A: \_\_\_\_\_

Have partners practice and perform the interviews. Encourage students to read with expression.

**“A Modern Leonardo!,” “The Spirit of Invention,” and “Obtaining a Patent” pages 34–38**

1. How is the ATLAS Powered Rope Ascender the same as and different than Garrett Morgan’s helmet?
2. What would Nathan Ball and Garrett Morgan need to protect their inventions from others making, using, or selling their devices without permission?
3. What are the specific steps involved in protecting an invention?

**“From Past to Present: From Clay Tablets to the Digital Age,” pages 40–43**

- Have students brainstorm a list of all of the useful inventions and digital devices they come in contact with on a daily basis.

To help students get started, encourage them to make a concept web by writing *useful inventions and digital devices* in a center circle. Around the center circle, have students write examples of these devices, circle them, and connect them with lines back to the center circle.

Now, have students write about a day-in-the-life without these inventions. How would their day start without an alarm clock? How would their lives be affected by the absence of the Internet, cell phones, iPods, or computer games? What kind of solutions would they need to seek out in order to get through the day?

**ANSWER KEY:**

**“Ingenious But Little-Known Inventors”**

1. the principle of the pendulum
2. Possible responses: sun dial, grandfather clock, wall clock, wristwatch, digital clock
3. Possible responses: cell phone, stereo, stove

**“Breakthrough!”**

Guide students through the brainstorming and inventing process.

**“Why Thumbs Matter”**

1. (In timeline below, “~” indicates “around” or “almost,” according to the text.)  
~2.7 million years ago—pebble tools  
1.7 million years ago—hand axes  
1 million years ago—bone needle, oldest bone tool found  
200,000 years ago—scrapers  
~40,000 years ago—blades

(~40,000–10,000 B.C.—bone tools [You may wish to discuss the difference between 40,000 years ago and 40,000 B.C.]  
~10,000 years ago—stone sickles  
3,000 years ago—metal tools

2.

- |                      |  |
|----------------------|--|
| A. scraper           | _C_ used to pound open nuts and plants             |
| B. double-purpose ax | _E_ used to hack through brush and to skin animals |
| C. pebble tool       | _A_ a flake with a “bulb of percussion”            |
| D. stone sickle      | _F_ a flake twice as long as it is wide            |
| E. hand ax           | _B_ a cutting edge on one end, hammer on the other |
| F. blade             | _D_ used to cut wild grains                        |

### “Moving Life Forward”

1. large domestic animals to pull heavy loads in carts or wagons
2. no cattle or horses to use wheels to do work (You may want to describe inferring as “reading between the lines” or making a decision about something the text does not specifically state.)
3. Enormous loads of hay, harvested crops, and goods could be carried to market; manure could be brought to fertilize poor soil in fields where previously nothing could be grown; more crops could be harvested from the field at one time; and/or food from the countryside could be imported to feed people in early cities.
4. chariot; used in battle; light frame, light wheels made with spokes, fast horses to pull the light chariot

### “That Which Is Brilliant”

1. False: Faience is relatively robust and many examples of it have survived.
2. True
3. True
4. False: Glass workers heated a core on the end of a rod and rolled the core in ground glass, repeating to build up several layers, or workers dipped the core in liquid glass. After cooling, the core was carefully removed.

### “Maya Creativity”

1. kin
2. kins, uinal
3. tun, uinals
4. tuns, katun
5. katuns, baktun
6. Similarities may include both have days, months, years, and so on. Differences may include number of days in a month versus a uinal, and so on.

### “Bridging the Gap”

Encourage students to use the descriptions in the text to add detail to their drawings.

### “A Man for All Time”

**Question:** Mr. da Vinci, you are one of the world’s greatest inventors. What are some of the inventions you have come up with?

**Answer:** Among my inventions, I have devised an armored tank, an automatic feeder for a printing press, a monkey wrench, a parade drum, and a two-level bridge, to name a few.

**Q:** What is the purpose of a two-level bridge? What does it accommodate for?

**A:** This bridge provides a place for pedestrians to walk on the top level and a passage for carts and carriages to travel on the lower level.

**Q:** Is it possible for this bridge to collapse?

**A:** No, not if the main supports are strong and well put together.

**Q:** What material is the bridge made out of?

**A:** Wooden beams.

**Q:** From your sketch, I can see that the beams form triangles. Why did you choose this construction?

**A:** This structure provides the strongest support for the bridge because a triangle, more than any other figure with straight sides, gives the most resistance to being bent out of shape.

**“A Modern Leonardo!,” “The Spirit of Invention,” and “Obtaining a Patent”**

1. Both inventions help people in danger. The ATLAS evacuates a casualty to a rooftop for immediate helicopter pickup. The helmet allows the wearer to avoid breathing toxic fumes from an explosion while rescuing a casualty of the explosion.

2. a patent

3. Students should identify the steps to obtaining a patent found on page 38.

**“From Past to Present: From Clay Tablets to the Digital Age”**

Guide students to describe what life would be like without the inventions upon which they depend or may take for granted each day.