Introduction: Today's low cost metal sextants offer high accuracy and ease of use. Plastic models are perfect for lifeboat provisioning. Older sextants tend to have smaller mirrors and scopes which make them harder to use. For all practical purposes, metal sextants are error free when compared to the many uncontrollable errors which may exist from such things as refraction, oblateness of the earth, and data tabulation. Generally, a minute of arc (one mile) is about the best anyone can hope to achieve. Plastic sextants commonly exhibit errors in excess of 5 minutes, even when great care is exercised. The size of the mirrors on a sextant generally vary directly with the quality of the instrument. Large index and horizon mirrors are desirable. Sextants are available with their major metal parts of either aluminum or brass. The alloys of each metal are both suitable for use at sea. A 3.5 (or 4) x 40 scope is a good choice for stars. The specified power magnification helps you find and maintain stars in view in both calm or pitching seaways.

Many sextants have an option of either the traditional (half-silvered) horizon mirror or what is called a “whole horizon mirror”. With the traditional mirror, the horizon glass is divided vertically into two halves producing a “split image”. The half nearest the frame is a silvered mirror and the other half is clear glass. A later development in sextant technology is the whole horizon mirror. This superimposes both the horizon and the celestial body on the entire mirror with no split image. Sextant lighting is the least needed feature on a sextant, since a flashlight should normally be available in any event for recording observations.

Learner Objective(s):

- The student will be able to describe the various evolutionary changes that marine sextants have undergone.
- The student will be able to discuss the advantages and limitations of different navigational instruments.

Florida Sunshine State Standards: Science: SC.H.1.3.5  Math: M.A.B.3.3.1
**Competency Based Curriculum:** Science: M/J-I-3.A; Math: M/J-I-III-5-A; Math: M/J-3-II-13-C

**Materials:**

Evolution of the Sextant article, by Rod Cardoza  
http://home.earthlink.net/~nbrass1/cardart.htm  
Color print copies of each sextant to be discussed.

**Activity Procedure(s):**

1. Allow students to read the article, Evolution of the Sextant, by Rod Cardoza. Article can be found at http://home.earthlink.net/~nbrass1/cardart.htm

2. Divide the class into eight groups and each group will be responsible to discuss the features of the assigned sextant. The sextants are the following: Quintant, Davis Quadrant, Hadley Octant, Reflecting Quadrant, Pillar Sextant, Ebony & Ivory Octant, Parkinson & Frodsham Octant, and the Negus, NY Sextant.

3. Following a few minutes of individual group discussions, a group representative will briefly explain the features of the assigned sextant. The features should include benefits and restrictions of the instrument.

**Student Assessment:**

Allow the student to answer critical thinking skills questions assigned by the teacher.

a). Compare and contrast the evolution of the marine sextant with the evolution of the personal computer.

b). Some nautical instruments are more accurate than others. How do you determine the accuracy of these instruments?

Student participation is assessed during group activity.

**Activity Extension(s):**

Before the sextant was invented, navigators such as Columbus, Magellan, and Drake used an instrument known as the cross-staff. How did they use this instrument for their travels? (Social Studies)

Latitude and longitude are systems of coordinates on the surface of a sphere. Rene Descartes, a French scientist and philosopher, devised a systematic way of labeling each point on a flat plane by a pair of numbers. How did the so-called “cartesian coordinates” facilitate navigators in locating destinations? (Math)
Activity Extensions (Cont'd):

Read the following literary piece, Sea Fever, by John Masefield and react to the author’s message (Language Arts):

I must go down to the sea again
To the lonely sea and sky
And all I ask is a tall ship
And a star to steer her by

Is there any association to the use of a sextant in the piece?

Home Learning Activity:

Explain how the sun and the stars aided the use of the sextant.

Vocabulary: sextants, refraction, oblateness, tabulation, horizon

References/Related Links:

www.mmbc.bc.ba (Maritime Museum of British Columbia)
http://home.earthlink.net/~nbrass1/cardart.htm
http://celestaire.com
http://www.cln.org/themes/earlynavigation.html
Marine Sextants: History & Technology

Reading Passage

The sextant has come to be widely recognized as a universal nautical symbol. Indeed, the sextant, in conjunction with the compass, has been the basic navigational tool for more than two centuries. The mariners' most prized possession was often his sextant. Perhaps the earliest instrument, of which a rare few still remain, is the astrolabe or "astrolage". The sea astrolabe was an adaptation of the astronomical type. Around the rim were inscribed the hours of the day, the days of the year, and the signs of the zodiac. A contemporary of the astrolabe was the simple quadrant. Like the sea astrolabe, the mariner's quadrant was adapted from its earlier and more complex astronomical counterpart. A rare, hydrographic surveying sextant also known as a "Quintant" was also designed to take triangulation sightings when making soundings for Admiralty charts.

The evolution of the backstaff, or "Davis Quadrant" followed during the mid-18th century. The "Hadley Octant" also known as a reflecting quadrant was developed and used by mariners and in 1735, John Harrison successfully constructed the first marine chronometer. Along with these developments, came the more familiar sextant. The sextant was very nearly contemporary with the octant. In 1830, the Double Frame or "Pillar Sextant" was patented. Among the earliest accessory improvements was optical enhancement of the image by means of a telescopic attachment. A feature unique to the sextant and lacking in the octant was the scale/vernier magnifier. Because of its smaller size and finer scale, the sextant was read by means of a small magnifier affixed to the index arm. The octant required none.

By 1850, the demise of the octant was imminent, even though its use persisted into the 20th century. The superiority of the sextant in terms of accuracy, compactness, and durability was indisputable. The last half of the 19th century saw little change in navigational instruments in general and the sextant in particular. The advent of the drum micrometer sextant by the end of the World War I was the greatest single improvement in the sextant during this century. Just prior to World War II, the long evolution of the sextant culminated in the invention of the ball recording sextant, developed for use at night when no horizon was reading.
**Marine Sextants: History & Technology**

**FCAT Questions**

**Directions:** Read the passage, then answer all the questions below. Answer multiple-choice questions by circling the letter of the answer that you select. Write your answer to the “Read, Think, and Explain” question on the lines provided.

1. **Besides the sextant, what other instrument is the basic navigational tool?**
   - A. Astrolabe
   - B. Chronometer
   - C. Compass
   - D. Sea Quadrant

   **Answer:** C

2. **Which of the following instruments contains the hours of the day, the days of the year, and the signs of the zodiac around the rim?**
   - A. Sea astrolabe
   - B. Astronomer astrolabe
   - C. Davis Quadrant
   - D. Hadley Octant

   **Answer:** B

3. **Which of the following sextant features is the least important?**
   - A. Metal properties
   - B. Mirrors
   - C. Lighting
   - D. Power magnification

   **Answer:** C

4. **How has the sextant changed during the years?**

   ________________________________
   ________________________________
   ________________________________
   ________________________________

   **READ**
   **THINK**
   **EXPLAIN**