



National Museum of African Art

*African Cosmos: Stellar Arts*

*June 20, 2012 through December 6, 2012*



*Astronomic Arts Lesson Plans,  
Grade 5 through Grade 8*

Exhibit-related lessons and activities for the classroom and home

# ASTRONOMIC ARTS

*African Cosmos: Stellar Arts*, June 20-December 6, 2012  
National Museum of African Art

## Schedule a Tour

***To schedule a tour please call Frank Esposito at 202-633-4633 or email him at [espositof@si.edu](mailto:espositof@si.edu).***

*Tours are subject to docent availability.*

*Ask about our hands-on Jambo! School Tours for younger students. Thematic Tours and Highlights Tours are also available.*

*Art Workshops and Outreach Programs are also offered upon request.*

*Please see [www.africa.si.edu](http://www.africa.si.edu) for more information.*

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# Lesson 1: *The Rainbow Serpent*— Creating a “Green” Sculpture



*Rainbow Serpent*, Romauld Hazoumè, 2007

In this lesson students will be introduced to the work of Romauld Hazoumè, whose work addresses the exploitation of resources and its effect on communities. Students will also create their own animal sculpture from recycled and found objects.

Estimated Time: varied

## Lesson Objectives:

- Identify *Rainbow Serpent* by Romauld Hazoumè,
- Discuss the artists' work as it relates to the exploitation of resources, pollution, and consumerism
- Explore recyclables are art materials

## Materials:

- Recyclables from home, collected ahead of time (bottles, jugs, boxes, cardboard, cardboard tubes, old magazines, etc.)
- Glue
- Tape
- Scissors
- Any other materials that may be used to create a sculpture

## Key Terms:

Found object: an object not originally intended to be used to make art

Exploitation: use (and often abuse) of valuable resources such as gasoline, land, or food products

Consumerism: attachment to material things, the purchasing and use of products

**Images from “Images for *Astronomic Arts* Lesson Plans, Grades, 5-8” PowerPoint  
(Available at <http://africa.si.edu>):**

- Image 1: *Rainbow Serpent*, Romauld Hazoumè, 2007
- Image 2: *Rainbow Serpent*, Romauld Hazoumè (detail), 2007

**Background Information**

Romauld Hazoumè fashions a monumental, predatory creature – the rainbow serpent – out of recycled jerry cans, typically used to carry gasoline, in order to address the exploitation of resources and how this impacts communities around the world and over time. This includes the horrors of the transatlantic slave trade centuries ago and its economic equivalents in the present day.

**Introductory Discussion**

Show Images 1-2 (*Rainbow Serpent*). Discuss the sculpture as a class.

- Why do you think the artist chose to make this piece out of jerry cans?
- How would the piece be different if it were made out of different materials? (Gold? Cloth?)
- What objects represent exploitation or consumerism to you? Why?

The circular image of the rainbow serpent swallowing its tail is a powerful symbol among Fon and Yoruba peoples in Benin and Nigeria, where it references spiritual forces and positive ideas about fertility, prosperity, and the eternal cycle of life.

- What does a serpent symbolize to you?
- Think about animals commonly represented in your own culture. What do they symbolize? (eagle=freedom, lion=bravery, beaver=hard work)

**Activity**

Procedure:

Begin by having each student write down a value or issue important to him or her. Possible values could be unity, freedom or peace. Important issues could be things like conserving water or child labor. Once each student has chosen a value or issue, invite the students to brainstorm an animal that accurately represents their particular value or issue. Have them write it down, as well. For older students, take it one step further by having them brainstorm specific found objects that they could use to build their sculpture to add yet another level of meaning. Have the students sketch what they want their sculpture to look like.

Students can then begin building their sculptures. When the students are finished building, have them write a short paragraph explaining their work. If possible, display the work and allow students to share their pieces.

**Reflection:**

- Why do artists create art about political and social issues?
- Do you think it is effective? Why or why not?
- If you could display your sculpture anywhere, where would that be?
- Who is the primary audience of your artwork?

**Evaluation (On scale of 1-5, 5 being the highest)**

- Did the student engage appropriately during the opening discussion?
- Did the student follow directions?
- Did the student represent a value or idea in his/her work?
- Can the student explain his/her work to others?
- Did the student participate appropriately in the closing reflection conversation?

## Lesson 2: Connecting the Dots



Constellation, Timbuktu manuscript, Mamma Haidara Library

In this lesson plan, students will look at ancient manuscripts and use graphing skills to graph constellations on a coordinate plane.

Estimated Time: 2 45-minute class periods

### Lesson Objectives:

- Graph constellations on a grid using the coordinate system
- Recognize that sky constellations relate to African history and culture
- Explore how myths provide fictional explanations for things in nature
- Understand the elements of writing a myth
- Create own creation myth

### Materials:

- African myth (See Appendix A, Suggested Reading List/Additional Resources)
- “Graphing Constellations Worksheet” for each student (See Appendix B, Worksheets)

### Key Terms:

**Constellation:** a group of stars that has been given a name based on the shape they form

**Myth:** an invented story, idea, or concept

**Supernatural:** unexplainable by science, abnormal

**Phenomenon:** a fact or situation that is difficult to explain

**God/goddess:** being with supernatural powers or attributes, often worshipped within a particular culture or religion

**Manuscript:** a hand-written document

**Images from “Images for *Astronomic Arts Lesson Plans, Grades, 5-8*” PowerPoint (Available at <http://africa.si.edu>):**

- Image 3: Orion and Taurus constellation
- Image 4: Constellation, Timbuktu manuscript, Mamma Haidara Library
- Image 5: *The Important Stars Among the Multitudes of the Heavens*, 1733, Timbuktu manuscript, Mamma Haidara Library
- Image 6: Mamma Haidara Library, organizing and reshelving manuscripts

**Background Information (Timbuktu Manuscripts)**

During the 11<sup>th</sup> century, Timbuktu (Mali) was an important center of learning that linked trade routes from Europe, Africa, and the Middle East. Timbuktu is home to one of the oldest universities in the world and attracted scholars from surrounding areas. One of the many subjects taught at the university was astronomy. Astronomy manuscript tracts (that combine astrology and astronomy) can be found in the university library and private collections.

The manuscript titles, “The Important Stars Among the Multitude of the Heavens” (1733) shows a diagram of how the heavens rotate and how the movement of the stars determines the beginning of each season. Another manuscript shows the appearance of particular stars.

Unfortunately, there is a limited amount of written astronomic records in Africa, but that does not mean that a significant body of knowledge doesn’t exist on the continent. The majority of information is kept alive through rich oral traditions.



*The Important Stars Among the Multitudes of the Heavens*, 1733, Timbuktu manuscript 2, Mamma Haidara Library

**Introductory Discussion**

Constellations are groups of stars that are given names. Some groups or stars are named after animals or mythical characters and have accompanying stories. A long time ago people used constellations to find their way. Other constellations were used as part of religion or entertainment. As the earth rotates, you can see different constellations in the night sky. The stars comprising some constellations of African cultures can differ from constellations of Western cultures.

**Story time/Discussion**

1. Read an African myth about the stars and/or sky. Ask the following questions. Show Images 4-6 of the Timbuktu manuscripts.

- Why do you think the people looked for patterns and images in the stars?
- How could those patterns be useful?
- Why do you think they gave those star pattern names?
- Is it important to keep ancient records of those constellations? Why or why not?

### ***What is a myth?***

The Greek word *mythos* means story or word. Myths often are created to explain a natural phenomenon man's experience in the world. Characters in myths are frequently gods, goddesses, animals, or people with supernatural powers. Unlike fairy tales, myths are not necessarily optimistic. People have been telling myths for hundreds of years all.

Myths also attempt to explain a natural occurrence, such as why the sun sets or why mosquitoes buzz in people's ears. This type of story can be found in every culture.

As a class, answer the following questions about the myth you just read. You may wish to write the answers on the board.

- What is the setting?
- Who are the characters?
- How would you describe the main character(s)? (brave, scared, shy, etc.)
- What does the myth explain?
- What is the purpose of the myth? (explain something in nature, teach moral values)
- Is the explanation of the natural phenomenon based in science?

### **Write Your Own Myth Workshop**

Direct students to author Jane Yolen's Myth Writing Workshop at [http://teacher.scholastic.com/writewit/mff/mythswshop\\_index.htm](http://teacher.scholastic.com/writewit/mff/mythswshop_index.htm). On this website, students will:

- 1) Read a short page about myths in general. (What are they? What are common elements?)
- 2) Read a short example of a myth by contemporary author, Jane Yolen.
- 3) Do warm-up activities/brainstorming before creating his or her own myth. (Try "The Myth Brainstorming Machine" [Flash required].)
- 4) Write a myth.
- 5) Publish their myths online.
- 6) Read myths created by other students.

### Activity

Procedures:

1. Organize students into pairs.
2. Pass out a "Graphing Constellations" worksheet to each student. (Found in Appendix C.)
2. Review directions for worksheet with class.

Directions for "Graphing Constellations" Worksheet:

(For the first 15 minutes, every student will follow the directions for Partner A. Then, after the students switch papers with his/her partner, every student will be Partner B.)

Partner A: Plot out 10 random stars by making 10 dots on the left coordinate plane. Write the coordinates of each star (dot) in the area provided below the graph. Copy the coordinates for your constellation in the area below the graph to the right, as well. Connect the dots on the left graph to create a constellation. Write the name of your constellation below. Fold your paper back so only the blank right graph shows. Give your paper to another student.



Partner B: Use the coordinates written below the graph to plot out the 10 stars. Connect the 10 stars in your own way to create a constellation. Name your constellation and write it below your graph. Check the placement of your stars by looking at the graph folded back on the left. If both students did the work correctly, they will have stars in the exact same places. Get together with your partner and share what constellations created. Each constellation will be totally unique!

### Reflection:

- What did you learn about myths today?
- What myths are associated with your culture?
- Write down something you don't understand. In a paragraph, write down how you make sense of it.
- How does the use of computers and technology affect oral traditions?
- How do you pass on memories, stories, or other important information?

### Evaluation (On scale of 1-5, 5 being the highest)

- Did the student engage appropriately during the opening discussion/story?
- Did the student follow directions?
- Did the student do participate in at least one brainstorming activity before writing?
- Does the student's myth contain the necessary elements?
- Is it clear what natural phenomenon the myth is attempting to explain?
- Did the student participate appropriately in the closing reflection conversation?

## Lesson 3: Like a Diamond in the Sky



Hubble Sees Glittering Jewels of Messier 9, Image Credit: NASA and ESA

In this lesson, students will practice estimation skills and analyze the relationship between color, temperature, and mass of stars by plotting star data on a graph.

Estimated Time: 60 minutes

### Lesson Objectives:

- Apply estimation and graphing skills to real life situations
- Recognize that not all stars are identical in color, temperature, and mass
- Analyze the relationship between color, temperature, and mass of stars by plotting data on a graph

### Materials:

- African myth (See Appendix A, Suggested Reading List/Additional Resources)
- “Graphing Constellations Worksheet” for each student (See Appendix B, Worksheets)

Images from “Selected Images for *Astronomic Arts* Lesson Plans, Grades, 5-8” PowerPoint (Available at <http://africa.si.edu>):

- Image 7: Hubble Sees Glittering Jewels of Messier 9

## Background Information

When you look into the night sky, if you took them time to count them, you may see a few thousand individual stars with your naked eye. With a simple telescope, you could see millions more, but how many stars are really out there? Even scientists have a hard time answering this question!

Stars are gathered into groups called galaxies, scattered throughout space. We live in the Milky Way galaxy, where astronomers estimate there are about 100 thousand million stars. There are million and millions of galaxies outside our own, each with millions of stars.

## Introductory Discussion:

Show the students an image of the night sky with lots of stars.

- Who has ever tried to count all of the stars in the sky?

Explain that even astronomers can't count all of them, but we can estimate how many there are.

Estimate the number of stars in Image 7 as a class by dividing the image into a squares, as on a graph. Count the number in one square area and times it by the number of squares that cover the image.

- What colors do you see in these images?
- Are there more big stars or more small stars?
- Are there more white stars or more red stars?

Introduce the students to the idea that not all stars are the same. Stars vary in mass, color, size, energy, and life spans. Explain that today we are going to look specifically at the relationship between the color and temperature of stars.

## Estimating Activity

Scientists estimate the number of stars in a similar way to the way we can estimate how many objects there are in a box (or the volume). Show the students the box filled with objects. We can estimate the number of gumballs or grapes in the whole box by counting just a few of them and putting the numbers into a formula:

## Key Terms:

**Luminosity:** the brightness of a star in comparison with that of the sun; for example, the luminosity of Sirius has a luminosity of 23, meaning that it is 23 times brighter than the sun

**Magnitude:** the brightness of a star or other celestial body as seen by the naked eye and expressed by a mathematical ratio of 2.512: for example, a star of the first magnitude is approximately 2 1 / 2 times as bright as one of the second magnitude and 100 times brighter than one of the sixth magnitude. (We can only see stars of the sixth magnitude or brighter without a telescope.)

**Main sequence:** a narrow band in the Hertzsprung-Russell diagram, 90 percent of all known stars are plotted in this band

**Hertzsprung-Russell diagram:** scatter graph showing the relationship between stars' luminosities against their

$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$

There are an estimated  $10^{11}$  to  $10^{12}$  stars in the Milky Way and somewhere around  $10^{11}$  to  $10^{12}$  galaxies. If you multiply it out, there are roughly  $10^{22}$  to  $10^{24}$  stars out there! This is a very approximate estimation, though, because not all galaxies are the same size. So...how many stars are there exactly? No one knows for sure!

### **Having a Hypothesis**

Have a paper circles of red, orange, yellow, white, and blue cut out. Explain that stars come in different colors. As a class, have a few students come to the front of the class and put the colored circles in order according to what color star they think is the coolest to which color of star they think is the hottest. Tell them that we will do an activity in a minute that will help them find the answer after they make a hypothesis. Scientists often predict what they think the answer is to a problem or what they think will happen in an experiment. Tape the circles on the board in that order for everyone to see. The paper circles represent what our class thinks we will find out about the relationship between the color and temperature of stars. The graphing activity below will test the students' hypothesis by looking at data about stars' color and temperature and graphing it out.

### **Activity**

Inform the students that there is a specific graph called the Hertzsprung-Russell diagram that shows us the correlation between a star's brightness, temperature, and color. Give each student colored pencils and a copy of the "Like a Diamond in the Sky" worksheet. (See Appendix B.) Students will then graph the temperature of 12 stars and their corresponding colors as recorded on the Hertzsprung-Russell diagram. Make sure the students label each point with the star's name. Instruct students to connect the points with a curving line. The relationship that will appear in the data is called the *main sequence*. Ninety percent of all known stars can be plotted in this band.

Extension Activity:

\*Math (fractions): Convert the temperature of each star in Celsius to Fahrenheit. Take the temperature in Celsius and multiply by 1.8. Then add 32. This number is the equivalent degree in degrees Fahrenheit.

**Reflection:**

- What is something new that you learned?
- What do you wonder about?
- How can this type of information be useful in learning more about our universe?
- Each year NASA spends approximately \$15.82 billion dollars on research and space exploration. Is this money well spent? Why or why not?  
(Note: This is a more complex question that could be further researched by students and used as a persuasive essay prompt.)

**Evaluation (On scale of 1-5, 5 being the highest)**

- Did the student engage appropriately during the opening discussion?
- Did the student follow directions?
- Did the student do the worksheet to the best of his/her ability?
- Can the student accurately explain the purpose of the Hertzsprung-Russell diagram?
- Did the student participate appropriately in the closing reflection conversation?

# Appendix A: Suggested Reading List/ Additional Resources

## **Books**

### Astronomy/Cultural Astronomy Reference

Fansler, Judah. *Space: A Visual Encyclopedia*. New York: DK Publishing, 2010.

Goldsmith, Mike. *Amazing Space Q & A*. New York: DK Publishing, 2010.

Davis, Kenneth C. *Don't Know Much About Space*. New York: Harper Collins, 2001.

Sipiera, Diane M. and Paul P. Sipiera. *The Hubble Space Telescope*. Connecticut: Children's Press, 1998.

### Creation Myths

Anderson, David. *The Origin of Life on Earth*. Maryland: Sights Productions, 1996.

Bryan, Ashley. *The Story of Lightning and Thunder*. New York: Macmillan Publishing Company, 1993.

Dayrell, Elphinstone. *Why the Sun and the Moon Live in the Sky*. Boston: Houghton Mifflin, 1968.

Elkin, Benjamin. *Why the Sun was Late*. New York: Parents' Magazine Press, 1966.

Gatti, Anne. "Why the Moon Comes Out at Night." *Tales from the African Plains*. London: Puffin Books, 2001.

Gerson, Mary-Joan. *Why the Sky is Far Away*. Boston: Little Brown and Company, 1974.

Mollel, Tololwa M. *A Promise to the Sun*. Boston: Little Brown and Company, 1992.

Riordon, James. *The Coming of Night: A Yoruba Creation Myth from West Africa*. London: Frances Lincoln Limited, 1999.

Roth, Susan L. *Fire Came to the Earth People*. New York: St. Martin's Press, 1988.

Stewart, Dianne. *The Gift of the Sun: A Tale from South Africa*. London: Frances Lincoln Children's Books, 2007.

### Constellation Myths and Other Books for Children

Driscoll, Michael. *A Child's Introduction to the Night Sky: The Story of the Stars, Planets, and Constellations—and How You Can Find Them in the Sky*. New York: Black Dog and Leventhal Publishers, 2004.

Lee, Fran. *Wishing on a Star: Constellation Stories and Stargazing Activities for Kids*. Utah: Gibbs Smith Publishers, 2001.

Winter, Jeanette. *Follow the Drinking Gourd*. New York: Random House, Inc., 1988.

### Books in Braille

Grice, Noreen Simon Steel, and Doris Daou. *Touch the Invisible Sky*. Puerto Rico: Ozone Publishing, 2007.

Grice, Noreen. *The Little Moon Phase Book*. Puerto Rico: Ozone Publishing Corporation, 2005.

### **Teacher Guides**

NASA---Educational Materials

<http://www.nasa.gov/education/materials>

National Museum of African Art

<http://africa.si.edu/exhibits/teachers.html>

## Appendix B: Worksheets

- a. Graphing Constellations Worksheet
- b. Like a Diamond in the Sky Worksheet



# GRAPHING CONSTELLATIONS

National Museum of African Art

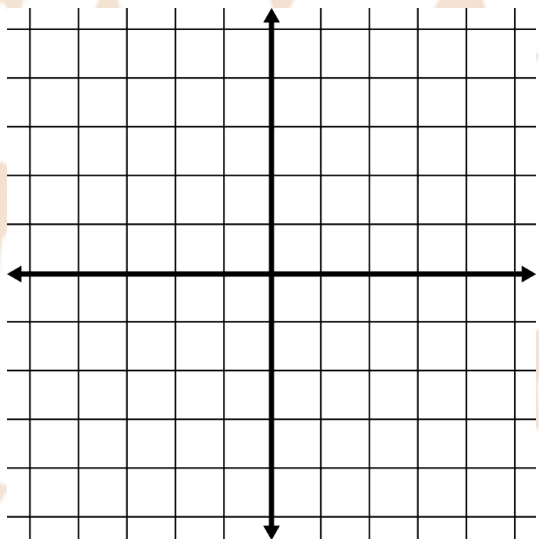
Name of Partner A: \_\_\_\_\_

Name of Partner B: \_\_\_\_\_

## DIRECTIONS:

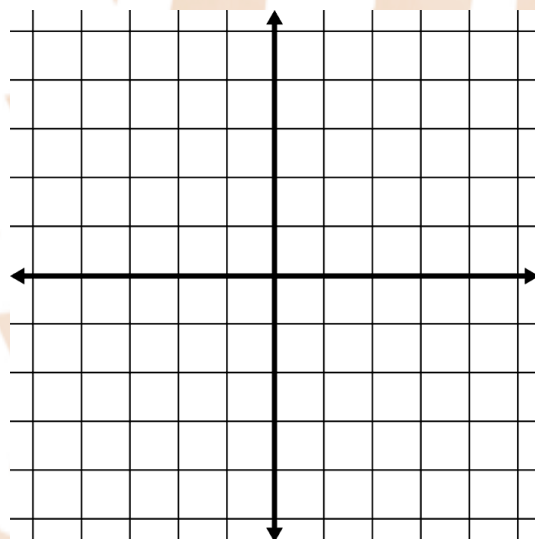
Partner A: Plot out 10 random stars by making 10 dots on the left coordinate plane. Write the coordinates of each star (dot) in the area provided below the graph. Copy the coordinates for your constellation in the area below the graph to the right, as well. Connect the dots on the left graph to create a constellation. Write the name of your constellation below. Fold your paper back so only the blank right graph shows. Give your paper to another student.

Partner B: Use the coordinates written below the graph to plot out the 10 stars. Connect the 10 stars in your own way to create a constellation. Name your constellation and write it below your graph. Check the placement of your stars by looking at the graph folded back on the left. Get together with Partner A and share what constellations you each imagined. Each will be totally unique!



1. ( , )
2. ( , )
3. ( , )
4. ( , )
5. ( , )

6. ( , )
7. ( , )
8. ( , )
9. ( , )
10. ( , )



1. ( , )
2. ( , )
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6. ( , )
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9. ( , )
10. ( , )

Constellation Name: \_\_\_\_\_

Constellation Name: \_\_\_\_\_

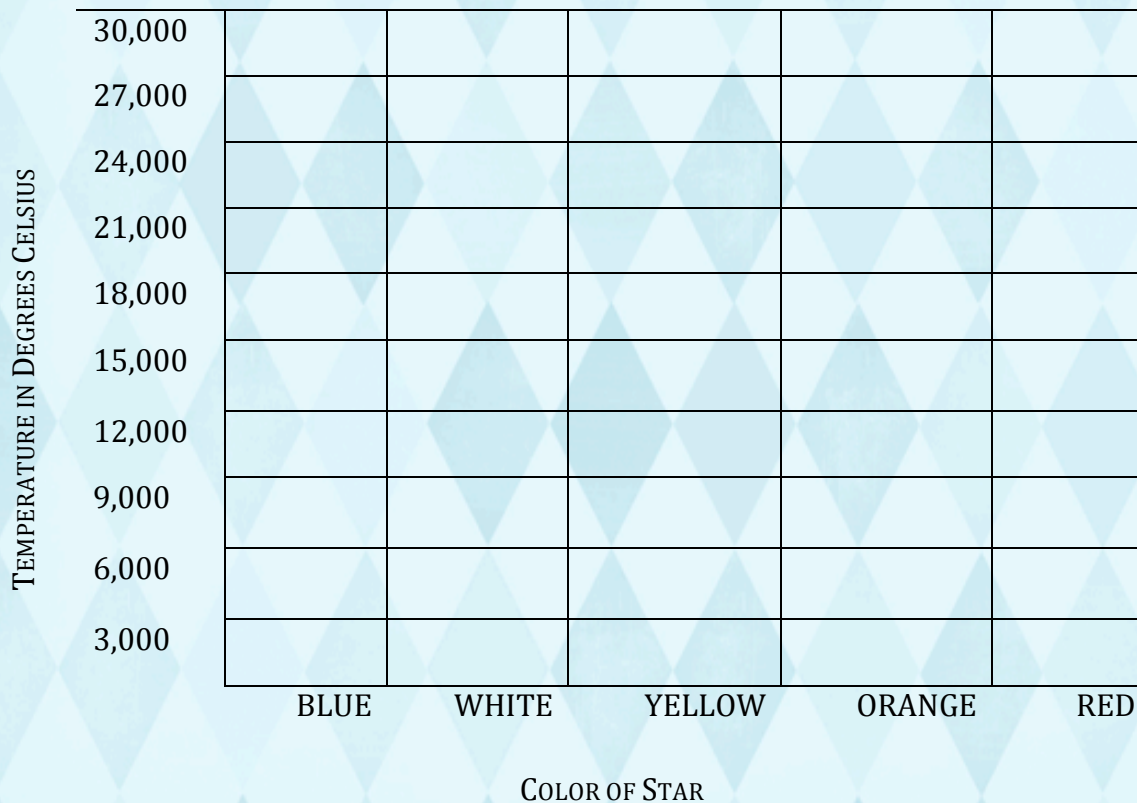
Name \_\_\_\_\_

## Like a Diamond in the Sky

**DIRECTIONS:** Use the data below to plot and label the 12 stars on the graph under the table. This will create scatter graph. Use a black line to connect the points when you are done. This is called the *main sequence*.

STAR	COLOR	TEMPERATURE in degrees Celsius
Vega	White	9,900
Barnard's Star	Red	3,000
Altair	White	8,000
Hadar	Blue	25,500
Sirius	White	10,000
Alnilam	Blue	27,000
Rigel	White	10,000
Sun	Yellow	5,700
Regulus	White	11,000
Alpha Centauri	Yellow	6,000

### Hertzprung-Russell Diagram



# Appendix B: Learning Standards

## **Lesson 1: The Rainbow Serpent—Making a “Green” Sculpture**

### Grades 6-8

National Standards for Arts Education

1. Students select media, techniques, and processes; analyze what makes them effective or not effective in communicating ideas; and reflect upon the effectiveness of their choices. Students intentionally take advantage of the qualities and characteristics of art media, techniques, and processes to enhance communication of their experience and ideas.

## **Lesson 2: Connecting the Dots**

### Grades 6-8

Common Core State Standards for Language Arts & Literacy in History/SS, Science, and Technical Subjects

3. Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences.

- a. Engage and orient the reader by establishing context and introducing a narrator and/or characters; organize an event that unfolds naturally and logically.

## **Lesson 3: Like a Diamond in the Sky**

### Grade 5-8

Common Core State Standards for Mathematics

5.MD.5 Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

- b. Apply the formulas  $V=l \times w \times h$  and  $V= b \times h$  for rectangular prisms to find volumes of right rectangular prisms with whole-edge lengths in the context of solving real world and mathematical problems.