Title: A Day in Space Unit

Author: Julie Muffler

Subject(s): Space Science, Science, Mathematics, Language Arts

Topics: History of Spaceflight, Space Science, History, Space Travel, Observation, Prediction, Reaction time, Data collection, Data analysis, Constellations, Stars, Star magnitude, Astronomy, Space Science

Grade Level: 3-8

Objectives: See individual lessons

Summary of Lessons: An introduction to the history of space flight, to spacecraft navigation using constellations and reaction time to monitor the health of astronaut crews.

Time Allotment:

- History of Space Exploration Timeline: 10 minutes
- Reaction Time: 30 minutes
- Constellations: 30 minutes

Procedures/Instructions:
See individual lessons

Instructional Materials:
See individual lessons

National Science or Mathematics Standards:
Science

Science as Inquiry
CONTENT STANDARD A:
As a result of activities in grades K-4 and 5-8, all students should develop

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Physical Science
CONTENT STANDARD B:

As a result of activities in grades K-4, all students should develop an understanding of

- Position and motion of objects

As a result of activities in grades 5-8, all students should develop an understanding of

- Motions and forces

Life Science
CONTENT STANDARD C:
As a result of activities in grades K-4, all students should develop understanding of

- Organisms and their environments

Earth and Space Science
CONTENT STANDARD D:
As a result of activities in grades K-4, all students should develop an understanding of

- Objects in the sky

History and Nature of Science
CONTENT STANDARD G:
As a result of activities in grades K-4 and 5-8, all students should develop understanding of

- Science as human endeavor

Mathematics

Data Analysis and Probability Standard
Instructional programs from pre-kindergarten through grade 12 should enable all students to—

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them

In grades 3-5 all students should—

- Collect data using observations, surveys, and experiments.

In grades 6–8 all students should—

- Formulate questions, design studies, and collect data about a characteristic shared by two populations or different characteristics within one population.

Assessment Plan:
See individual lessons

Title: Timeline: History of Space Exploration

Author: Julie Muffler

Subject(s): Science, Social Studies

Topics(s): History of Spaceflight, Space Science, History, Space Travel

Grade Level: 3-8

Summary of activity: Students compile a timeline of the history of spaceflight.

Objectives:
By the end of this activity, students will be able to:
- Provide background in space history.
- See science as a human endeavor.
- Sequence historical events in a timeline.

Time: 10 minutes

Procedures/Instructions:
1. Mix up the photos and give one to each student.
2. Instruct the students to arrange themselves in order by the date of the event depicted in their photo.

Note: You may want to write the date (year) on for students to put in chronological order. You can also take out photos to have teams represent one event and put 5 or 10 in order.

Instructional Materials:
- Timeline Photos (Timeline.pdf)
- Timeline Key

National Science or Mathematics Standards:

Science
- Science as a Human Endeavor

Assessment Plan:
Students should check themselves at the end of the activity for accuracy.

History of Space Timeline
Sequence of Events Key

Card Number	Date	Event
1	1917	NACA Logo
2	1917	NACA Hangar
3	1917	NACA First Employee
4	1926	Robert Goddard 1st Liquid Fueled Rocket
5	1947	Chuck Yeager 1st Human to Break Sound Barrier
6	1957	Sputnik 1st Manmade Satellite
7	1958	Explorer 1 1st American Satellite
8	1958	NACA became NASA
9	1959	X-15
10	1959 - 1963	**Project Mercury**
11	1961	"Ham" 1st American Animal in Space
12	1961	Alan Shepard 1st American in Space
13	1962	1st Mercury Atlas Rocket Booster
14	1962	John Glenn 1st American to Orbit Earth
15	1962	Telstar 1st Commercial Communication Satellite
16	1964 - 1966	**Project Gemini**
17	1965	Ed White 1st American Space Walk (EVA)
18	1967 - 1972	**Project Apollo**
19	1969	Neil Armstrong 1st Human to Walk on the Moon
20	1973 - 1974	Skylab 1st U.S. Space Station
21	1975	Apollo-Soyuz Test Project
22	1981	1st Space Shuttle Launch
23	1983	Sally Ride 1st American Women in Space

24	1984	Bruce McCandless 1st Human Satellite
25	1998 - Present	**International Space Station**
26	????? (future)	1st Permanent Moon Base

Title: Constellations

Author: Julie Muffler

Subject(s): Science, Mathematics, Language Arts

Topic(s): Constellations, Stars, Star magnitude, Astronomy, Space Science

Grade/Level: 3-6

Summary of Lesson: Students will practice making models of constellations that show the magnitudes of different stars in that constellation using a Lite Brite.

Objectives:
By the end of this activity, students will be able to:
- Identify various constellations.
- Build constellation models showing magnitudes of the stars.
- Define the word magnitude.

Time Allotment: 30 minutes

Procedures/Instructions:

Background: When finding a certain constellation in the night sky, you will usually look for the brightest stars first. Stars have grades according to their brightness called magnitudes.

Bright to Very Bright	1st magnitude
Fairly Bright	2nd magnitude
Medium	3rd magnitude
Faint	4th magnitude
Very Faint	5th magnitude

Preparation:
1. Make a constellation model on black construction paper for the students to use as an example. The model should fit Lite Brite. For younger students, you should draw the constellations on cards ahead of time with symbols for the stars using the key below. The students will find the right color for the symbol and put the peg in themselves. The older students can use a constellation guide (such as Rey's) and make their own cards.
2. Get a copy of Find the Constellations by H. Rey. This is an excellent reference for the team to use as they build their own models.

Instructions:

1. Your team will look at the sample constellation and use the key to determine the magnitude of the stars in that constellation.
2. Now your team will select a constellation from the resource book at the station and create a card for use with the Lite Brite of a different constellation using the chart symbols to indicate magnitude.
3. Label the card with the name of the constellation.
4. Put the card into the Lite Brite and use the colored pegs that stand for the different magnitudes.
5. Take the pegs out and try a different constellation if time permits.
6. Leave the new card(s) in the card file for future use by other teams.

Extensions:

Discuss the difference between color and magnitude using the Student Handout

Check out the Virtual Star Explorer and navigate through the stars exploring their magnitude, luminosity and distance using navigational coordinate systems. http://www.kidsastronomy.com/virtual_explorer/

Instructional Materials:

- Lite Brite toy with pegs
- Set of constellation model sheets (see Sample)
- Various pictures of constellations, i.e. in the book, Find the Constellations by H. Rey or another constellation book
- Magnitude chart

National Science or Mathematics Standards:

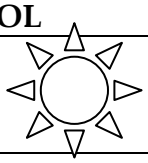
Science

- Science as Inquiry (K-8)
- Physical Science: (K-4) Position and Motion of Objects, (5-8) Motions and Forces
- Life Science: (K-4) Humans depend on their natural and constructed environments.
- Earth and Space Science: (K-4) Objects in the Sky, Patterns of Movement

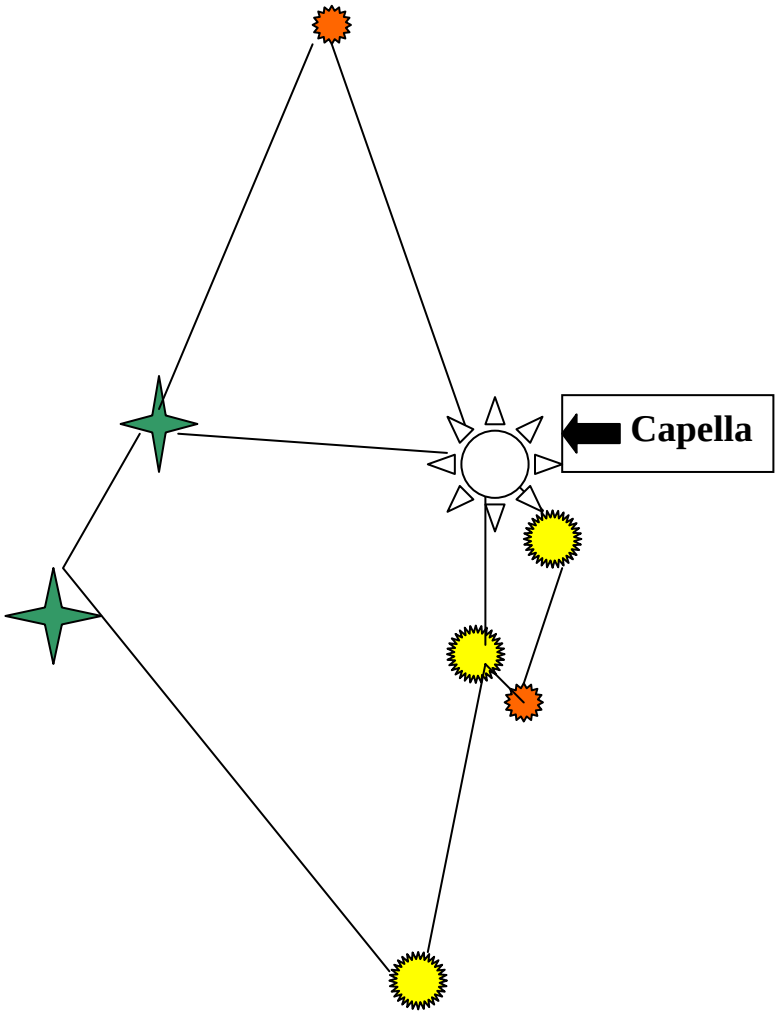
Assessment Plan:

Students can be assessed on their completed cards (older) or their completed Lite Brite models (younger).

STAR MAGNITUDE CHART

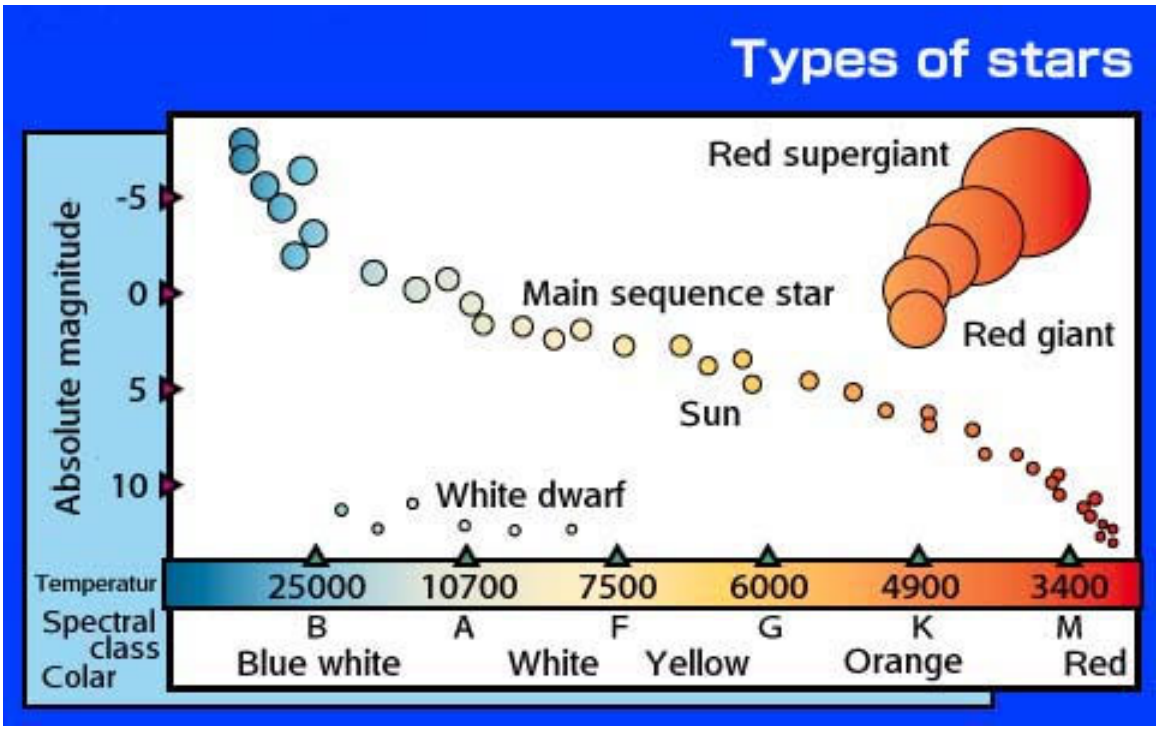
DESCRIPTION	SYMBOL	COLOR PEG
Very Bright		White
Bright		Blue
Fairly Bright		Green
Medium		Yellow
Faint		Orange
Very Faint		Red

SAMPLE CONSTELLATION



Types of Stars

A star's brightness is indicated by its "magnitude" The brightness of stars that are visible from Earth is expressed in units called magnitude. The stars that appear brightest to the naked eye are called "stars of the first magnitude," while stars that can barely be seen are called "stars of the sixth magnitude." The difference in brightness between each level of magnitude is about 2.5 times. Many stars have a more precise rating with a decimal point, such as magnitude 1.5, etc. Stars brighter than magnitude 1 are classed as magnitude 0, or -1, etc. However, as each star is a different distance from the Earth, "absolute magnitude", which expresses the "apparent magnitude" of a star at a fixed distance from the Earth (32.6 light years) is used to express its actual brightness.



Stars with the hottest surface temperatures appear white, while cooler stars appear red. Antares, which is a first magnitude star in the constellation of Scorpio, appears red, while Sirius, which is a first magnitude star in the constellation of Canis Major, appears bluish white. The reason that stars have different colors is the difference in their surface temperatures. Stars with a fairly low surface temperature of around 3,000 degrees Celsius appear red. A star with a surface temperature of around 6,000 degrees Celsius will appear yellow, and even hotter stars will be white. Stars with a surface temperature of 20,000 degrees Celsius or more shine with a bluish white light. Stars so faint that their color cannot be clearly distinguished from Earth can nevertheless be viewed through a

prism, and their light examined by means of spectral analysis. In this way, we can discover the dominant color of the star, and estimate its surface temperature. http://spaceinfo.jaxa.jp/note/hoshi/e/hos02_e.html

Title: Reaction Time: Quick as a Wink

Author: Julie Muffler

Subject(s): Science, Mathematics, Language Arts

Topic(s): Observation, Prediction, Reaction time, Data collection, Data analysis

Grade Level: 3-8

Summary of lesson: Students will practice experiments that test reaction times and make observations based on the data.

Objectives:
By the end of this lesson, students will be able to:
- Measure reaction time.
- Make inferences as to whether the data will change if variables are introduced (i.e. practice, times of day).
- Calculate averages.
- Compare data.

Time: 40 minutes

Materials (per team):

Reaction time scale
Data Log.
Stop watch

Procedures/Instructions:

Background:
Reaction time is the amount of time it takes for you to react to a situation; it involves the body's nervous system. You can measure you reaction time using a scale. The following are the typical average reaction times according to age groups.

Age 5	0.40 seconds	Age 40	0.25 seconds
Age 10	0.30 seconds	Age 50	0.28 seconds

Age 20	0.20 seconds	Age 55	0.35 seconds
Age 30	0.22 seconds	Age 60	0.50 seconds

Test pilot: 0.16 seconds

Procedures:

1. Explain the directions by demonstrating with one student.
2. In their teams:
   a. One student sits at a desk and lays his/her arm across the desk so that the dominant hand extends out over the desk.
   b. The other student holds the reaction time scale between the open thumb and index finger of his/her partner.
   c. The student being tested is to look straight ahead, as the other drops the scale without a warning.
   d. The student being tested then tries to catch the scale between his/her thumb and fingers.
   e. Record the reaction time on the Data Log.
   f. Do this five times.
   g. If students can average, have them find their average reaction times and record them.
3. Discuss the following questions:
   a. Was your fifth reaction time better than your first?
   b. Which time was your best time?
4. Make a list of the best reaction time for each student on the board. In working with students who have learned how to find the average, list their average reaction times on the board.
5. Ask the students to make observations about the data and what variables may have impacted their scores.
6. Give them the average reaction time for their age group and have them compare it to their results.

Extension Activity:

Complete Test 2 and record each of the five trials on the Data Log 2. If students can average, have them find their average reaction times and record them. Ask the students to make observations about the data and what variables may have impacted their scores.

National Science or Mathematics Standards:

SCIENCE

- Science As Inquiry

MATHEMATICS

- (3-5) Collect data using observations, surveys, and experiments

- (6-8) Formulate questions, design studies, and collect data about a characteristic shared by two populations or different characteristics within one population

Assessment Plan:

Students can be assessed on their data logs, inferences, comparisons, participation and teamwork.

Reaction Time: Quick as a Wink

Preparation: Copy the scale below on tag board, glue the 2 pieces together, and laminate.

Note: This side is blank.	**REACTION TIMER** _____ **0.25 seconds**_____ **0.24 seconds**_____ **0.23 seconds**_____ **0.22 seconds**_____ **0.21 seconds** _____ **0.20 seconds** _____ **0.19 seconds** _____ **(Glue to back of panel)** _____

Note: This side is blank.	**0.18 seconds** _____ **0.17 seconds** _____ **0.16 seconds** _____ **0.15 seconds** _____ **0.14 seconds** _____ **0.13 seconds** _____ **0.12 seconds** _____ **0.11 seconds** _____ **0.10 seconds** _____ Place thumb here

Quick as a Wink Reaction Time

Test 1 DATA LOG

What Is Your Reaction Time?

Time in Seconds

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Trial 1					
Trial 2					
Trial 3					
Trial 4					
Trial 5					
Average					

Quick as a Wink Reaction Time Test 2

How fast can you react?

5 seconds = Excellent
7 seconds = Very Good
9 seconds = Average
More than 9 seconds = Slow

Note: Use Only 1 Finger

1. Touch each square in numerical order.
2. Touch each square in reverse numerical order.
3. Touch even squares in order.
4. Touch odd squares in order. How do times compare?
5. Try the other hand now. Any difference? How much?

4	**3**	**10**	**12**
6	**11**	**8**	**9**
1	**7**	**2**	**5**

Quick as a Wink Reaction Time

Test 2 DATA LOG

What Is Your Reaction Time?

Time in Seconds
5 seconds = Excellent
7 seconds = Very Good
9 seconds = Average
More than 9 seconds = Slow

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Trial 1					
Trial 2					
Trial 3					
Trial 4					
Trial 5					
Average					