

Astronomy

TABLE OF CONTENTS

ABOUT DELTA SCIENCE MODULES

Program Introduction	iii
Teacher's Guide	iv
Delta Science Readers	vi
Equipment and Materials Kit	vii
Scope and Sequence	viii
Assessment Features	ix
Process Skills	x
Communicating About Science	xi
Integrating the Curriculum	xii
Meeting the Standards	xiii
What We Believe	xiv

ASTRONOMY OVERVIEW

About Astronomy	1
Overview Charts	
Hands-on Activities	2
Delta Science Reader	4
Science Background	5
Materials List	7

HANDS-ON ACTIVITIES

Activity Summary	9
Schedule	10
Preparing for the Activities	
Classroom Management	11
Advance Preparation	11
Materials Management	12
Activities	
1. The Sky in Motion	13
2. As the Earth Turns	23
3. Skies Around the World	31
4. Stars Throughout the Year	41
5. The Sun and Seasons	51

6. Planet Watch	61
7. Constellations and Myths	69
8. Three-Dimensional Starfield	77
9. Seeing More	85
10. Life Cycle of a Star	93
11. Galaxies	101
12. Are We Alone?	109

Assessment

Activities 1–12	119
---------------------------	-----

Glossary

.	125
-----------	-----

TEACHER RESOURCES

Unit Test: Teacher Information	127
References and Resources	129
Science Safety	131
Standards Correlations	133
Measurement Resources	137
Building Science Vocabulary	141

DELTA SCIENCE READER TEACHER'S GUIDE

Introduction	Tii
Science and Literacy	Tii
Assessment Features	Tiii
Including All Learners	Tiv
About the Teaching Plan	Tv
Teaching Astronomy	Tvi

COPYMASTERS

Student Activity Sheets	
Assessment Activity Sheets	
Assessment Summary Chart	
Unit Test	
Pattern Sheets	



About **Astronomy**

DeltaScienceModules, THIRD EDITION

Students use a set of 12 SkyCaps—a tool created by Dr. Carolyn Sumners of the Houston Museum of Natural History—to experience observational astronomy in the classroom. Students discover how Earth’s motion relates to the cycles of day and night, the annual seasons, and the predictably changing positions of planets and constellations in the night sky. Color transparencies from Hubble images and space shuttle training programs support student investigations of the life cycles of stars, the shapes of galaxies, and the size of the universe. Students also build instruments, including astrolabes, solar quadrants, and rudimentary telescopes, to explore celestial navigation.

In the Delta Science Reader *Astronomy*, students read about the characteristics and movement patterns of objects in our solar system and beyond, such as planets, moons, asteroids, meteors, and comets. They learn about our Sun and other stars—magnitudes, temperatures, distances, and composition—and the main sequence. Students find out how stars produce and release energy, and they are introduced to the ongoing process of star formation and destruction. They read about constellations and the shapes and compositions of different types of galaxies. Finally, students learn how astronomers use tools and technology such as telescopes, artificial satellites, and space probes to study space, and they trace the history of space exploration.

Overview Chart for Hands-on Activities

Hands-on Activity	Student Objectives
1 The Sky in Motion <i>page 13</i>	<ul style="list-style-type: none"> • assemble SkyCaps and use them to see how the skies change over the course of a day • observe and describe how the stars move across the sky during the night • observe and describe how the Sun moves across the sky during the day
2 As the Earth Turns <i>page 23</i>	<ul style="list-style-type: none"> • build a model of the Earth and sky • explain how the rotation of Earth causes the sky motions they have described • explain how the rotation of Earth causes sunrise and sunset each day
3 Skies Around the World <i>page 31</i>	<ul style="list-style-type: none"> • discover how and why the sky changes as an observer moves from the equator toward the poles • construct an astrolabe and use it to determine the elevation of objects • construct a solar quadrant and use it to determine their latitude • learn that differences in the night sky around the world are the basis for celestial navigation
4 Stars Throughout the Year <i>page 41</i>	<ul style="list-style-type: none"> • observe and describe how the stars change during the year • build a model showing how Earth revolves around the Sun • relate Earth's orbital motions to the changing sky
5 The Sun and Seasons <i>page 51</i>	<ul style="list-style-type: none"> • observe that the Sun is higher in summer and lower in winter • discover that Earth's motion around the Sun causes the seasons • construct a model of an ancient ruin to see how astronomers centuries ago observed the Sun to predict the changing seasons
6 Planet Watch <i>page 61</i>	<ul style="list-style-type: none"> • construct a solar system scale model • use planet orbital positions to determine where the planets are in Earth's sky tonight • learn more about individual planet characteristics
7 Constellations and Myths <i>page 69</i>	<ul style="list-style-type: none"> • match shuttle starfield patterns with sky maps • discover some of the myths behind constellation names • construct card models showing their favorite constellation patterns
8 Three-Dimensional Starfield <i>page 77</i>	<ul style="list-style-type: none"> • use star distance data to make a three-dimensional model of part of the starfield • discover that a constellation has a different two-dimensional appearance when observed from a new direction • learn that starlight intensity varies according to the star's intrinsic brightness and the star's distance from the observer
9 Seeing More <i>page 85</i>	<ul style="list-style-type: none"> • experiment with lenses and the images they produce • assemble a telescope and calculate its magnification • use the telescope to observe distant objects
10 Life Cycle of A Star <i>page 93</i>	<ul style="list-style-type: none"> • discover that stars have life cycles just as living things do • arrange star cloud images in sequence from youngest to oldest • create flipbooks showing the life cycle of a star
11 Galaxies <i>page 101</i>	<ul style="list-style-type: none"> • classify different galaxies by shape • discover that Earth is located in the Milky Way galaxy • estimate the number of galaxies in the universe based on images of deep space taken by the Hubble Space Telescope
12 Are We Alone? <i>page 109</i>	<ul style="list-style-type: none"> • calculate the probability of other intelligent life forms existing in the Milky Way galaxy • interpret humanity's first messages to the stars • create their own messages to aliens
Assessment <i>page 119</i>	<ul style="list-style-type: none"> • See page 119.

Process Skills	Vocabulary	Delta Science Reader
observe, make and use models, communicate, compare	astronomy, constellation, horizon, rise, set, star	pages 2–7
hypothesize, make and use models, conclude, predict	axis, rotation	pages 2, 5
make and use models, use numbers, measure, infer	astrolabe, celestial, latitude, solar quadrant	
make and use models, observe, infer, predict, collect and record data	orbit, revolution, zodiac	pages 2–5, 8–10
observe, measure, analyze data, conclude, make and use models	Stonehenge, summer solstice	pages 2, 5, 8
make and use models; collect, record, display, and analyze data; predict	planet, solar system	pages 2–7
observe, compare, make and use models, communicate	myth, space shuttle	page 13
make and use models, use numbers, compare, infer	light-year, magnitude, three-dimensional	pages 8–10, 13
make and use models, use numbers, observe, compare	convex, focal length, lens, magnification, power	page 16
compare, conclude, classify, make and use models, communicate	birth cloud, black hole, nebula, neutron star, nuclear fusion, red giant, supernova, white dwarf	pages 8–10, 11–12
compare, classify, infer, use numbers	galaxy, Milky Way, universe	pages 14–15, 18, 21
use numbers, hypothesize, make and use models	alien, extraterrestrial, variable	pages 16–20, 22–23

See the following page for the Delta Science Reader Overview Chart.

Overview Chart for Delta Science Reader

Astronomy

Selections	Vocabulary	Related Activity
Think About...		
<p>What Makes Up Our Solar System? pages 2–7</p> <ul style="list-style-type: none"> • Inner Planets • Asteroid Belt • Outer Planets • Other Space Objects 	<p>asteroid, astronomical unit (AU), astronomy, axis, comet, crater, elliptical, gravity, inner planets, meteoroid, moon, nebula, orbit, outer planets, planet, revolve, rotate, solar system, universe</p>	<p>Activities 1, 2, 6</p>
<p>What Are Stars? pages 8–10</p> <ul style="list-style-type: none"> • Our Sun • Star Characteristics 	<p>absolute magnitude, apparent magnitude, electromagnetic radiation, electromagnetic spectrum, frequency, Hertzsprung-Russell (H-R) diagram, light-year, main sequence, nuclear fusion, parallax, spectrograph, spectrum, visible light, wavelength</p>	<p>Activities 2, 3, 4, 5</p>
<p>What Are the Life Stages of Stars? pages 10–12</p> <ul style="list-style-type: none"> • Stars Form • Stars Change and Die 	<p>black dwarf, black hole, neutron star, planetary nebula, protostar, red giant, supernova, white dwarf</p>	<p>Activity 10</p>
<p>How Are Stars Grouped? pages 13–15</p> <ul style="list-style-type: none"> • Constellations • Star Systems • Galaxies 	<p>big bang, binary system, constellation, elliptical galaxy, galaxy, irregular galaxy, red shift, spiral galaxy, star system</p>	<p>Activities 7, 8, 11</p>
<p>How Have We Learned About Space? pages 16–20</p> <ul style="list-style-type: none"> • Optical Telescopes • Detecting Radio Waves • Detecting Other Waves • Hubble Space Telescope • Space Probes 	<p>artificial satellite, gamma ray, geosynchronous orbit, infrared radiation, radio telescope, radio wave, reflecting telescope, refracting telescope, space probe, ultraviolet (UV) ray, x-ray</p>	<p>Activities 9, 11, 12</p>
People in Science		
<ul style="list-style-type: none"> • Edwin Hubble page 21 		<p>Activity 11</p>
Did You Know?		
<ul style="list-style-type: none"> • About the History of Space Exploration pages 22–23 		<p>Activities 9, 12</p>

Teaching suggestions for the Delta Science Reader are in a 32-page booklet included with this guide.

MATERIALS LIST

Astronomy

Quantity	Description	Quantity	Description
9	beads, beige, small*	3	posters, resource
9	beads, blue, small*	8	SkyCaps, set/12
9	beads, brown, small*	8	Solar System Orbit Maps
9	beads, green, small*	9	spheres, clear, plastic
18	beads, orange, small*	1	stickers, star, sheets, p/3*
9	beads, purple, small*	8	Stonehenge Bases*
9	beads, teal, small*	1	string, black*
9	beads, white, small*	9	tagboard pieces*
9	beads, yellow, large	1	tape, masking*
9	cardboard pieces, corrugated*	1	tape, transparent*
9	cardboard tubes*	1	transparency, Arecibo Message
3	cards, Hubble Deep Field Image, p/3	1	transparency, Hubble Deep Field Image
1	cellophane roll, red*	1	transparencies, Nebulas, set/6
1	clay, modeling, stick*	1	transparencies, Shuttle Starfields, set/8
1	Delta Science Dictionary	1	transparency, M100 Galaxy
1	Delta Science Dictionary Copymaster Booklet	1	transparency, Pioneer Plaque
9	Earth globes	1	transparency, Ursa Major/Ursa Minor
1	glue, bottle*	9	wires, coated, 12-in*
8	grease pencils, black	1	Teacher's Guide
8	grease pencils, yellow	8	Delta Science Readers
1	index cards, 4" x 6", p/100*		
9	lenses, large		
9	lenses, small		
2	packing peanuts*		
15	paper, construction, black*		
18	paper, construction, blue*		
1	paper fasteners, p/100*		
1	paper, graph, p/50*		
1	pattern sheet, Astrolabe		
1	pattern sheet, Autumn Constellations		
1	pattern sheet, Big Dipper		
1	pattern sheet, Hemisphere Star Patterns		
1	pattern sheet, Milky Way Map		
1	pattern sheet, Planetary Orbit Chart, p/2		
1	pattern sheet, Planet Cards		
1	pattern sheet, Solar Quadrant		
1	pattern sheet, Spring Constellations		
1	pattern sheet, Star Life Cycle Cards		
1	pattern sheet, Star Party		
1	pattern sheet, Star Time Chart		
1	pattern sheet, Summer Constellations		
1	pattern sheet, Sun Map		
1	pattern sheet, Winter Constellations		
2	posters, astronomy†		

* = consumable item

† = in separate box

ACTIVITY SUMMARY

In this Delta Science Module, students investigate the far reaches of the universe using a unique tool that transfers the observation of sky motions into the classroom.

The 12 SkyCaps have been created to display the sequence of sky images students would see were they to observe the sky every 2 hours throughout the day, *or* every month throughout the year. The SkyCaps provide the data and allow students to observe and record changes in the starfield over a day or a year.

ACTIVITY 1 Students become familiar with the SkyCaps and learn that objects in the sky, specifically the Sun and other stars, have predictable motions. They are also encouraged to examine the night sky for direct observational experience.

ACTIVITY 2 Students explore the reasons why the skies change. By constructing a fixed Sky Sphere showing constellations and the Sun, and then rotating an Earth model within it, they discover that Earth's movement is the cause of the changing starfield and of night and day.

ACTIVITY 3 Students step back in time to the centuries when the stars were a heavenly road map for sailors. They build astrolabes and solar quadrants and experiment with them to calculate their latitude and investigate the concept of celestial navigation.

ACTIVITY 4 Students use a Solar System Orbit Map to plot Earth's movement around the Sun. They observe how and why the sky changes from month to month and discover how to determine the Sun's constellation location.

ACTIVITY 5 Students discover the relationships among Earth's orbit, the tilt of its axis, and the seasons. They also connect the elevation of the Sun in the sky with the length of day and the intensity of sunlight reaching Earth.

ACTIVITY 6 Students add other planets to the Solar System Orbit Maps and study their movements through Earth's starfield.

ACTIVITY 7 Students simulate one aspect of astronaut training, learning to identify constellations from various orientations. They also discover the myths behind the patterns and reproduce a favorite constellation.

ACTIVITY 8 Students use a 3-D model, the familiar Big Dipper, based on stellar distances in light-years to explore the real locations of the stars as well as star magnitudes.

ACTIVITY 9 Students build and use simple telescopes.

ACTIVITY 10 Students' views expand to those of the Hubble Space Telescope. They study Hubble images of star clouds for clues of different life cycle stages. Then they assemble flipbooks showing the birth, middle age, and death of a star.

ACTIVITY 11 Students discover our solar system's place in the cosmos, learning about the shapes and scope of galaxies. Counting and extrapolating from the Hubble Deep Field Image, they estimate the size of the universe.

ACTIVITY 12 Students tackle hypothetical calculations and scientific means of intergalactic communication as they explore the question of alien life in the universe.