

Earth, Moon, and Sun

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

EARTH, MOON, AND SUN OVERVIEW

About <i>Earth, Moon, and Sun</i>	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. Solar Journal	13
2. Lunar Journal	21
3. How Big Are the Planets?	29
4. How Far Are the Planets?	37
5. The Earth-Moon System	45

6. The Rectified Globe	53
7. The Human Sundial	61
8. Earth's Motion in Space	71
9. The Reason for Seasons	81
10. Modeling Moon Phases	93
11. Eclipses of All Kinds	103
12. Tides	111
13. Simple Celestial Navigation	121

Assessment

Activities 1–13	131
---------------------------	-----

Glossary	137
---------------------------	-----

TEACHER RESOURCES

Unit Test: Teacher Information	139
References and Resources	141
Science Safety	143
Standards Correlations	145
Measurement Resources	149
Building Science Vocabulary	153

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 <i>Earth, Moon, and Sun</i>	Tvi

COPYMASTERS

Student Activity Sheets	
Assessment Activity Sheets	
Assessment Summary Chart	
Unit Test	



About **Earth, Moon, and Sun**

DeltaScienceModules, THIRD EDITION

Students learn to distinguish between the apparent motions of the Sun and Moon versus the actual motion of Earth. They record daily observations about the time and position of sunrise and sunset, shape of the Moon, daytime visibility, and elevation. Their data reflect interactions among Earth, its Moon, and the Sun that explain such phenomena as day and night, seasons, Moon phases, length of day, tides, and more. Scale models of the solar system demonstrate its massive distances and the relative sizes of the planets. The final activity puts students onboard famous ocean voyages, relying on celestial navigation to stay on course.

In the Delta Science Reader *Earth, Moon, and Sun*, students read about Earth's place in space, the forces that affect our planet, and the Earth movements that bring about day and night, years, and seasons. They discover how the Sun is similar to and different from other stars and find out about its composition and the source of its heat and light energy. They learn about Earth's nearest neighbor in space, the Moon, and how its motion relative to Earth causes Moon phases, tides, and eclipses. A biographical sketch introduces Copernicus and the heliocentric theory. Finally, a field guide to the planets summarizes important data and interesting facts about our solar system.

Overview Chart for Hands-on Activities

Hands-on Activity	Student Objectives
1 Solar Journal <i>page 13</i>	<ul style="list-style-type: none"> • keep an ongoing record of the times and positions of sunset and sunrise • recognize the apparent motion of the Sun • prepare data for use in future activities
2 Lunar Journal <i>page 21</i>	<ul style="list-style-type: none"> • observe and record the position and appearance of the Moon over time • prepare data for use in future activities
3 How Big Are the Planets? <i>page 29</i>	<ul style="list-style-type: none"> • review the components of our solar system • draw and cut out planets and the Moon for a class solar system model • compare the sizes of the planets, Moon, and Sun
4 How Far Are the Planets? <i>page 37</i>	<ul style="list-style-type: none"> • create a walk-through scale model of the solar system • calculate the distance of their team's planet from other planets in the solar system • map the solar system scale model
5 The Earth-Moon System <i>page 45</i>	<ul style="list-style-type: none"> • estimate the size of the Moon in relation to a given Earth globe • investigate the difference in volume between the Earth and Moon by seeing how many Moons are needed to create one Earth • use models to demonstrate distances between the Earth, Moon, and artificial satellites
6 The Rectified Globe <i>page 53</i>	<ul style="list-style-type: none"> • simulate Earth's orientation in space by rectifying a globe • use the globe to investigate day, night, sunrise, sunset, noon, and midnight
7 The Human Sundial <i>page 61</i>	<ul style="list-style-type: none"> • construct a large, simple, horizontal sundial in which they will act as the gnomon • relate the Sun's position to the length and direction of shadows and to the time of day • construct a small, portable, horizontal sundial
8 Earth's Motion in Space <i>page 71</i>	<ul style="list-style-type: none"> • demonstrate the daily rotation of Earth and the conditions that create sunrise, sunset, noon, and midnight • demonstrate the revolution of Earth around the Sun and the resulting change that occurs in the angle of the Sun's rays relative to Earth • translate observations of their own motions to Earth, Moon, and Sun models
9 The Reason for Seasons <i>page 81</i>	<ul style="list-style-type: none"> • model the tilt of Earth's axis as it orbits the Sun • learn about solstices and equinoxes and the role they play in the Sun's apparent motion • explore how the angle at which sunlight reaches a given location affects its concentration • infer the causes of seasonal changes
10 Modeling Moon Phases <i>page 93</i>	<ul style="list-style-type: none"> • model the orbit of the Moon around Earth • learn how the orbit of the Moon results in the phases we observe from Earth
11 Eclipses of All Kinds <i>page 103</i>	<ul style="list-style-type: none"> • learn how the relative positions of the Sun, Earth, and Moon can result in solar and lunar eclipses • model partial and total solar eclipses and note their characteristics • model partial and total lunar eclipses and note their characteristics
12 Tides <i>page 111</i>	<ul style="list-style-type: none"> • model Earth's tides • compare tidal motion with the phases of the Moon and the position of the Sun • relate these celestial objects to Earth's tides
13 Simple Celestial Navigation <i>page 121</i>	<ul style="list-style-type: none"> • identify latitude and longitude lines on a globe • determine the course of two historic voyages with data from simulated ships' logs • identify their own longitude and latitude
Assessment <i>page 131</i>	<ul style="list-style-type: none"> • See page 131.

Earth, Moon, and Sun

Process Skills	Vocabulary	Delta Science Reader
observe; collect, record, display, and interpret data	horizon, sunrise, sunset	pages 6–7, 8, 20
observe; collect, record, display, and interpret data	altitude, lunar	pages 13–15
use numbers, make and use models, compare, display data	orbit, planet, solar system, star	pages 2–5, 21–23
use numbers, make and use models, measure, compare, display data		pages 2–5, 21–23
use numbers, predict, investigate, make and use models	artificial satellite, natural satellite	pages 13–15
make and use models, investigate	midnight, noon, rectified	pages 8–10
make and use models, infer, predict	gnomon, sundial	pages 6–7, 8–10
make and use models, compare	axis, revolution, rotation	pages 2–5, 8–10, 11–12, 20
make and use models, investigate, infer	direct sunlight, equinox, indirect sunlight, solstice	pages 11–12
make and use models, compare, communicate	crescent, first quarter Moon, full Moon, gibbous, new Moon, phase, third quarter Moon	pages 14–15
make and use models, draw conclusions	lunar eclipse, partial eclipse, solar eclipse, total eclipse	pages 18–19
make and use models, compare, infer	gravity, neap tide, spring tide, tide	pages 16–17
use numbers, draw conclusions, measure	celestial navigation, latitude, local noon, longitude, Polaris, Prime Meridian, Universal Time	pages 8–10, 11–12

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

Overview Chart for Delta Science Reader

Earth, Moon, and Sun

Selections	Vocabulary	Related Activity
Think About...		
Where Is Earth in Space? <i>pages 2–5</i> <ul style="list-style-type: none"> • What Is Earth Like? • Earth in the Solar System • Stars • Galaxies and the Universe • What Force Keeps Satellites in Orbit? 	asteroid, atmosphere, comet, galaxy, gravity, hydrosphere, law of universal gravitation, light-year, lithosphere, meteoroid, moon, orbit, planet, satellite, solar system, star, Sun, universe, weight	Activities 3, 4, 8, 13
What Is the Sun Like? <i>pages 6–7</i> <ul style="list-style-type: none"> • The Sun’s Atmosphere • The Sun’s Interior • Studying the Sun 	chromosphere, convection zone, core, corona, electromagnetic spectrum, nuclear fusion, photosphere, prominence, radiation zone, solar energy, solar flare, solar wind, spectrometer, sunspot, telescope	Activities 1, 7
What Causes Days and Years? <i>pages 8–10</i> <ul style="list-style-type: none"> • Days • Years 	axis, day, ellipse, International Date Line, revolution, rotation, time zone, year	Activities 1, 6, 7, 8, 13
What Causes Seasons? <i>pages 11–12</i> <ul style="list-style-type: none"> • Solstices • Equinoxes 	axial tilt, equinox, latitude, season, solstice	Activities 8, 9, 13
What Is the Moon Like? <i>pages 13–15</i> <ul style="list-style-type: none"> • Maria and Highlands • Craters • Exploring the Moon • Moon Phases 	crater, highlands, maria, phases, waning, waxing	Activities 2, 5, 10
What Causes Tides? <i>pages 16–17</i>	neap tides, spring tides, tidal range, tide	Activity 12
What Causes Eclipses? <i>pages 18–19</i> <ul style="list-style-type: none"> • Lunar Eclipses • Solar Eclipses 	eclipse, lunar eclipse, penumbra, solar eclipse, umbra	Activity 11
People in Science		
<ul style="list-style-type: none"> • Nicolaus Copernicus <i>page 20</i> 		Activity 1
Did You Know?		
<ul style="list-style-type: none"> • About the Planets <i>pages 21–23</i> 		Activities 3, 4

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

MATERIALS LIST

Earth, Moon, and Sun

Quantity	Description	Quantity	Description
8	bags, plastic, reclosable*	9	rings, metal
8	balls, foam, large	8	ropes, 2 m
8	balls, foam, small	1	string, 75 m
8	batteries*	33	Sundial Model Sheets*
8	chalk, large, blue	1	tape, masking*
8	chalk, large, yellow	1	thread
1	chart, Class Sunrise/ Sunset Data†	1	toothpicks, p/250*
24	clay, modeling, 0.25 lb*	9	tubes, cardboard
1	cloth, yellow, 1.25 m × 1.25 m (for Sun model)	1	Teacher's Guide
8	compasses, directional	8	Delta Science Readers
1	Delta Science Dictionary	TEACHER-PROVIDED ITEMS	
1	Delta Science Dictionary Copymaster Booklet	10	compasses, drawing
9	dowels, wooden, 60-cm	–	markers
2	extension cords	10	paper, scrap*
8	globe bases	8	pencils
1	globe, inflatable	10	rulers, metric
8	globes	10	scissors
8	golf tees	–	sheets, to cover windows (optional)
1	iron filings	1	watch or clock
1	labels, adhesive, p/100*		
1	labels, names of planets		
2	light bulbs		
2	light sources		
8	magnets, ring		
8	marbles		
8	measuring tapes		
1	paper clips, p/100		
2	paper, construction, p/50*		
8	penlights		
8	petri dishes		
4	photos, Earth from Moon		
4	photos, Moon from Earth		
1	poster, Building Science Vocabulary		
1	poster, Earth from Space		
1	poster, Measurement		
1	poster, Moon Map		
1	poster, Science Safety		
1	poster, Solar System†		
16	push pins		

* = consumable item

† = in separate box

ACTIVITY SUMMARY

In this Delta Science Module, students investigate the properties of, and the relationships among, the Earth, Moon, and Sun within our solar system.

By reproducing the motion of celestial bodies with physical models—including themselves—students explore how our view of the solar system is affected by our earthly perspective. They also see how the bodies interact with one another and influence conditions on Earth. The Sun, because of its sheer size and power, dominates the sky from our perspective on Earth. The Moon, because of its proximity, has a much greater influence on us than do other celestial bodies.

ACTIVITIES 1 and 2 Students learn to gather and analyze data on the Sun and Moon through actual observation, as real astronomers do. They watch the length of days change, the phases of the Moon progress, and the positions of the Sun and the Moon shift relative to the horizon. These daily observations keep the students in touch with the real sky throughout the module and help them to develop their skills in data gathering.

ACTIVITY 3 Students create two- and three-dimensional models to overcome common misconceptions concerning the size of, and distance between, objects in our solar system. In the study of astronomy, the size and distance of objects is difficult for students to grasp. In this activity, students discover the enormous size of the Sun relative to the planets.

ACTIVITY 4 Students expand their solar system model to the playground, where they experience how close Mercury must be to the Sun in order for Pluto even to fall on school grounds.

ACTIVITY 5 Students calculate the Moon's volume relative to Earth's volume and compare its distance from Earth with that of artificial

satellites. Once students have experienced the actual scale of these objects, they can better understand the interactions that influence our experiences on Earth.

ACTIVITY 6 Students “return” to the surface of Earth and begin to make the connection between our earthly view of the Sun's daily motions and how those observations are actually pieces of the larger celestial picture. They rectify a globe, which allows them to see how the Sun is striking any place on Earth at the current moment.

ACTIVITY 7 Students set up sundials and track the apparent motion of the Sun across the sky during the course of a day.

ACTIVITIES 8 through 11 Students synthesize the two perspectives explored in previous activities—celestial motion and events on Earth. Through questions and modeling, the students learn how common events such as day and night, the phases of the Moon, and the changing of the seasons all can be explained by the positions and motions of the Earth, Moon, and Sun.

ACTIVITY 12 Students simulate the attractive force of the Moon and learn how it affects Earth and its oceans to create tides.

ACTIVITY 13 Students determine the course of two historic voyages using data from simulated ships' logs.

Throughout the module, students model, discover, and apply knowledge of the Earth, Moon, and Sun. Through their experiences, they come to appreciate humankind's most clever applications of knowledge accumulated through centuries of sky-gazing and decades of space exploration.