I. ABSTRACT
This unit is an interactive, experiential approach to learning astronomy as detailed in the Core Knowledge Sequence. It looks at astronomy, as it was understood in the past, how we study it today, and how it might look in the future. Students will participate in activities and experiments that are designed to help them understand the workings of our universe. This unit with all appendices included is also available at www.ckcolorado.org.

II. OVERVIEW
A. Concept Objectives
1. Students will analyze different objects in space and their interaction with each other.
2. Students will understand that order exists in the relationship and interaction between objects in space.
3. Students will recognize that our knowledge of space has changed over time and will continue to change in the future.

B. Content from the Core Knowledge Sequence
1. The “Big Bang” (p. 83)
2. The Universe: an extent almost beyond imagining (p. 83)
3. Galaxies: Milky Way and Andromeda (p. 83)
4. Our solar system (p. 83)
   a. Sun: source of energy (heat and light)
   b. The nine planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto
5. Planetary motion: orbit and rotation (p. 83)
   a. How day and night on earth are caused by the earth’s rotation
   b. Sunrise in the east and sunset in the west
   c. How the seasons are caused by the earth’s orbit around the sun, tilt of the earth’s axis
6. Gravity, gravitational pull (p. 83)
   a. Gravitational pull of the moon (and to a lesser degree, the sun) causes the ocean tides on earth
   b. Gravitational pull of “black holes” prevents even light from escaping
7. Asteroids, meteors (“shooting stars”), comets, Halley’s Comet (p. 83)
8. How an eclipse happens (p. 83)
9. Stars and constellations (p. 83)
10. Orienteering (finding your way) by using the North Star, Big Dipper (p. 83)
11. Exploration of space (p. 83)
   a. Observation through telescopes
   b. Rockets and satellites: from unmanned to manned space flight
   c. Apollo 11, first landing on the moon: “One small step for man, one giant leap for mankind.”
   d. Space shuttle
12. Science biography: Copernicus (p. 83)
C. Skill Objectives
1. Students will understand that patterns of organization provide useful ways of interpreting the world. (Jefferson County Standards Science Strand 1.1)
2. Students will understand that most things are in the process of change and that there are patterns to those changes. (Jefferson County Standards Science Strand 1.2)
3. Students will seek answers by making careful observations and trying things out. (Jefferson County Standards Science Strand 2.1.B)
4. Students will make predictions based on their experiences. (Jefferson County Standards Science Strand 2.1.C)
5. Students will follow written directions. (Jefferson County Standards Science Strand 2.1.D)
6. Students will describe and compare things using such characteristics as shape, color, size, texture, weight, numbers and motion. (Jefferson County Standards Science Strand 2.1.E)
7. Students will use charts with appropriate labels to record and organize data. (Jefferson County Standards Science Strand 2.1.F)
8. Students will explain procedures or ideas in a variety of ways, such as sketching and labeling. (Jefferson County Standards Science Strand 2.2.A)
9. Students will be able to explain that tools are used to do things better. (Jefferson County Standards Science Strand 3.1.A)
10. Students will give examples of tools and technologies that are used in particular careers or occupations. (Jefferson County Standards Science Strand 3.2.E)
11. Students will recognize that the sun is a principal source of the Earth’s energy. (Jefferson County Standards Science Strand 4.2.A and 5.2.A)
12. Students will describe what can be observed in the daytime and nighttime sky. (Jefferson County Standards Science Strand 4.4.A)
13. Students will explain the motion of the Earth in relation to the sun. (Jefferson County Standards Science Strand 4.4.B)
14. Students will recognize the basic components of the Solar System. (Jefferson County Standards Science Strand 4.4.C)
15. Students will describe and explain the significance of achievements of scientists. (Jefferson County Standards History Strand 4.1.B)

III. BACKGROUND KNOWLEDGE
A. For Teachers

B. For Students
1. Seasons (Kindergarten and 2nd Grade)
2. Sun: source of energy, light, heat (1st Grade)
3. The nine planets (1st Grade)
4. Stars (1st Grade)
5. Earth and its place in the solar system (1st Grade)
IV. RESOURCES
A. *The Universe: Think Big* by Jeanne Bendick (book for Lesson One)
B. *A True Book: Galaxies* by Paul P. Sipiera (book for Lesson Two)
C. *Galaxies* by Seymour Simon (book for Lesson Two)
D. *What Your Third Grader Needs to Know (Revised Edition)* (Varied Lessons)
E. *A True Book: Black Holes* by Paul P. Sipiera (book for Lesson Five)
F. *A True Book: Stars* by Paul P. Sipiera (book for Lesson Six)
G. *A True Book: Constellations* by Paul P. Sipiera (book for Lesson Six)
H. *Comets, Meteors, and Asteroids* by Seymour Simon (book for Lesson Eight)

V. LESSONS
Lesson One: The Universe: Let’s Start off with a Bang (60-80 minutes)
A. Daily Objectives
1. Concept Objectives
   a. Students will analyze different objects in space and their interaction with each other.
   b. Students will understand that order exists in the relationship and interaction between objects in space.
   c. Students will recognize that our knowledge of space has changed over time and will continue to change in the future.
2. Lesson Content
   a. The universe: an extent almost beyond imagining
   b. The “Big Bang”
3. Skill Objective
   a. Students will understand that most things are in the process of change and that there are patterns to those changes. (Jefferson County Standards Science Strand 1.2)

B. Materials
1. *The Universe: Think Big* by Jeanne Bendick
2. Appendix A: Leaping Light Years (one copy per student)
3. Cut out stars (two stars for each student)
4. Jar
5. Small beads (enough to fill the jar)
6. Newspapers
7. Black construction paper
8. White, yellow or glow in the dark paint

C. Key Vocabulary
1. Universe - everything in space and the space in between those things
2. “Big Bang” - a theory that states that all material in the universe was packed into a dense ball; something caused it to explode; this explosion sent chunks of matter into space; eventually, this matter became stars, planets and everything else in our universe
3. Light year - the distance light travels in one year, about 6 trillion miles

D. Procedures/Activities
1. Give each child two stars. Have them write one thing they already know about astronomy on one of the stars. On the other star, have them write one thing that they hope to learn. Collect the stars and display them in the classroom.
2. Fill a jar with small beads the night before lesson one. Have the students estimate how many beads are in the jar. Give the child with the closest estimate a small prize.
3. Have a discussion with the students estimating how many miles from one end of the universe to another. Discuss how many stars might be in the universe.
4. Pass out Appendix A: Leaping Light Years.
5. Brainstorm answers together accepting all reasonable responses. Ask questions to get them thinking about why we don’t measure distances between cities in inches and length of a paper clip in miles.
6. Introduce the idea of a light year being used to measure distances in space because miles are not big enough to cover the distances that occur in outer space. Light travels at about 186,000 miles per second. A light year is the distance light travels in one year, about six trillion miles. Write 6,000,000,000,000 on the board. Discuss the advantages of using light years over miles when measuring distances in space.
7. Tell the class that we do not know how large the universe is, or how many stars it contains, but scientists believe there is no beginning or end to the universe. Also, scientists believe that the universe is continuing to expand and grow larger. Even light years are not large enough to measure all distances in the universe; the universe is simply too big.
8. Read *The Universe: Think Big* or out loud to the class.
9. Demonstrate the “Big Bang” by opening the jar of beads and “bang” the bottom, sending beads in all directions. Have the students look for clusters of beads throughout the room. (We will identify these as galaxies tomorrow.)
10. Have the students go on a “galactic garbage” trip through the classroom picking up all the beads.
11. Make a splatter painting of a portion of the universe. Cover a large area of the room with newspaper. Have one or two students at a time fill a paintbrush with paint. Then they need to hold the brush over the paper and gently “bang” the handle of the brush. This works well with white, yellow and/or glow in the dark paint on black. Let paintings dry overnight and use them in Lesson Two.

**E. Assessment/Evaluation**

1. Ask comprehension questions to check understanding:
   a. What special unit of measurement is used to measure distances in space?
   b. Explain why we use light years instead of miles to measure distances in space.
   c. What theory explains that a big explosion created the universe?
   d. What is the universe?

**Lesson Two: Glittering Galaxies (60-80 minutes)**

**A. Daily Objectives**

1. Concept Objectives
   a. Students will analyze different objects in space and their interaction with each other.
   b. Students will understand that order exists in the relationship and interaction between objects in space.
   c. Students will recognize that our knowledge of space has changed over time and will continue to change in the future.

2. Lesson Content
   a. Galaxies: Milky Way and Andromeda

3. Skill Objectives
   a. Students will understand that patterns of organization provide useful ways of interpreting the world. (Jefferson County Standards Science Strand 1.1)
b. Students will describe and compare things using characteristics such as shape, size and motion. (Jefferson County Standards Science Strand 2.1.E)

B. Materials
1. *A True Book: Galaxies* by Paul P. Sipiera
2. *Galaxies* by Seymour Simon or other pictures of galaxies
3. *What Your Third Grader Needs to Know (Revised Edition)*
4. Splatter Paintings from Lesson One
5. Glass bowl
6. Water
7. Small metallic confetti (stars or circles)
8. Appendix B: Our Place in the Galaxy (made into an overhead)
9. Appendix C: Our Place in the Neighboring Galaxies (made into an overhead)
10. Black construction paper
11. White or yellow crayons

C. Key Vocabulary
1. Galaxy - a group of stars attracted to each other by gravity
2. Milky Way - the galaxy we live in
3. Andromeda - one of our neighboring galaxies
4. Spiral galaxy - a galaxy with a central bulge and arms of stars that curve outwards from the center

D. Procedures/Activities
1. Remind the class of yesterday’s bead explosion. Ask if there were any groupings of beads. Take a few of yesterday’s splatter paintings. Look for groupings of paint splatters. Tell the class that the universe is filled with large groups of stars and other space objects known as galaxies.
2. Fill a glass bowl with water. Sprinkle the star confetti into the bowl gently. Look for clumps of stars. Ask the class what we call the clumps of stars in the universe.
3. Read *A True Book: Galaxies* by Paul P. Sipiera or pp. 320-321 in *What Your Third Grader Needs to Know (Revised Edition).*
4. Discuss our galaxy, the Milky Way. If you look into the sky on a clear night, you might see a stripe of white running through the sky. Ancient people thought it was a road and named it the Milky Way, or milky road. It is part of the galaxy we live in within the universe.
5. Show Appendix B: Our place in the Milky Way on an overhead.
6. Tell the class that our galaxy is a spiral shaped galaxy and define spiral galaxy for them.
7. Show Appendix C: Our place with the Neighboring Galaxies on an overhead.
8. Discuss the Andromeda galaxy. It is one of our neighboring galaxies and can be seen with a telescope. It is 2 million light years away. Ask how long it would take us to get there. Two million light years would be 12 trillion miles away. If we traveled at 1,000 miles per hour the whole way, it would take 12 billion hours to get there. That would be 500 million days or about one and a half million years. Ask if it would be possible for one person to travel there in their lifetime.
9. Show pictures of various galaxies using *Galaxies* by Seymour Simon, other books, or the Internet
10. Have the students design a spiral galaxy using crayons on black paper. Tell them to make the center thicker and denser than the spiraling arms.
11. Optional: Have the students name their galaxy and create a myth or legend explaining how it got into the sky.
E. Assessment/Evaluation
1. Review comprehension questions from Lesson One.
2. Ask the following comprehension questions:
   a. What is a galaxy?
   b. What galaxy do we live in?
   c. Name one of our neighboring galaxies.
   d. How would you distinguish a spiral galaxy from an elliptical galaxy?

Lesson Three: Steppin’ Through Our Solar System (60-80 minutes)
A. Daily Objectives
   1. Concept Objectives
      a. Students will analyze different objects in space and their interaction with each other.
      b. Students will understand that order exists in the relationship and interaction between objects in space.
   2. Lesson Content
      a. Our Solar System
      b. Sun: source of energy (heat and light)
      c. The nine planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Neptune, Pluto
   3. Skill Objectives
      a. Students will understand that patterns of organization provide useful ways of interpreting the world. (Jefferson County Standards Science Strand 1.1)
      b. Students will describe and compare things using such characteristics as shape, color, size, texture, weight, numbers and motion. (Jefferson County Science Standards Science Strand 2.1.E)
      c. Students will recognize that the sun is a principal source of the Earth’s energy. (Jefferson County Standards Science Strand 4.2.A and 5.2.A)
      d. Students will recognize the basic components of the solar system. (Jefferson County Standards Science Strand 4.4.C)

B. Materials
   1. Appendix D: Solar System Walk (one copy for teacher)
   2. Appendix E: Solar System Quiz (one copy per student)
   3. Basketball
   4. Two grains of rice
   5. Two whole cloves
   6. One cherry
   7. One blueberry
   8. Two kernels of corn
   9. One grain/speck of coarsely ground black pepper

C. Key Vocabulary
   1. Solar System - the sun, its nine planets, their moons, the asteroids and comets
   2. Sun - our own star which the planets, asteroids and comets all orbit
   3. Planet - a round rocky or gaseous body which orbits a star
   4. Energy - waves of heat or light given out by an object

D. Procedures/Activities
   1. Ask the class to tell you how the Sun helps us. Be sure that the discussion covers the fact that the Sun gives us energy, the heat and light we need to live.
   2. Ask the class if they can define solar system. If they are not specific enough, give the definition.
3. Ask the class how many planets are in our solar system. Be sure they come to the conclusion that there are nine planets. Some astronomers are considering a tenth planet, but there has not been a conclusive decision about including it as a tenth planet.

4. Take a “Solar System Walk” using Appendix D. The walk will take 30-45 minutes. Give the class the facts for each planet as you mark the spot to represent their distance from the sun.

5. Ask comprehension questions such as the following:
   a. What would happen if we lived on Venus where the average temperature is over 800°F?
   b. Why can’t we live on Jupiter?
   c. Why can’t we live on Pluto?
   d. What other planets could support human life?
   e. Why is Earth the only planet that is able to support life?


E. **Assessment/Evaluation**
   1. Appendix E: Solar System Quiz

**Lesson Four: Whirling and Twirling in the Solar System (60-80 minutes)**

A. **Daily Objectives**
   1. **Concept Objectives**
      a. Students will analyze different objects in space and their interaction with each other.
      b. Students will understand that order exists in the relationship and interaction between objects in space.
      c. Students will recognize that our knowledge of space has changed over time and will continue to change in the future.
   2. **Lesson Content**
      a. Planetary motion: orbit and rotation
      b. How day and night on Earth are caused by the earth’s rotation
      c. Sunrise in the east and sunset in the west
      d. How the seasons are caused by the earth’s orbit around the sun, tilt of the Earth’s axis
      e. Science biographies: Copernicus
   3. **Skill Objectives**
      a. Students will understand that patterns of organization provide useful ways of interpreting the world. (Jefferson County Standards Science Strand 1.1)
      b. Students will make predictions based on their experience. (Jefferson County Standards Science Strand 2.1.C)
      c. Students will use charts with appropriate labels to record and organize data. (Jefferson County Standards Science Strand 2.1.F)
      d. Students will explain procedures or ideas in a variety of ways, such as sketching and labeling. (Jefferson County Standards Science Strand 2.2.A)
      e. Students will be able to explain that tools are used to do things better. (Jefferson County Standards Science Strand 3.1.A)
      f. Students will explain the motion of the Earth in relation to the sun. (Jefferson County Standards Science Strand 4.4.B)
      g. Students will describe and explain the significance of achievements of scientists. (Jefferson County Standards History Strand 4.1.B)
B. Materials
1. Appendix F: Rotations and Revolutions (one copy for teacher)
2. Appendix G: Ptolemy’s Universe (one overhead)
3. Appendix H: Copernicus: A Radical Thinker (one copy per student)
4. Appendix I: Copernicus’ Universe (one overhead)
5. Appendix J: An Updated Look (one overhead)
6. Globe
7. Lamp with the shade removed
8. Ball smaller than the globe to represent the moon
9. White construction paper (one 12” X 18” piece per student)

C. Key Vocabulary
1. Orbit - a planet’s path around the sun
2. Rotation - the time it takes a planet or other object to spin on its axis once
3. Revolution - the time it takes a planet or other object to orbit the sun
4. Axis - a straight line around which a body orbits
5. Elliptical - oval shaped

D. Procedures/Activities
1. Ask the students to explain why we have day and night and seasons. Remind them of learning about the seasons in second grade.
2. Use Appendix F: Rotations and Revolutions for a class demonstration.
3. Ask the students if they remember the myth of Demeter and Persephone from second grade. Ask them to sum up how seasons occur according to this myth. Ask them if that is the real reason we have seasons.
4. Introduce the idea that people’s beliefs about the universe have changed over time. Show overhead of Appendix G: Ptolemy’s Universe. Explain that for hundreds of years people believed Ptolemy’s idea that the Earth was the center of the universe and everything revolved around it.
6. Read the paragraph together as a class. (If you use Step Up to Writing, this paragraph can be color coded to reinforce writing concepts).
7. Show overhead of Appendix I: Copernicus’ Universe.
8. Discuss how modern science has proved that Copernicus’ ideas were correct. However, with modern telescopes we have expanded on Copernicus’ idea. We now know that the planets do not travel around the sun in perfect circles, but in elliptical orbits.
10. Ask the students if they think our understanding of how the solar system works will continue to change.
11. Have the class sketch and label the three views of the universe on 12” X 18” paper that is divided into three sections.

E. Assessment/Evaluation
1. Review with a few questions from Lessons One and Two.
2. Ask comprehension questions orally:
   a. What is the Solar System?
   b. How many planets are in our Solar System?
   c. What is an orbit?
   d. What is a rotation?
   e. What is a revolution?
   f. How did Ptolemy see the universe?
   g. How did Copernicus see the universe differently?
   h. How do we see the universe differently today?
i. How do day and night occur?

j. How do the seasons occur?

k. Where does the sun rise?

l. Where does the sun set?

Lesson Five: Gravity: It’s What Keeps Us Together (60-80 minutes)

A. Daily Objectives

1. Concept Objectives
   a. Students will analyze different objects in space and their interactions with each other.
   b. Students will understand that order exists in the relationship and interactions between objects in space.

2. Lesson Content
   a. Gravity, gravitational pull
   b. Gravitational pull of the moon (and to a lesser degree, the sun) causes ocean tides on Earth
   c. Gravitational pull of “black holes” prevents even light from escaping

3. Skill Objectives
   a. Students will understand that most things are in the process of change and that there are patterns to those changes. (Jefferson County Standards Science Strand 1.2)
   b. Students will seek answers by making careful observations and trying things out. (Jefferson County Standards Science Strand 2.1.B)
   c. Students will make predictions based on their experiences. (Jefferson County Standards Science Strand 2.1.C)
   d. Students will follow written directions. (Jefferson County Standards Science Strand 2.1.D)

B. Materials

1. Appendix K: Falling, Falling, Falling (one copy per student)
2. Appendix L: Pulling, Pulling, Pulling (one copy for teacher)
3. Appendix M: Groovy Gravity Game (one copy for teacher)
4. Apples, oranges, grapes, raisins, peanuts (one of each for every group of 4 students)
5. Tarp or plastic tablecloth
6. Globe
7. Stairs
8. A True Book: Black Holes by Paul P. Sipiera
9. What Your Third Grader Needs to Know (Revised Edition)
10. Vacuum with hose attachment
11. Thin, black cloth
12. Confetti from Lesson Two

C. Key Vocabulary

1. Gravity - the pull one object has on another
2. Black holes - an invisible object with enough gravity to pull in and destroy anything near to it
3. Tides - the rise and fall of the surface of the ocean

D. Procedures/Activities

1. Hold up a globe. Ask the class if the people in Australia will fall off the globe. Ask them to explain why or why not. If no one volunteers gravity as the answer, ask if they know what gravity is. Give the definition.
2. Go to a place in your school with stairs. Have each student jump onto the first stair and off of the first stair. Discuss which was more difficult. Explain that gravity makes jumping down easier and jumping up more difficult.

3. Use Appendix K: Falling, Falling, Falling to conduct an experiment about gravity.

4. Read pp. 5-29 in *A New Book: Black Holes* by Paul P. Sipiera.

5. Read pp. 328-329 in *What Your Third Grader Needs to Know (Revised Edition).*

6. Use Appendix L: Pulling, Pulling, Pulling to demonstrate how scientists believe a black hole works.

E. Assessment/Evaluation

1. Appendix M: Groovy Gravity Game

**Lesson Six: Stars and Constellations (60-80 minutes)**

A. Daily Objectives

1. Concept Objectives
   a. Students will analyze different objects in space and their interaction with each other.
   b. Students will understand that order exists in the relationship and interaction between objects in space.
   c. Students will recognize that our knowledge of space has changed over time and will continue to change in the future.

2. Lesson Content
   a. Stars and constellations
   b. “The Hunting of the Great Bear” (an Iroquois legend)

3. Skill Objectives
   a. Students will understand that patterns of organization provide useful ways of interpreting the world. (Jefferson County Standards Science Strand 1.1)
   b. Students will describe and compare things using characteristics such as shape, size and numbers. (Jefferson County Standards Science Strand 2.1.E)
   c. Students will describe what can be observed in the daytime and nighttime sky. (Jefferson County Standards Science Strand 4.4.A)

B. Materials

1. *What Your Third Grader Needs to Know (Revised Edition)*
2. *A True Book: Stars* by Paul P. Sipiera
3. *A True Book: Constellations* by Paul P. Sipiera
4. Appendix N: A Star is Born (one copy per pair of students with sentences cut apart and scrambled ahead of time)
5. Appendix O: We Go Together (one copy made into an overhead)
6. Cereal boxes (one per student)

C. Key Vocabulary

1. Star - a hot, glowing ball of gases
2. Constellation - a grouping of stars that forms a picture

D. Procedures/Activities

1. Be sure you have enough cereal boxes for all students to use for their constellations.
2. Read “The Hunting of the Great Bear” (an Iroquois legend) to the class. It is on pp. 29-31 in *What Your Third Grader Needs to Know Revised Edition.*
3. Discuss how myths were used to explain nature.
4. Pass out sentence strips to pairs of students from Appendix N: A Star is Born.
5. Have students put the strips in the order they think is best. Let them know they will have a chance to change the order after you read the book.
6. Read pp. 5-8 and 16-36 in *A True Book: Stars* by Paul P. Sipiera.
7. Let students make corrections to their sentence strip order.
8. Check the correct order as a class.
9. Read pp. 5-16 in *A True Book: Constellations* by Paul P. Sipiera
10. Check to see if students can define “star” and “constellation.”
11. Show overhead of Appendix O: We Go Together.
12. Students copy one of the constellations onto the bottom of a cereal box. Tell them to be sure to leave enough space between the dots. Students poke their pencil or pen through each dot.
13. Take flashlights and cereal box constellations to a dark room. Shine the flashlight into the box, projecting the constellation onto the ceiling and have the class “Name that constellation!”
14. Optional activity for language arts time: Create your own constellation and write a story explaining how it got into the sky.

E. Assessment/Evaluation
1. Review with a few questions from previous lessons.
2. Ask comprehension questions:
   a. What is a star?
   b. What is a constellation?
   c. What is gravity?
   d. What is a black hole?
   e. What do you think would happen if you were close to a black hole?
   f. What is the relationship between the ocean tides on Earth and the gravity on the moon?

Lesson Seven: Finding Your Way in the World (60-80 minutes)

A. Daily Objectives
1. Concept Objectives
   a. Students will analyze different objects in space and their interaction with each other.
   b. Students will understand that order exists in the relationship and interaction between objects in space.
   c. Students will recognize that our knowledge of space has changed over time and will continue to change into the future.

2. Lesson Content
   a. Orienteering by using the North Star and the Big Dipper

3. Skill Objectives
   a. Students will understand that patterns of organization provide useful ways of interpreting the world. (Jefferson County Standards Science Strand 1.1)
   b. Students will follow written directions. (Jefferson County Standards Science Strand 2.1.D)
   c. Students will explain that tools are used to do things better, faster, or more easily. (Jefferson County Standards Science Strand 3.1.A)

B. Materials
1. Appendix P: Long Ago (one copy per student)
2. Piece of black butcher paper with the North Star drawn or painted in the center and the Big Dipper drawn or painted pointing towards it
3. Parachute (if possible) with the black butcher paper attached
C. **Key Vocabulary**
   1. Orienteering - finding your way
   2. North Star - a fixed star that can be used to locate geographic north
   3. Big Dipper - a constellation shaped like a large spoon

D. **Procedures/Activities**
   1. Review with the class the idea of exploration. You can use Christopher Columbus or Lewis and Clark from previous grades or the explorers from the third grade content if you have already covered them. Discuss how they traveled and how they found their way. Mention that many of them lived before compasses.
   2. Read Appendix P: Long Ago and ask comprehension questions.
   3. Draw the diagram of the Big Dipper and the North Star on the board.
   4. Take the parachute, or black paper, to an area large enough for children to lay on their backs. Have some children lay on their backs looking up. Have other children walk slowly in a circle to “rotate” the Big Dipper. Explain that this is how the Big Dipper and the North Star seem to move throughout the year.
   5. Review lesson four’s content about the sun rising in the east and setting in the west.
   6. Ask the students how this method could help somebody determine direction.

E. **Assessment/Evaluation**
   1. Review with questions from previous lessons.
   2. Ask comprehension questions:
      a. What is orienteering?
      b. How did explorers find their way before compasses were invented?
      c. What constellation points to the North Star, helping travelers find out which way is north?

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**Lesson Eight: It’s a Bird, It’s a Plane, It’s a Shooting Star (60-80 minutes)**

A. **Daily Objectives**
   1. Concept Objectives
      a. Students will analyze different objects in space and their interaction with each other.
      b. Students will understand that order exists in the relationship between objects in space.
      c. Student will recognize that our knowledge of space has changed over time and will continue to change.
   2. Lesson Content
      a. Asteroids, meteors (“shooting stars”), and comets, Halley’s Comet
      b. Produce a variety of types of writing- poetry
   3. Skill Objectives
      a. Students will recognize the basic components of the Solar System. (Jefferson County Standards Science Strand 4.4.C)
      b. Students will make predictions based on their experiences. (Jefferson County Standards Science Strand 2.1.C) 
      c. Students will follow written directions. (Jefferson County Standards Science Strand 2.1.D)
      d. Students will describe and compare things using shape and size. (Jefferson County Standards Science Strand 2.1.E.)
      e. Students will use charts with appropriate labels to record information. (Jefferson County Standards Science Strand 2.1.F)
B. Materials
1. *Comets, Meteors, and Asteroids* by Seymour Simon
2. Construction paper (three 9” X 12” pieces per child)
3. Tissue paper
4. Appendix Q: Poetry Potpourri (one copy for teacher)
5. Appendix R: Poetry Rubric (one rubric is needed for each student)
6. Appendix S: Incoming! (one copy per student)
7. Cake pan
8. Flour
9. Golf ball
10. Ping pong ball
11. Ruler

C. Key Vocabulary
1. Asteroid - the largest space rocks
2. Meteor - small bits of rock that enter the earth’s atmosphere (sometimes called “shooting stars”)
3. Meteorite - a meteor that reaches the surface of the earth
4. Comet - a chunk of ice, dust, and rock which orbits the sun and often has a tail behind it

D. Procedures/Activities
1. Ask if anyone has ever seen a shooting star. Ask if anyone knows what a shooting star really is.
2. Read *Comets, Meteors, and Asteroids* by Seymour Simon.
3. Write the definition for the vocabulary words on the board.
4. Have the class brainstorm facts about each space object based on the reading. Write them on the board.
5. Have each student design an asteroid, a meteor and a comet using construction paper. Use the tissue paper for the comet’s tail.
6. Have each student write a different kind of poem on each object. The poem must include at least three facts about the object. Use Appendix Q: Poetry Potpourri for ideas on different kinds of poems.
7. While students are working on their poems, use Appendix S: Incoming! to have small groups conduct an experiment about meteorites and the craters they create.

E. Assessment/Evaluation
1. Use Appendix R: Poetry Rubric to evaluate poems.

Lesson Nine: Eclipses: Who Turned Out the Lights? (60-80 minutes)

A. Daily Objectives
1. Concept Objectives
   a. Students will analyze different objects in space and their interactions with each other.
   b. Students will understand that order exists in the relationship and interaction between objects in space.
   c. Students will recognize that our knowledge of space has changed over time and will continue to change.
2. Lesson Content
   a. How an eclipse happens
3. Skill Objectives
   a. Students will understand that most things are in the process of change and that there are patterns to those changes. (Jefferson County Standards Science Strand 1.2)
b. Students will seek answers by making careful observations and trying things out. (Jefferson County Standards Science Strand 2.1.B)

c. Students will explain procedures in a variety of ways, such as sketching and labeling. (Jefferson County Standards Science Strand 2.2.A)

B. Materials
1. Appendix T: Darkness in Daytime (one copy per student)
2. Appendix U: Make Your Own Eclipse (one copy per student)
3. What Your Third Grader Needs to Know (Revised Edition)
4. One circle with a 12 inch diameter for each group of four students
5. One circle with a 4 inch diameter for each group of four students
6. One flashlights for each group of four students
7. 9” X 12” white construction paper for each student

C. Key Vocabulary
1. Eclipse- when one body in space totally or partially blocks another body in space

D. Procedures/Activities
1. Pass out Appendix T: Darkness in the Daytime.
2. Read the stories of how ancient people explained eclipses.
3. Ask the students if any of these stories seem scientific.
5. Have students summarize the scientific explanation for an eclipse.
6. Use Appendix U: Make Your Own Eclipse to demonstrate how an eclipse occurs.
7. Have students work in groups to try to make their own eclipses.
8. Have students divide a 9” X 12” piece of white construction paper into four sections. Explain that the Sun should be the largest object and the moon should be the smallest object. Tell them they will have time to color their drawings at the end of the class period. Give the following directions with time to complete each sketch. In section one, draw the moon between the sun and the Earth, but do not have it causing an eclipse. In section two, draw the moon between the Sun and the Earth causing a solar eclipse. In section three, draw the Earth between the Sun and the moon, but do not have it causing an eclipse. In section four, draw the Earth between the Sun and the moon causing a lunar eclipse.

E. Assessment/Evaluation
1. Section one should show the moon between the Earth and sun, but not lined up exactly. Section two should show a solar eclipse, when the moon is directly between the sun and the Earth. They should draw a small circular shadow to represent the area affected by the eclipse. Section three should show the Earth between the Sun and the moon, but not lined up directly. Section four should show a lunar eclipse where the Earth blocks all light from hitting the moon.

Lesson Ten: Space: The Final Frontier (60-80 minutes)

A. Daily Objectives
1. Concept Objective
   a. Students will recognize that our knowledge of space has changed over time and will continue to change in the future.

2. Lesson Content
   a. Exploration of space
   b. Observation through telescopes
   c. Rockets and satellites: from unmanned to manned space flights
   d. Apollo 11, first landing on the moon: “One small step for man, one giant leap for mankind.”
3. **Skill Objectives**  
a. Students will see answers by making careful observations and trying things out. (Jefferson County Standards Science Strand 2.1.B)  
b. Students will explain that tools are used to do things better, faster, or more easily. (Jefferson County Standards Science Strand 3.1.A)  
c. Students will use tools to observe, measure, and make things. (Jefferson County Standards Science Strand 3.1.B)  
d. Students will give examples of tools and technologies that are used in particular careers or occupations. (Jefferson County Standards Science Strand 3.2.E)

B. **Materials**  
1. Appendix V: Space Travel Begins (one copy per student)  
2. Telescope (you can make a simple telescope by attaching magnifying glasses to both ends of a large cardboard tube)  
3. Paper towel tubes, two for each student  
4. Pictures of rockets from books or the internet

C. **Key Vocabulary**  
1. Astronomer - a person who studies the universe  
2. Mankind - the human race, or humans  
3. Rocket - a craft with a strong enough engine to escape Earth’s atmosphere and travel into space  
4. Manned - carrying a person  
5. Unmanned - not carrying a person  
6. Satellite - an object that orbits another object

D. **Procedures/Activities**  
1. Introduce the idea that space has always fascinated mankind. Ancient people created stories about the stars and other objects in space.  
2. Discuss how technology has made it possible to study space more closely. Review how use of telescopes to study the movement of the stars and planets helped confirm Copernicus’ theory about the sun being the center of the universe. A person whose job is an astronomer would use telescopes to do his work. He would learn more about the universe by using telescopes.  
3. Use a telescope to look at objects in the area. You can look at objects in a park, instead of objects in the sky, because it will be daylight.  
4. Go over the vocabulary from the lesson.  
5. Pass out and read Appendix V: Space Travel Begins. If you teach Step Up to Writing, you can color code these paragraphs as well.  
6. Have rocket races to test how design affects distance and speed of rockets. Give each student two paper towel tubes. Have them use one tube to design a rocket. They must attach pieces securely so their rocket doesn’t fall apart. If possible, show them pictures of rockets. Take the tubes and the rockets outside and have them throw the tube as far as they can. Have them then throw their rocket in the same direction, as far as they can. Did their rockets travel farther than the simple tube? If time permits, have the students do 3-5 trials with their rockets.  
7. Discuss what factors made some rockets fly farther than others. (strength of the thrower, how securely all parts were attached, what direction each student faced, etc.)  
8. Explain that the features and shape of the rockets help them to travel as quickly and accurately as possible.
E. **Assessment/Evaluation**
1. Use a few review questions from each previous lesson to assess understanding of the unit.
2. Ask comprehension questions:
   a. Who was the first man to walk on the moon?
   b. What did he say when he took his first step?
   c. How did space travel change over time?
   d. What tool helps us see objects in space more clearly?
   e. What is a satellite?
   f. What is a rocket?

**Lesson Eleven: Traveling to Space Again and Again (60-80 minutes)**

A. **Daily Objectives**
1. Concept Objective
   b. Students will recognize that our knowledge of space has changed over time and will continue to change.
2. Lesson Content
   a. Exploration of space
   c. Space shuttle
   d. Science biography: Mae Jemison
3. Skill Objective
   a. Students will give examples of tools and technologies that are used in particular careers or occupations. (Jefferson County Standards Science Strand 3.2.E)

B. **Materials**
1. Appendix W: Meet Mae Jemison (make copies for each reader and highlight the parts they will read)
2. *What Your Third Grader Needs to Know (Revised Edition)*
3. Pictures of the space shuttle from books or the Internet

C. **Key Vocabulary**
1. Space shuttle - a vehicle used for traveling to space, it can be used many times

D. **Procedures/Activities**
1. Review yesterday’s information about space travel. Explain that a rocket that could only be used once got very expensive. NASA (National Aeronautics and Space Administration) needed to find a vehicle that could travel to space over and over again. Ask if anyone knows what that vehicle is.
2. Show pictures of the space shuttle.
3. Discuss the similarities and differences between space shuttles and rockets.
4. Read about space shuttles on pp. 338 in *What Your Third Grader Needs to Know (Revised Edition)*.
5. Pass out Appendix W: Meet Mae Jemison.
6. Read Appendix W together.

E. **Assessment/Evaluation**
1. Have the students write a sequence of events in Mae Jemison’s life.
2. Oral review for the test. Use all previous questions and add the following:
   a. What is Mae Jemison known for?
   b. How is a space shuttle different than a rocket?

VI. **CULMINATING ACTIVITY**
A. Appendix X: Astronomy Assessment
B. Create a newscast. Some students create commercials for space travel, joining NASA, space food etc. Some students prepare weather reports for the planets. Some students compose an interview with someone we studied during the astronomy unit. Some students debate about the necessity of space travel. Some students report on various bodies found in space. Practice and perform for parents or another class.

VII. HANDOUTS/WORKSHEETS (available at www.ckcolorado.org)
A. Appendix A: Leaping Light Years
B. Appendix B: Our Place in the Galaxy
C. Appendix C: Our Place in the Neighboring Galaxies
D. Appendix D: Solar System Walk
E. Appendix E: Solar System Quiz
F. Appendix F: Rotations and Revolutions
G. Appendix G: Ptolemy’s Universe
H. Appendix H: Copernicus: A Radical Thinker
I. Appendix I: Copernicus’ Universe
J. Appendix J: An Updated Look
K. Appendix K: Falling, Falling, Falling
L. Appendix L: Pulling, Pulling, Pulling
M. Appendix M: Groovy Gravity Game
N. Appendix N: A Star is Born
O. Appendix O: We Go Together
P. Appendix P: Long Ago
Q. Appendix Q: Poetry Potpourri
R. Appendix R: Poetry Rubric
S. Appendix S: Incoming!
T. Appendix T: Darkness in the Daytime
U. Appendix U: Make Your Own Eclipse
V. Appendix V: Space Travel Begins
W. Appendix W: Meet Mae Jemison
X. Appendix X: Astronomy Assessment
Y. Appendix Y: Quiz and Assessment Grading Key

VIII. BIBLIOGRAPHY


Appendix E: Solar System Quiz

Name: __________________________  Date: ________________

Answer each of the following questions with the name of one of the planets. You may use the same planet for more than one answer.

1. _____________ is the closest planet to the sun.

2. Earth’s twin is ________________.

3. The Great Red Spot is found on ________________.

4. ________________ has two spots similar to the Great Red Spot.

5. The hottest planet is ________________.

6. We live on ________________.

7. ________________ is called the Red Planet because of the rust that covers the surface.

8. The largest mountain in the Solar System is on ________________.

9. ________________ spins on its side.

10. The smallest planet in the Solar System is ________________.

11. ________________ has thousands of ringlets surrounding it.

12. Uranus’ twin is ________________.
Appendix M
Groovy Gravity Game

• Have each student make a tic-tac-toe grid on a piece of paper.
• Have each student write nine of the following words, one in each space of their tic-tac-toe grid: gravity, tides, moon, black holes, Jupiter, Pluto, oceans, jumping up, jumping down, orbit.
• Tell the students that they need to try to cover two sets of three words in a row.
• Randomly choose one of the questions or clues below and read it out loud to the class.
• Students should cover or mark off the word that answers the question or completes the clue.
• Continue choosing questions and clues until a student wins.

Questions and Clues

• What do we call the force that pulls objects together?
• What do we call the rise and fall of the surface of the ocean?
• What object pulls on the ocean causing high tide and low tide?
• What invisible object in space has enough gravity to keep light from escaping?
• Which planet has a stronger gravitational pull than Earth?
• Which planet has a weaker gravitational pull than Earth?
• What geographic term describes the feature on Earth that is most affected by the moon's gravity?
• Which way of jumping is made easier by the pull of gravity?
• Which way of jumping is made more difficult by the pull of gravity?
• What do you call the path each planet makes around the sun as it is pulled by the sun's gravity?
## Appendix R
### Poetry Rubric

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<th>Unsatisfactory</th>
<th>Partially Proficient</th>
<th>Proficient</th>
<th>Advanced</th>
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<tr>
<td><strong>Poetry Forms</strong></td>
<td>Used no form for poems (0 points)</td>
<td>Used 1 different form for poems (2 points)</td>
<td>Used 2 different forms for poems (3 points)</td>
<td>Used 3 different forms for poems (4 points)</td>
</tr>
<tr>
<td><strong>Scientific Facts</strong></td>
<td>Poems include less than 1 fact about each object (0 points)</td>
<td>Poems include at least 1 fact about each object (2 points)</td>
<td>Poems include at least 2 facts about each object (3 points)</td>
<td>Poems include at least 3 facts about each object (4 points)</td>
</tr>
<tr>
<td><strong>Conventions</strong></td>
<td>Spelling errors in poems interfere with meaning. (0 points)</td>
<td>Poems have many spelling errors. (2 points)</td>
<td>Poems include a few spelling errors. (3 points)</td>
<td>Poems have no spelling errors. (4 points)</td>
</tr>
<tr>
<td><strong>Presentation</strong></td>
<td>Poems are sloppily written. (0 points)</td>
<td>Poems are fairly neatly written. (2 points)</td>
<td>Poems are neatly written. (3 points)</td>
<td>Poems are neatly written and have attractive details. (4 points)</td>
</tr>
<tr>
<td><strong>Total Points</strong></td>
<td></td>
<td></td>
<td></td>
<td>/12</td>
</tr>
</tbody>
</table>

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2003 Core Knowledge® National Conference, Our Universe: Always Moving, Always Changing, Grade 3
Appendix X
Astronomy Test

Name:________________________

Write correct letter on the blank.

___ 1. What is the name of our galaxy?
   a. Milky Way   b. Halley
   c. Andromeda   d. Pluto

___ 2. The sun gives us heat and __________.
   a. plants   b. animals
   c. sound   d. light

___ 3. We have one sun and nine _______ in our solar system.
   a. asteroids   b. comets
   c. planets   d. meteors

___ 4. The Earth is the _____ planet from the sun.
   a. first   b. third
   c. ninth   d. twentieth

___ 5. A galaxy close to our own.
   a. Halley   b. Copernicus
   c. Andromeda   d. Big Dipper

___ 6. The _____ is the center of our solar system.
   a. sun   b. moon
   c. asteroid belt   d. Earth

___ 7. One of the most famous comets is __________ Comet.
   a. Copernicus’   b. Halley’s
   c. Mae Jemison’s   d. Aristotle’s

___ 8. Chunks of rock that float in space.
   a. stars and planets   b. comets and stars
   c. comets and planets   d. meteors and asteroids
Appendix X, page 2
Astronomy Test

Write the letter to match each word and its definition and description.

9. stars  a. a collapsed star whose gravity is so strong even light cannot escape
10. comets  b. balls of dirty ice, rocks etc. that orbit the sun. They have a tail.
11. Mae Jemison  c. balls of hot, glowing gases
12. orbit  d. the first black woman in space
13. black holes  e. a tool used to see things in space more clearly
14. eclipse  f. a planet’s path around the sun
g. when the moon block the sun’s light to Earth for a short time
15. telescope

16. What was Copernicus’ discovery?

17. How are rockets and space shuttles different?

18. What did Neil Armstrong say when he took his first step onto the moon?

Match each word with its correct definition or description.

19. Apollo 11  a. to spin on an axis causing day and night
20. Big Bang  b. a huge group of stars that spins around a common center of gravity
21. galaxy  c. the largest space rocks
22. rotate  d. a theory that the universe started from an explosion
23. revolve  e. to travel around the sun
24. asteroids  f. the trip when man first walked on the moon
g. small space rocks that enter our atmosphere
Appendix X, page 3

Astronomy Test

Choose the correct answer for each question or statement.

___ 26. The force that pulls objects in the universe together.
   a. friction         b. gravity
   c. galaxy           d. rotation

___ 27. We often call these shooting stars.
   a. asteroids        b. comets
   c. meteors          d. planets

___ 28. A group of stars that make a picture.
   a. constellation    b. meteor shower
   c. rockets           d. satellites

___ 29. An object that orbits around the Earth.
   a. Jupiter           b. satellite
   c. asteroid          d. Sun

___ 30. Everything in space and the space between those things.
   a. galaxy            b. universe
   c. solar system       d. asteroid belt

Name the nine planets in order. They must be spelled correctly.

1.        6. 
2.        7. 
3.        8. 
4.        9. 
5.                             

Extra Credit: List facts about a planet on the back of this paper.
Appendix Y
Solar System Quiz Key and Astronomy Assessment Key

Quiz Key
1. Mercury 7. Mars
2. Venus 8. Mars
5. Venus 11. Saturn

Assessment Key
1. a. Milky Way 24. c. the largest space rocks
2. d. light 25. g. small rocks that enter...
3. c. planets 26. b. gravity
4. b. third 27. c. meteors
5. c. Andromeda 28. a. constellation
6. a. sun 29. b. satellite
7. b. Halley's 30. b. universe
8. d. meteors and asteroids
9. c. balls of hot, glowing gases
10. b. balls of dirty ice, rocks, etc.
11. d. the first black woman in space
12. f. a planet's path around the sun
13. a. a collapsed star...
14. g. when the moon block the sun
15. e. a tool used to see things...
16. That the sun is the center of the Solar System.
17. Rockets travel once and a space Shuttle can make many trips.
18. “One small step for man, one giant leap for mankind.”
19. f. the trip when man first walked...
20. d. the theory that the universe ...
21. b. a huge group of stars that spins...
22. a. to spin on an axis
23. e. to travel around the sun

Planets:
1. Mercury
2. Venus
3. Earth
4. Mars
5. Jupiter
6. Saturn
7. Uranus
8. Neptune
9. Pluto