STAR LIGHT, STAR BRIGHT

STAR DISCOVERY MODULE

STEPHANIE BIRCH AND JULIE MUNSON
EL CAMINO COLLEGE
JULY 2004

THIS MODULE WAS DEVELOPED AS PART OF THE SCIENCE FEST PROJECT
NATIONAL SCIENCE FOUNDATION #02-01981

TOPIC OF MODULE

This module will first focus on star formation. Then the children will discover the various constellations, discussing the history as well as focusing on those constellations that can be seen here in the northern hemisphere. Then we will identify the types of galaxies, as well as focusing on the Milky Way galaxy. Finally, we will explore the big bang theory and the origins of the universe.

GOAL OF MODULE

The goal of this module is to educate students about stars so that they will identify their properties, differentiate them from other objects in space and realize their importance to the origins of the universe.

TARGETED GRADE LEVEL

This module is designed for third grade students. This module can be adapted to the first through fifth grade levels.

OBJECTIVES

Students will be able to:

1 Identify the properties of stars
2 Describe how a star is formed
3 Identify various stars, including the sun
4 Determine why stars cannot be seen during the day
5 Explain why stars are different colors
6 Describe how stars shine
7 Draw the size of stars in relationship to the earth
8 Identify constellations in the night sky
9 Describe the history of constellations
10 Explain that stars in constellations are far apart
11 Identify the three types of galaxies
12 Determine the properties of the milky way galaxies
13 Explain where our solar system is situated in our galaxy
14 Describe the universe
15 Explain the big bang theory

TIME NEEDED

The expected timeline for this module is four days for one hour per day and will be presented as follows:

DAY	**TOPICS DISCUSSED**
1	What is a star? What star is closest to earth? How many stars can we see? Why can't we see stars in the day? What are the biggest and smallest stars? Why are there different colored stars? Which stars are the hottest and the coolest? How is a star formed? Why do stars shine?
2	What is a constellation? How many constellations are there? Why do we see different constellations during different times of the year? What constellations can be seen here in the northern hemisphere? Are stars in constellations close to one another or are they far apart? Who invented the constellations? Why did they use constellations? Why were myths created for the constellations?
3	What is a galaxy? How many stars are in galaxies? How big are galaxies What are the three kinds of galaxies? How many galaxies are there in the universe? How were galaxies formed? What is the name of our galaxy? What type of galaxy is our galaxy? Where is the sun and earth in our galaxy? When we look into the Milky Way, what do we see?
4	What is the universe? How big is the universe? When was the universe created? What is the big bang theory?

STANDARDS

For Grade 2

<u>Physical Science</u>

1. The motion of objects can be observed and measured.

a. the position of an object can be described by locating it relative to another object or the background. (Students learn the distance of stars by using earth as a starting point)

b. an objects' motion can be described by recording the change in its position over time. (Students learn that the earth is revolving around the sun because of the change in constellations)

<u>Investigation and Experimentation</u>

As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

d. write or draw descriptions of a sequence of steps, events and observations.

For Grade 3

<u>Physical Science</u>

1. Energy and matter have multiple forms and can be changed from one form to another.

b. sources of stored energy take many forms, such as food, fuel, and batteries. (Students learn that stars have energy.)

<u>Earth Science</u>

4. Objects in the sky move in regular and predictable patterns.

a. the patterns of stars stay the same, although they appear to move across the sky nightly, and different stars can be seen in different seasons. (One of main focuses for is module is explaining constellations in detail.)

For Grade 5

<u>Earth Science</u>

5. The solar system consists of planets and other bodies that orbit the sun in predictable paths.

a. the sun, an average star, is the central and largest body in the solar system and is composed primarily of hydrogen and helium. (Students are exposed to the construction of star on the first day of this module.)

CALIFORNIA SCIENCE CONTENT STANDARDS FOR GRADE

THREE:

NATIONAL SCIENCE EDUCATION STANDARDS:

PRE-REQUISITE SKILLS AND KNOWLEDGE

There are no pre-requisite skills or knowledge needed to successfully complete this module.

GLOSSARY

Star – A self-luminous celestial body consisting of a mass of gas held together by its own gravity in which the energy generated by nuclear reactions in the interior is balanced by the outflow of energy to the surface, and the inward-directed gravitational forces are balanced by the outward-directed gas and radiation pressures.

Solar system - The group of nine planets and other celestial bodies that are held by attraction and revolve around the sun.

Nebula – A diffuse mass of interstellar dust or gas or both, visible as luminous patches or areas of darkness depending on the way the mass absorbs or reflects incident radiation**.**

Hydrogen – A colorless, highly flammable gaseous element, the lightest of all gases.

Helium – A colorless, odorless inert gaseous element.

Gravity – The natural force of attraction exerted by a celestial body, such as Earth, tending to draw them toward the center of the body.

Protostar – A cloud of gas and dust in space believed to develop into a star

Constellation - Any of 88 arbitrary configurations of stars.

Myth – A usually traditional story of historical events that serves to unfold part of the world view of a people or explain a practice, belief, or natural phenomenon

Northern hemisphere – Half of the earth that lies north of the equator.

Southern hemisphere – Half of the earth that lies south of the equator

Galaxy – Any of the very large groups of stars and associated matter that are found throughout the universe.

Elliptical – Something that relates to, or is shaped like an ellipse or oval.

Universe – A huge wide-open space that holds everything from the smallest particle to the biggest galaxy.

CONTENT BACKGROUND

1. **What is a star? What are they made of? What is the nearest star to the Sun? How far is it? How far are the stars in the Big Dipper?**

A star is an astronomical object, which at some stage of its life undergoes thermonuclear reactions in its core. A star has a continuous battle with the unstoppable force of gravity. From the moment an interstellar cloud of gas and dust begins to collapse under its own gravitational forces, it is doomed to one day become a cold, dense, degenerate object like a white dwarf, neutron star, or possibly, if it's massive enough, even a black hole.

Stars are mostly comprised of hydrogen and helium. Hydrogen burns to helium, helium to lithium, and so on up the periodic table of elements, until the process comes to the end when iron is produced. Thus, a star consists of spherical shells around the center each of different chemical composition.

The star nearest to the Sun is Alpha Centauri, which is a triple star system, and is 4.3 light-years away. It is best seen in the southern hemisphere.

The distance to the main stars of the Big Dipper range from about 68 light-years to about 210 light-years. The stars of this or any constellation need not have any physical relationship to each other. They may be vast distances apart; we simply associate them because they happen to be the same general direction from our viewpoint.

* 88 LY

* 210 LY

* 68 LY

*　　　*　105 LY

90 LY　　*　　　*　78 LY

2. **What is the biggest star? What is the most powerful star? What is the smallest star?**

Betelgeuse in the constellation Orion is one of the largest known stars. It's a red super giant with a physical size that's 500 to 700 times that of the Sun. One of the most massive stars is Eta Carinae, with a mass of 200 Solar masses.

The Pistol Star is the most powerful star and could measure up to 279 million miles in diameter. It has 10 million times the energy of our Sun. It releases as much energy in 6 seconds as the Sun does in a year. It has a bright, pistol-shaped nebula. It is estimated to be 25,000 light years away from Earth, and is near the center of our Milky Way. Some astronomers doubt these findings, however, and feel it may not be a single star.

The white dwarf named L362-81 is the smallest star in size, with a diameter of only 3500 miles. The star with the smallest mass is RG 00.58.8-2807 with a mass of .0014 solar masses and is also known as the dimmest known star.

3. **How hot is the Sun? How hot is it inside?**

The surface of the Sun has a temperature of 5500° Celsius, with a central temperature of 15,000,000° Celsius.

4. **Why are stars hot?**

Stars are hot because of gravity. Gravity compresses and squeezes the gasses inside the star causing it to heat up.

5. **Why is the Sun so bright?**

Stars are bright because they are hot.

6. **What powers stars?**

Gravity is what powers stars. Although nuclear fusion adds energy to the core of a star, that does not serve to power it. In fact, it actually allows it to remain stable and prevent it from getting even hotter. Nuclear fusion acts as a sort of cooling system for the star. Gravity is the force that is powering stars. It is always trying to contract the star and heat it up. For example, without gravity, there would be no stars. Without nuclear fusion, there would still be stars, but they would live short lives.

7. **Are there double stars? Triples? Quadruples? How common are they?**

A binary star is a pair of stars in orbit around a common center of gravity under their mutual gravitational attraction. The individual stars are called components;

component “A” is the primary or brightest while component “B” is secondary or faintest.

There are three theories for the formation of binaries. The first is that two stars passing close enough so that one forces the other into a stable orbit. Second the gravitational coupling between two young stars that still had flattened disks of dust and gas surrounding them. And third, fragmentation, is when binary stars are born during a phase when dense molecular clouds collapse under their own gravity and become proto stars. The obscuring gas and dust clear away and a newly formed binary star emerges.

There are a surprising number of multiple star systems observed by astronomers. The latest findings say that 50% of all stars are binary, 10% are triple, and 30% are single stars. Quadruple star systems are less common, but do exist.

8. **Are there other planets around stars? How do we know?**

We think our own Solar System formed as a natural by-product of the formation of the Sun. About 5 billion years ago a huge amorphous cloud of gas and dust began to contract. The cloud collapsed under its own gravity, with most of the gas and dust falling to the center to form the Sun. The remaining material fell into a broad, flattened disk. Throughout the disk, dust grains orbiting the proto-Sun collided with one another, occasionally sticking together. Small clumps joined together to make larger ones, eventually forming the planets. This process of accumulation material is called accretion. According to this scenario, planets are a natural by-product of the formation of the Sun. Thus, astronomers think many stars like the Sun should have planets.

Because planets are small, appear to lie close to their parent star, and shine only by reflected starlight, the faint glimmer of a planet is lost in the brilliant glare from its parent star. Since most stars are so far away, there is little chance of seeing or photographing individual planets around other stars.

Although we cannot see the planet itself, we can see the effect of the gravitational tug the planet exerts on its parent star. As the planet revolves around the star, it pulls the star first one way, then the other. The more massive the planet, the more noticeable its effect on the star will be. Analysis of the wobble can give information about the planet’s mass, orbit, period and distance from the star.

Planets around other stars can be detected using the Doppler effect, and was first used to detect a planet orbiting the star 51 Pegasi.

9. **How many stars are there in the Milky Way?**

There are approximately 200 billion stars in the Milky Way galaxy.

10. **How old is the Sun? How do we know that?**

The Sun is approximately 4.5 billion years old. It is a medium sized star, and as such, will evolve the same as other medium sized stars. In the Sun's core, hydrogen is converted into helium. This process lasts around 10 billion years, so our Sun is roughly halfway through this process. The best estimate of the age of the sun comes from meteorites. All are approximately 4.5 billion years old. One way to explain the difference between million and billion is stating that one million seconds lasts 11 days, while one billion seconds last 31 years.

11. How will the Sun die? When will it die? What will happen to the Earth?

The core of our Sun will gradually shrink as the hydrogen nuclei are replaced by a smaller number of the heavier helium nuclei, and the internal temperature will rise. When the hydrogen in the core of the Sun is gone, the core gets smaller. The shell surrounding the core has reached high enough temperatures for hydrogen to be fused into helium. This continues until all the hydrogen in the core is used up. While this is happening, the outer layers expand and cool and the Sun will become a red giant, reaching a size of 10 to 100 times its former radius. At this size, the Sun would envelope Mercury, Venus, Earth and perhaps Mars. During the red giant phase, the helium core continues to be heated by the reactions going on around it. Eventually the temperature becomes sufficiently high for helium to be converted to carbon. This takes place very quickly and then the core returns to a more normal state as the outer layers contract and the star is no longer a red giant. Eventually, the helium in the core becomes exhausted, leaving an inner core of carbon. Helium still burns in a shell around the core, and there could even be an active hydrogen-burning shell farther out at the same time. The star expands and cools, becoming a red giant for the second time. As the nuclear fuel in the interior runs out, the core shrinks and the star sheds its outer layers. The star becomes a planetary nebula. The density increases as the stellar remnant condenses under the force of gravity. A larger fraction of the star's interior becomes degenerate. As the star shrinks, it stays hot, but its luminosity decreases because of its diminishing surface area. It is now a white dwarf. It will no longer undergo nuclear reactions, so it will no longer evolve further. It just sits there, radiating away the heat and energy still contained inside and slowly cooling off. This will be the end for the Sun.

12. Why are hot stars blue and warm ones red?

The color of a star, also known as its spectral class, can range from blue to white, yellow and red, with blue being the hottest and red being the coolest. Color depends upon the wavelength of the light emitted by the object, which is dependant solely on the temperature of the body. This is known as Wein's law. Blue light has a smaller wavelength than red light. This means that blue photons have more energy than red photons. This indicates that hotter objects, which have high energies, probably emit more energy in blue photons than cool objects do. Therefore, the hotter the object is, the bluer it will be. An object at about 7000 degrees Celsius will be blue, while an object at about 4000 degrees will be red. This is why we say that hot stars are blue and cool stars are red.

13. What kinds of stars blow up?

Supernovas fall into two different types whose evolutionary history is different. Type I supernova result from mass transfer inside a binary system consisting of a white dwarf star and an evolving giant star. Type II supernova are, in general, single massive stars which come to the end of their lives.

14. **Why do they blow up? What is the explosion called?**

Type II Supernovas occur at the end of a star's lifetime, when its nuclear fuel is exhausted and it is no longer supported by the release of nuclear energy. If the star is particularly massive, the gravity will crush the inner core so badly that the energy released from this crushing blows the outer layers into space. The inner core gets crushed to a teeny size.

Type I supernovas are brighter objects than Type II supernovas. Although the explosion mechanism is somewhat similar, the cause is rather different. The origin of a Type I supernova is an old, evolved binary system in which at least one component is a white dwarf star. White dwarf stars are very small compact stars which have collapsed to a size about one tenth that of the Sun. They represent the final evolutionary stage of all low-mass stars. The electrons in a white dwarf are subject to quantum mechanical constraints and this state can only be maintained for star masses less than about 1.4 times that of the Sun. The pair of stars loses angular momentum until they are so close together that the matter in the companion star is transferred into a thick disc around the white dwarf and is gradually accreted by the white dwarf. The mass transferred from the giant star increases the mass of the white dwarf to a value significantly higher than the critical value whereupon the whole star collapses and the nuclear burning of the carbon and oxygen to nickel yields sufficient energy to blow the star to bits. The subsequent energy released is, as in the Type II case, from the radioactive decay of the nickel through cobalt to iron.

15. What role do stellar explosions play in the changing universe?

The nuclear reactions that occur in stars are not only the source of energy for the stars but are the processes that are responsible for creating the elements in all living organisms. Each of us is composed of elements created in stars millions of years ago. The processes of star formation, evolution and explosion form a cycle that constantly enriches the interstellar medium with heavy elements and sows the seed for new generations of stars. Without the elements produced in supernovae, life on Earth, or elsewhere in the universe, would not be possible. Stellar explosions are the key factor to all aspects of our changing universe.

16. What connection is there to stars and black holes?

Black holes are the evolutionary endpoints of stars. See answer to next question.

17. What is a black hole?

Black holes are the evolutionary endpoints of stars at least 10 to 15 times as massive as the Sun. If a star that massive or larger undergoes a supernova explosion, it may leave behind a fairly massive burned out stellar remnant. With no outward forces to oppose gravitational forces, the remnant will collapse in on itself. The star eventually collapses to the point of zero volume and infinite density, creating what is known as a singularity. As the density increases, the path of light rays emitted from the star are bent and eventually wrapped up irrevocably around the star. Any emitted photons are trapped into an orbit by the intense gravitational field; they will never leave it. Because no light escapes after the star reaches this infinite destiny, it is called a black hole.

18. What is a constellation?

Constellations have been documented in many different forms, such as pottery, coins and other items dating back to 4000 B.C. They are totally imaginary things that poets, farmers and astronomers have made up, its real purpose is to help us tell which stars are which. Constellations help by breaking up the sky into more manageable bits, and are used as memory aids. Farmers invented the constellations to help them plant seasonal crops. Historians suspect that many of the myths associated with the constellations were invented to help the farmers remember them. When they saw certain constellations, they would know it was time to plant or reap the crops. This dependence upon the sky became a strong part of many cultures. They have changed over time, and in our modern world, they have been redefined so now every star in the sky is in exactly one constellation. In 1929, the International Astronomical Union adopted official constellation boundaries that defined the 88 official constellations that exist today.

19. Why do constellations look that way?

Constellations are drawn to indicate the stars as different sizes and brightness. There is a standard way to connect the stars that allow people what they are looking at. Every star on the chart is labeled.

20. Why can't I see stars in the daytime?

Particles in the air, the air molecules themselves, water vapor, ice crystals and tiny dust particles scatter the light from the Sun, and different wavelengths are scattered by different amounts. This scattering of light makes the sky appear very bright and blue. By day the sky is usually too bright to see anything but the Moon and the Sun. Because the Sun is so much closer to us than all the other stars, and its light is so much brighter than the starlight we cannot see the stars in the daytime. We can see the stars at night because the Sun is out of sight.

21. Where is the north star?

The North Star, or Polaris, is a binary star located less than one degree to the North Celestial Pole. It is 390 light years away and can be found at the end of the handle of the Little Dipper. Situated in this position, people on the Northern hemisphere can find their North direction on Earth by locating this star.

22. When can I see Orion?

The best time to view Orion is December – March. Face south and look for the shape of Orion high in the southern sky.

23. **When can I see the Big Dipper? Is it a constellation?**
The Big Dipper is an asterism, which is a distinct group of stars. The Big Dipper's star group is made up of seven stars that seem to form the shape of a ladle, or dipper, and is part of the constellation Ursa Major. The best time to view the Big Dipper from the northern hemisphere is from January through October looking towards the north.

24. **What is the difference between a planet and a star?**
Stars and planets are traditionally differentiated based on two properties: the way they form and whether or not they undergo nuclear reactions that burn hydrogen in their cores. Stars form when a cloud of gas, out in a nebula or other region of interstellar space, collapses under the influence of gravity. Planets, on the other hand, form when material in the disk around the pre-existing star begin to condense around rock/ice cores. You can have situations where the entire planet is almost completely rock/ice/water (such as the Earth) or situations where a large amount of gas is subsequently attracted to the rock/ice core (such as Jupiter, Saturn, etc.) Stars undergo nuclear reactions that burn hydrogen in their cores, but planets do not. In order to have high enough temperatures in the core to burn hydrogen, an object needs to have a mass of at least 75 or so times that of Jupiter. Anything more massive than that is automatically considered a star.

25. **Why do planets look like stars? How can I tell the difference?**
When you see a planet in the night sky, you're really seeing Sunlight reflected by the planets. You can tell the difference between planets and stars because planets are brighter and do not twinkle.

26. **When did the first stars form?**
According to the "Big Bang" theory, the first stars formed when the universe finally cooled enough and expanded enough to allow gravity to go to work. This occurred when the Universe was ½ billion years old.

27. **What are the oldest stars? How can we tell if a star is old or not?**
The oldest stars that we have found are between 10-15 billion years old. We can determine this by finding out what kind of star it is. When a star has used up the available hydrogen fuel in its center, it expands and becomes a red giant. Once we have found such a giant star, we know that it has used up all its hydrogen. If we can estimate its initial mass, and hence its initial power, we can estimate its lifetime and determine its age. In this way, we can measure the ages of certain stars. When we apply this method to the oldest stars we can find, we obtain ages of 10 – 15 billion years.

28. **How do stars form?**
Stars begin their lives as a large cloud of dust and gas, called a stellar nebula. Eventually the gravitational attractions of the atoms that compose the cloud cause

it to begin to collapse. As the cloud collapses, it begins to heat up, and its density and pressure increase. This stage in the life of a star is known as the proto star stage. Eventually, the cloud heats to extreme temperatures, and the pressure within is great enough to start a fusion reaction. The fusion reaction is caused by atoms of hydrogen joining together to form atoms of helium. The result is the release of an incredible amount of energy. This begins the stage in the life of a star known as the main sequence stage, when the star begins to shine. Eventually, after a star has used up all of its hydrogen, the nuclear reactions that have kept it burning begin to slow down. This causes the star to begin to expand and cool down, and eventually the star burns itself out. Fusion cools the star down and stabilizes it; otherwise, the gravity would continue to compress and heat up the star.

29. Who invented the constellations? Why?

The first people who invented constellations were farmers. They used constellations as an aid to let them know when it was the right time to farm their crops. It is believed that farmers began telling stories and myths about these constellations to help remember them.

30. What is astrology and can it predict the future?

The science/art of astrology has been researched and practiced for thousands of years in many cultures. Astrology assumes that life must have its origin in a supreme, all-embracing being – God, or whatever it should be called.
Astrology can be defined as how human personality and behavior can be inferred from the position of the Sun, moon and planets, etc. at the time of the first breath at birth. Astrologers generally believe that a person is born at a time when its soul is in harmony with the astrological energies present at the time in the solar system. Anyone interested in astrology will have to start with the individual natal birth chart based on the date of birth, the place of birth and the birth time. Astrology works with symbols – the planets and zodiac signs are symbols of forces here on Earth. Astrology is based strongly on probabilities. Astrologers have studied planetary cycles, drawn conclusions from repetitive occurrences and used this knowledge for their interpretations. Astrology is not so much a form of fortune telling, but rather a tool to self-discovery. Horoscopes are used as a "map" to help people along in life to show them where they came from, shows them their challenges, talents and possibilities, and allows them to define their destination out of their own free will. It is a philosophy that helps to explain life, rather than as a predictive tool.

31. **How many stars can you see at night? How about with a telescope?**

Depending upon where you are located, a person can see about 1,400 magnitude 5.5 stars with the naked eye. In the city, the ambient light can greatly reduce the amount of stars visible because your eyes lose the ability to be acclimatized to the darkness for the best stargazing. With a telescope, however, a person can see millions of stars, even with a modest telescope.

32. **Why can't I see colors in the stars? Are they really colored? Why?**

It is difficult to see different colored stars with the naked eye because you are looking through our atmosphere. Its different layers and temperatures distort images and colors of objects that we view from the surface of the Earth. However, when you use a high-powered telescope, you may then begin to identify stars by their various colors. The color of a star, also known as its spectral class, can range from blue to white, yellow and red, with blue being the hottest and red being the coolest. Color depends upon the wavelength of the light emitted by the object, which is dependant solely on the temperature of the body. This is known as Wein's law. Blue light has a smaller wavelength than red light. This means that blue photons have more energy than red photons. This indicates that hotter objects, which have high energies, probably emit more energy in blue photons than cool objects do. Therefore, the hotter the object is, the bluer it will be. An object at about 7000 degrees Celsius will be blue, while an object at about 4000 degrees will be red. This is why we say that hot stars are blue and cool stars are red.

33. **Why do stars still look like tiny points, even in a high-powered telescope?**

Stars look like tiny points, even with telescopes, because they are at vast distances away from our vantage point here on Earth.

34. **What is a shooting star?**

A shooting star looks like a star that quickly shoots across the sky, but they are not stars. A shooting star is really a meteor, which is a small piece of rock or dust that hits the Earth's atmosphere from space. It moves so fast that it heats up and glows as it moves through the atmosphere. Most meteors burn up in the atmosphere before they reach the ground. However, once in a while a meteor is large enough that some of it survives and reaches the Earth's surface.

35. **What is a light year?**

A light-year is a unit of distance. It is the distance that light can travel in one year, which is 5,880,500,000,000 miles. Light moves at a velocity of about 300,000 kilometers each second. So in one year, it can travel about 10 trillion km.

DAY ONE:

STUDENTS WILL BE ABLE TO DISCOVER THE PROPERTIES OF STARS, ENHANCING THEIR NOTE-TAKING SKILLS AS THEY WRITE THEIR OBSERVATIONS IN A "STAR NOTEBOOK." THEY WILL OBSERVE DEMONSTRATIONS ON TEMPERATURES OF STARS, DISCOVER WHY WE CAN'T SEE STARS IN THE DAY, AND PARTICIPATE IN A HANDS-ON ACTIVITY IN WHICH THEY WILL CREATE STARS OUT OF PLAY DOUGH.

OBJECTIVES:

STUDENTS WILL BE ABLE TO:

1 Determine what a star is.
2 Recognize which star is closest to earth.
3 Determine how many stars can we see at night.
4 Describe Why they can't we see stars in the day.
5 Draw what the biggest and smallest stars look like in relationship to the earth.
6 Describe why there are different colored stars.
7 Identify which stars are the hottest and the coolest.
8 Describe how a star is formed.
9 Determine why stars shine.

MATERIALS NEEDED TO BE PREPARED BY THE TEACHER PRIOR TO TEACHING:

INTRODUCTION:

1. Tape player
2. Tape from the movie 2001 Space Odyssey (can be obtained from most libraries.)
3. Set of 12 posters of stars, nebulas, and galaxies to be presented to the students to the song Sprach Zarathustra from the 2001 Space Odyssey soundtrack.
4. Tape from the "Lion King" movie, when Pumbaa, Simba and Timone are wondering what stars are

OVERHEAD PROJECTOR:

1. Overhead sheets.
2. Pens in green, red, blue and black inks used to write on overhead sheets.

HEATER DEMO:

1. Small space heater that allows you to view the filaments that glow red when turned on.

LIGHT DEMO:

1. Tri-folded project board, in black foam
2. Small yellow circles in various sizes representing stars and glued randomly on black foam board
3. Large sheet of painter's plastic, folded so that there is two layers, that represent the atmosphere
4. Large metal flood lamp with 250-watt bulb

PLAY DOUGH ACTIVITY

1. Each student receives a quart-sized bag containing four snack-sized bags of play dough in blue, white, yellow and red colors.

2. Play dough recipe:

   1 cup of flour
   ½ cup of salt
   2 teaspoons cream of tartar
   1 cup of water
   2 teaspoons oil
   Food Coloring
   Kool-Aid unsweetened drink mix for scent (optional)

   Mix ingredients well. Heat on medium, stirring continuously until mixture has the consistency of play dough. Should not be sticky. Knead for several minutes and allow to cool. Place in an airtight container.

3. All play dough will be rolled into small, pea-sized balls, in increasing amounts for each color. The amount of play dough needed varies depending upon class size. The following amounts are for 20 students.

   a. Red play dough (single recipe): ten balls per bag
   b. Yellow play dough (double recipe): twenty balls per bag
   c. White play dough (triple recipe): forty balls per bag
   D. Blue play dough (quadruple recipe): sixty balls per bag

MATERIALS FOR THE STUDENTS:

BAG OF PLAY DOUGH

1. Each student receives a quart-sized bag containing four snack-sized bags of play dough in blue, white, yellow and red colors.
2. Provide each student with a pencil and a small box of crayons to be used throughout this module to write and color in their star notebook.

THIS MODULE WILL ENHANCE THE STUDENTS' NOTE-TAKING SKILLS AS THEY LEARN ABOUT STARS. THEY WILL BE FILLING OUT THEIR NOTEBOOKS, DRAWING PICTURES AND COLORING THROUGHOUT THE DURATION OF THIS MODULE.

STAR NOTEBOOK:

1. Each student receives a notebook: type needed is a two-pocket folder with fasteners.
   a. The cover should have a label that includes the title as well as one for the students to write their name on.
   b. There should also be one of four different colored star stickers on the front that would allow the children to break up into groups during various activities throughout this module.
   c. The notebooks must be filled with all of the following pages:

All About Stars

"Twinkle, Twinkle, Little Star
How I Wonder What You Are
Up Above The World So High
Like A Diamond In The Sky
Twinkle, Twinkle, Little Star
How I Wonder What You Are"

My Star Notebook
Name:

____

Introduction

Think of a clear summer night. Picture yourself standing outdoors staring at the sky filled with tiny lights glimmering in the distance. When you look up at the stars, do you wonder what they are? How far away are they? How big are they? What are they made of?

In the next two weeks, you will learn the answers to these questions and many more.

LET'S GO LEARN ABOUT STARS!

ALL ABOUT STARS

1. What is a star?

Draw a picture of a star.

2. What is the closest star to the earth?

3. How far away is that star?

4. What star is closest to our solar system?

5. How many stars can we see in the night sky?

6. Other than the sun, why can't we see stars in the day?

7. What is the smallest star and what is the biggest star?

<table>
<tr><td>HERE IS A PICTURE OF THE EARTH.
</td><td>DRAW THE <u>SMALLEST</u> STAR.</td></tr>
<tr><td>DRAW THE <u>SUN</u>.</td><td>DRAW THE <u>LARGEST</u> STAR.</td></tr>
</table>

8. Why are there different colored stars?

____

____

_____

____

_____

____

_____

HOW A STAR IS FORMED

WRITE THE NAME OF EACH STAGE OF STAR FORMATION ON THE LINE PROVIDED. THEN DRAW A PICTURE OF EACH STAGE.

1. ______________________ A NEBULA IS A GIANT CLOUD OF DUST AND HYDROGEN GAS. IT WILL MAKE DOZENS AND EVEN THOUSANDS OF STARS.	
2. ______________________ INSIDE THE NEBULA, THE FORCE OF GRAVITY CAUSES LOTS AND LOTS OF CLUMPS TO FORM, CALLED PROTOSTARS. EACH PROTOSTAR WILL EVENTUALLY TURN INTO A NEW STAR. THE BIGGER THE CLUMP, THE BIGGER AND HOTTER THE STAR WILL BE.	
3. ______________________ EACH PROTOSTAR CONTRACTS AND HEATS UP	

INSIDE THE CORE UNTIL IT GETS SO HOT THAT HYDROGEN IS FUSED INTO HELIUM, CAUSING IT TO SHINE, AND A STAR IS BORN. THE STAR FINALLY STABILIZES AND ENTERS THE MAIN SEQUENCE PHASE WHERE IT WILL CONTINUE ON FOR MILLIONS TO TRILLIONS OF YEARS.	

Constellations

The Pleiades Star Cluster

"Star Light, Star Bright
First Star I See Tonight
I Wish I May, I Wish I Might
HAVE THIS WISH I WISH
TONIGHT!"

Constellation Station One

1. Who invented the constellations? ________________

2. Why did they use constellations? ________________

3. Why did they create myths about constellations? ____

4. Who else used the constellations? ________________

CONSTELLATION STATION TWO

1. WHAT IS A CONSTELLATION?

____

____
__
____
__
____
__

2. HOW MANY CONSTELLATIONS ARE THERE?__________________

____
__
____
__
____
__

3. WHY DO WE SEE DIFFERENT CONSTELLATIONS AT DIFFERENT TIMES OF THE YEAR?____

____
_
____

_

____

_

4. NAME ONE OF THE CONSTELLATIONS THAT WE CAN SEE HERE IN SOUTHERN CALIFORNIA.________________________________

____

_

____

_

____

_

CONSTELLATION STATION THREE

MAKE UP YOUR OWN CONSTELLATION AND DRAW A PICTURE OF IT IN THE BOX BELOW. DON'T FORGET TO SHOW WHERE THE STARS GO!

MAKE UP A MYTH THAT GOES ALONG WITH YOUR CONSTELLATION.

____

____

____

____

____

CONSTELLATION STATION FOUR

1. WHO WAS ORION?________________________________

____

_

____

_

2. WHERE CAN YOU SEE THIS CONSTELLATION?_____________

____

____

3. ARE STARS IN CONSTELLATIONS CLOSE TO EACH OTHER OR ARE THEY FAR AWAY FROM EACH OTHER?____________________________

____

____

4. DRAW A PICTURE OF THE SEVEN MAJOR STARS IN ORION.

The Milky Way Galaxy

Spiral Galaxy M74

My Dream

by

Annie Lee Funk, age 8

I dreamed I sat down on the sky
And cut out stars all day;
Then scattered them at purple dusk
To light the Milky Way.
I dreamed the Old Man Moon came up
And whispered in my ear:
"You'll have to clear away those stars
When morning comes, my dear!"

ALL ABOUT GALAXIES

1. What is a galaxy? ______________________________
____
____

2. How many stars are in galaxies? __________________
____
____

3. How big are galaxies? __________________________
____
____

4. What are the three kinds of galaxies? _____________
____
____

5. Draw each of the galaxies in the box below.

6. How many galaxies are there in the universe?________
____
____

7. How were galaxies formed?

____

____

_____

____

_____

____

_____

8. What is the name of our galaxy? ____________________

____

____

9. What type of galaxy is the Milky Way? _____________

____

____

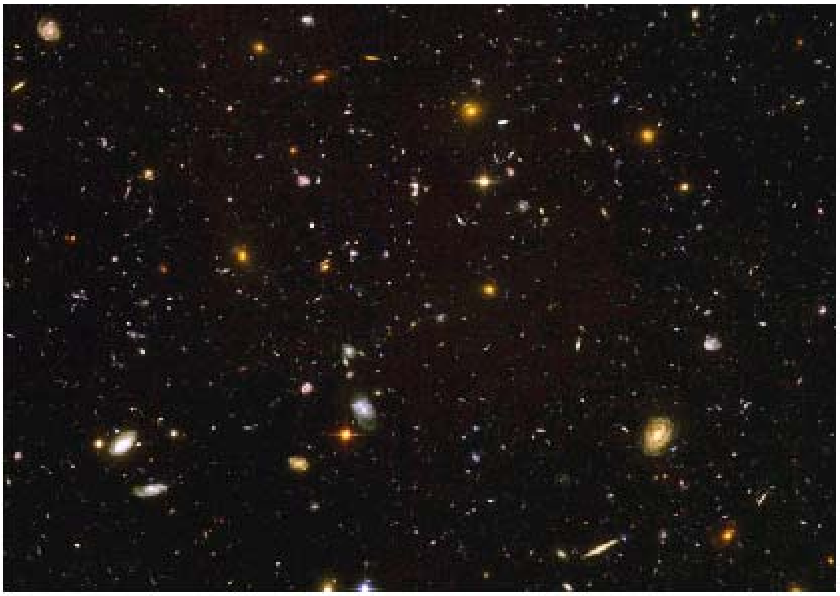
10. Where is our sun and the earth in the Milky Way?_____

____

____

11. When we see the Milky Way in the sky, what are we seeing? ____
____
____

Our Expanding Universe



Can you count all of the galaxies in this photograph? These galaxies are moving farther and farther way into our expanding universe!

Twinkle, Twinkle, Little Star
Now I Know Just What You Are!

Twinkle, twinkle, little star, now I know just what you are:
A giant ball of glowing gas, One of billions in a mass!
Twinkle, twinkle, little star, Oh, how big you really are!
Twinkle, twinkle, giant star, Larger than the Earth by far!
Since your distance is a lot, You look like a tiny dot.
Twinkle, twinkle, giant star, Very bright, yet very far!
Stars are twinkling, every one, Some are bigger than the sun!

Just a twinkle in the sky, Just because you’re oh, so high!
Twinkle, twinkle, little star, Oh how big you really are!

OUR EXPANDING UNIVERSE

1. What is the universe?

____

____

____

____

____

____

____

____

2. How big is the universe?

____

____

____

____

____

____

_____

____

_____

3. When was the universe created?

____

____

____

____

____

____

______

____

______

4. What is the Big Bang Theory?

____

____

____

____

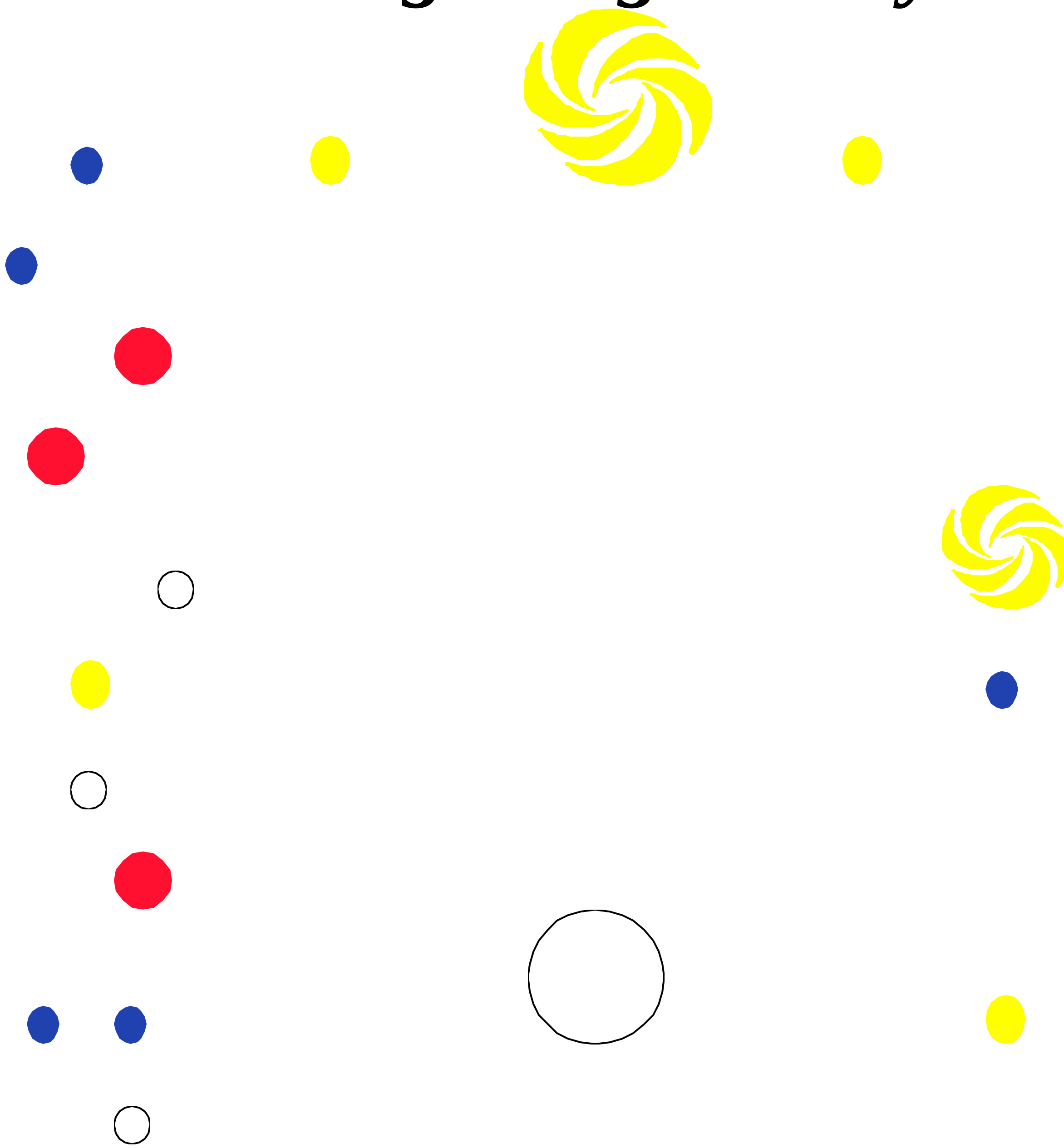
____

____

____

______

How Did The Universe Begin?
The Big Bang Theory



Want to Learn More?

Check out these wonderful websites for kids to learn more exciting facts about astronomy! Play fun games, too!

1. **NASA Kids:** This site, sponsored by the National Aeronautics and Space Administration (NASA), is dedicated to helping children learn about space and technology. Games, images, graphics, and more! www.nasakids.com/

2. **The Space Place:** This National Aeronautics and Space Administration (NASA) site is especially for younger children to actively learn about space science. spaceplace.jpl.nasa.gov/index.shtml

3. **SpaceKids:** This site is maintained for grade 3 and up as one of the SPACE.COM astronomy sites, presents space and space related subjects. www.spacekids.com/

4. **Astronomy for Kids:** This website explains meteorites, comets, stars, asteroids, galaxies, exploration, and more. www.frontiernet.net/~kidpower/astronomy.html

5. **Astronomy.com's Astronomy For Kids:** A fun place for kids to learn about the planets and solar system. www.astronomy.com/content/static/AstroForKids

6. **StarChild:** StarChild is an online astronomy-learning center for elementary and middle school students. Included are materials about the solar system, the Milky Way galaxy, etc. www.starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html (Note: You must use the capital letters in StarChild/StarChild when you enter this address.)

7. **Astronomy for kids:** Fun astronomy things to do for kids.

www.kidsastronomy.com/fun_index.htm

8. **Astronomy; Our Place in Space:** This children's site from the American Museum of Natural History contains information about the "study of the universe beyond earth." www.ology.amnh.org/astronomy

9. **Space For Kids:** Go to Solar System Central and learn about our Planets. Visit NASA. Learn about the International Space Station, check out our Astronomy Dictionary for Kids. www.gigglepotz.com/space.htm

10. **Astronomy Picture of the Day Archive:** This site is the archive for the NASA (National Aeronautic Space Administration) Astronomy Picture of the Day. Each day a different image or photograph is displayed on our website. antwrp.gsfc.nasa.gov/apod/archivepix.html

INTRODUCTION WITH MUSIC AND POSTERS

1. Play music and alternate photos of stars, galaxies, etc
2. Pass out star notebook.
3. Read the poem and introduction together with the students.

What is a star? Play tape with lion king conversation

1. People have wondered what stars are for thousands of years.

2. Have you ever seen the movie "The Lion King?" Do you remember the part where Simba, Timon and Pumbaa are lying in the grass wondering

what stars are?

3. Let's take a listen to what they have to say.

4. One of these characters is pretty close to being right. Which character do you think is correct?

5. Pumbaa says stars are "balls of gas burning billions of miles away." They are balls of gas, they are billions of miles away, but where he is wrong is when he says that stars are burning. They are not on fire. They are actually very hot, ***glowing*** balls of gas that are millions to trillions of miles away.

ACTIVITY #1

The intent of this first activity is for students to observe the filaments of the heater change colors as it gets hotter. This will not only show the color change, but will point out that things can be hot without being on fire. Most people have the misconception that stars are on fire. They are not. They are glowing balls of gas that extremely hot, the hottest being blue and the coolest being red.

CONTENT PREPARATION THE TEACHER BEFORE TEACHING THE LESSON

Teachers should be able to fully answer each of the following questions:

1. What is a star?
2. Why is it hot?
3. Why isn't it on fire?
4. Why are stars different colors?
5. How hot are stars?
6. How does it shine?

DIRECTIONS FOR THE TEACHER

1. When the teacher turns the heater on, the students will see the color change before their eyes.
2. The teacher can select a few students to come up and place their hand near the heater to verify that the heater is hot and is not on fire.
3. Once the demonstration is finished, it is time for the students to begin writing notes in their notebook. Do questions 1-5 on the overhead.

QUESTIONS POSED BY STUDENTS

1. Is there lava on stars?

ACTIVITY #2

The intent of this activity is to show the students why we don't see stars during the day. The students will observe a demonstration in which they will see stars placed on a black foam board disappear when a bright light is placed in front of them. They will discern that stars cannot be seen because the sun is too bright.

CONTENT PREPARATION THE TEACHER BEFORE TEACHING THE LESSON

Teachers should be able to fully answer each of the following questions:

1. Why can't we see stars during the day?
2. Where do the stars go during the day?

DIRECTIONS FOR THE TEACHER

1. Open black project board revealing the yellow stars glued onto it.
2. Hold the plastic in front of the board, and explain that the plastic is representing our atmosphere.
3. Ask the students whether or not they can see the stars beyond the plastic. They can.
4. Turn on the floodlight and explain that it is representing the sun. Show how bright it is.
5. Place the light between the board and the plastic (closer to the plastic works better, but you can experiment with it.)
6. Ask the students whether or not they can still see the stars. They may be able to see some, but the light overpowers most of them.
7. Explain that this is why we can't see the stars during the day, that the sun is also too bright and the stars can't be seen. It doesn't mean that the stars go away, they are still there, but you can't see them.
8. Once the demonstration is over, complete questions 6-8 in the notebook.

QUESTIONS POSED BY STUDENTS

1. What is the atmosphere?
2. Why is the sky blue?
3. How big is the sun?

ACTIVITY #3

The intent of this activity is to allow the students to learn about star formation by making their own stars. They will go through each stage of star formation, with each color play dough and will learn which star will be the biggest and the hottest. When the four stars are finished, they children will compare the sizes of each.

CONTENT BY THE TEACHER BEFORE TEACHING THE LESSON

Teachers should be able to fully answer each of the following questions:

1. Why are there different color stars?
2. Which star is the hottest and which is the coolest?
3. What are hydrogen and helium?
4. Why are stars hot?
5. What is fusion?
6. What is gravity?
7. What is a Protostar?

DIRECTIONS FOR THE TEACHER

1. Explain to the students that because we know a little more about stars, it's time to do an activity that shows you how stars are formed.
2. Pass out the activity to the children.
3. Explain that these balls represent the dust and gas inside a nebula.
4. Gravity squeezes and compresses everything until a clump is formed.
5. This clump is called a protostar.
6. The size of the clump determines how big and how hot the star will be. The smaller the clump, the cooler it will be. The coolest goes from red to yellow to white, and then the hottest will be blue.
7. Have the students complete each color play dough and compare the sizes.
8. Have the students should be able to demonstrate which star is the hottest and which is the coolest.

QUESTIONS POSED BY STUDENTS

1. Why are the hottest stars blue and not red?
2. Why are the coolest stars red and not blue?
3. How long do stars live?

WORKSHEET FOR ACTIVITY #3

<u>DIRECTIONS TO STUDENTS</u>: FOLLOW EACH OF THE FOLLOWING STEPS AND ANSWER EACH QUESTION.

HOW A STAR IS FORMED

WRITE THE NAME OF EACH STAGE OF STAR FORMATION ON THE LINE PROVIDED. THEN DRAW A PICTURE OF EACH STAGE.

1. ____________________________ A NEBULA IS A GIANT CLOUD OF DUST AND HYDROGEN GAS. IT WILL MAKE DOZENS AND EVEN THOUSANDS OF STARS.	
2. ____________________________ INSIDE THE NEBULA, THE FORCE OF GRAVITY CAUSES LOTS AND LOTS OF CLUMPS TO FORM, CALLED PROTOSTARS. EACH PROTOSTAR WILL EVENTUALLY TURN INTO A NEW STAR. THE BIGGER THE CLUMP, THE BIGGER AND HOTTER THE STAR WILL BE.	
3. ____________________________ EACH PROTOSTAR CONTRACTS AND HEATS UP	

INSIDE THE CORE UNTIL IT GETS SO HOT THAT HYDROGEN IS FUSED INTO HELIUM, CAUSING IT TO SHINE, AND A STAR IS BORN. THE STAR FINALLY STABILIZES AND ENTERS THE MAIN SEQUENCE PHASE WHERE IT WILL CONTINUE ON FOR MILLIONS TO TRILLIONS OF YEARS.	

ASSESSING UNDERSTANDING FOR DAY ONE:

Once day one's lesson is completed, an informal review will take place to assess the students' understanding of the material presented to them.

The following questions should be asked:

1. What is a star?
2. What is the closest star to the earth?
3. How many stars can we see in the night sky?
4. Why can't we see stars during the day?
5. Why are there different colored stars?
6. Which stars are the hottest and which are the coolest?
7. Are stars on fire?
8. What is a nebula?
9. What is a Protostar?
10. Why does a star shine?

DAY TWO:

Directions for the teacher: This day can be modified however the teacher desires. According to this module, the classroom should be setup for students to move around. There are four different station students should visit, each one has an activity. Materials will be described before each station. Students are expected to spend about fifteen minutes at each station. Ideally students should be grouped in fours. The teacher should have some way of letting the students know that it is time to move to the next station.

For Every Station

Materials

4 Science Project Poster board

Directions

Students should have in their star notebooks the questions for every stations. Using the poster board the teacher should display the questions and answers. After locating each question students should copy the answer in their notebooks. Once they have finished answer the questions they can begin the activity.

Constellation Station 1

Materials

Flash cards for different constellations
Paper with scattered dots (Take a paint brush dip it in black paint and spattered it over some white paper so the dots are random.)
Markers

Directions

They can then pick their favorite constellation from the flashcards. Once they have finish they can create their own constellation from the paper with scattered dots. Students can use the markers to color in their creations.

Constellation Station 2

Materials

Construction paper
15oz cans (1 for every student)

Markers
Toothpicks
Flashlights
Rubber bands
Electrical tape

Directions

Use a can opener to cut off both ends of the cans. Rise the cans well and make sure they are completely dry. Then cover the inside with black construction paper and wrap the outside with color construction paper. Use the electrical tape around the ends of the cans and over the construction paper. The tape holds the paper while ensuring that one will get cut. You will need to cut circle of black construction paper to place over the ends of the cans. Use the rubber band to fasten the cut out over the can. Use the toothpicks to punch holes in the construction paper. Then find a dark corner to display your “constellation in a can”. Take the flashlight and shine it through the can your constellation should appear. It may take some maneuvering to figure out what angle to place the flashlight. Students can use the markers to put their names on the outside of the cans.

Constellation Station 3

Materials

Examples of myths

Directions

Students need guided direction in creating their own story.

Constellation Station 4

Materials

Shadow box

Directions

(included later)

DAY THREE:

STUDENTS WILL BE ABLE TO IDENTIFY THE THREE TYPES OF GALAXIES. THEY WILL BE PARTICIPATING IN SEVERAL ACTIVITIES, WHICH INCLUDE CREATING THEIR OWN GALAXIES, OBSERVE A DEMONSTRATION ON HOW GALAXIES GET THEIR SHAPES, AND PLAY A MATCHING GAME IN WHICH THEY WILL FIND ONE OF THEIR CLASSMATES WHO HAS A MATCHING PHOTOGRAPH OF A GALAXY AND COME UP TO THE FRONT OF THE CLASS AND DISCUSS THEIR PHOTO.

OBJECTIVES:

STUDENTS WILL BE TO:

10 Determine what a galaxy is.
11 Recognize the three types of galaxies.
12 Determine which type of galaxy our solar system is in.
13 Describe where our solar system is in our galaxy.
14 Determine how many stars are in galaxies.
15 Draw the three types of galaxies in their notebooks.
16 Determine how galaxies get their formation.

MATERIALS NEEDED TO BE PREPARED BY THE TEACHER PRIOR TO TEACHING:

<u>OVERHEAD PROJECTOR:</u>

1. Overhead sheets
2. Pens in green, red, blue and black inks used to write on overhead sheets

<u>GALAXY ACTIVITY:</u>

1. Approximately 25 stars in red, blue, yellow and white must be made for each student and placed in a baggie, plus one for the teacher.

<u>GALAXY DEMO WITH PEPPER:</u>

1. Small containers
2. Water (fills the bottom of the container to one or two inches)
3. Pepper (approximately 1-2 teaspoons per container)
4. Spoons to stir pepper

<u>GALAXY MODEL</u>

1. Black tri-folded foam project board
2. 1500 small and large pins with colored balls on the head
3. Black duct tape (2-inch width)
4. Photos of the Milky Way galaxy, one for each student

GALAXY MATCHING GAME

1. Galaxy photos (2 of each type, plus select one or two galaxies to make an extra copy in the event there is an odd number of students in the class. Therefore, each and every student will have a partner.)

MATERIALS FOR THE STUDENTS:

STAR NOTEBOOK:

1. Each student needs their notebook

GALAXY ACTIVITY:

1. Each student will need a bag of assorted colored stars for this activity.

GALAXY MATCHING GAME

1. Each student receives a photo of a galaxy.

ACTIVITY #1

The intent of this first activity is for students to create the three principle types of galaxies by using paper stars. They will be creating irregular galaxies, spiral galaxies and elliptical galaxies. This will not only demonstrate their shapes, but will also point reveal how galaxies evolve.

CONTENT PREPARATION BY THE TEACHER BEFORE TEACHING THE LESSON

Teachers should be able to fully answer each of the following questions:

1. What is a galaxy?
2. How are galaxies formed?
3. What are irregular, spiral and elliptical galaxies?
4. What is the evolution of galaxies?
5. How many stars are in galaxies?
6. How big are galaxies?
7. How far away are galaxies?
8. What is the name of our galaxy and which type is it?

DIRECTIONS FOR THE TEACHER

1. Have the students begin their note taking in the notebooks. Begin with questions 1-4.
2. Once the students have learned about the three type of galaxies, it is time for the activity.
3. Pass out the bags of stars, one for each student.
4. Demonstrate and explain what an irregular galaxy is. Have kids make it as well.
5. Explain that irregular galaxies have no particular shape. They are among the smallest galaxies and are full of gas and dust. Having a lot of gas and dust means that these galaxies have a lot of star formation going on within them. This can make them very bright. About 20% of all galaxies are irregulars. Have kids draw one in their notebook.
6. Demonstrate and explain what a spiral galaxy is. Have kids make it as well.
7. Explain that spiral galaxies get their name from the shape of their disks. In a spiral galaxy, the stars, gas and dust are gathered in spiral arms that spread outward from the galaxy's center. Spiral galaxies have a lot of gas, dust and newly forming stars. Since they have a lot of hot, young stars, they are often among the brightest galaxies in the universe. About 20% of all galaxies are spirals. Have kids draw one in their handbook.
8. Demonstrate and explain what an elliptical galaxy is. Have kids make it as well.
9. Explain that elliptical galaxies are shaped like ellipses (stretched circles). Elliptical galaxies are made up of mostly old stars, and do not have much gas and dust. There is very little new star formation in these galaxies. Elliptical galaxies also come in many sizes. The largest galaxies we see are elliptical, but elliptical galaxies can also be small. About 60% of all galaxies are elliptical. Have kids draw one in their handbook.
10. Collect the stars and bags.

QUESTIONS POSED BY STUDENTS

1. How do galaxies get their shapes?
2. How do we know that our galaxy is a spiral galaxy?
3. How can we see our galaxy?
4. Can we ever see our galaxy?

ACTIVITY #2

The intent of this activity is to show how galaxies get their shapes. It is important to know that galaxy formation is not random, and that as galaxies get older, their shapes change until they finally become an elliptical galaxy. The students will observe a demonstration in which they will see that pepper, when stirred in water, have the same formation as galaxies. It starts out as a blob, similar to an irregular galaxy, then takes on a spiral formation when stirred in water, until it becomes elliptical in shape once the pepper stops spinning.

CONTENT PREPARATION BY THE TEACHER BEFORE TEACHING THE LESSON

Teachers should be able to fully answer each of the following questions:

1. Why are galaxies shaped the way they are?
2. Which type of galaxy do we see most often?
3. How old are galaxies?
4. Why are some galaxies brighter than others?
5. Why are galaxies spinning?

DIRECTIONS FOR THE TEACHER

1. This activity works best with smaller groups, if possible.
2. Pour about two inches of water in the bottom of plastic container.
3. Sprinkle pepper into the water, noting that it rests on the surface of the water shaped like a blob, similar to how an irregular galaxy looks.
4. Take the spoon and stir the pepper in a rapid, circular motion. Note that the pepper is now spiraling around in the container, similar to how a spiral galaxy looks.
5. When the pepper is spiraling around at a good speed, take the spoon out and continue watching the pepper spiral around. Note that the pepper collects at the bottom of the container in an elliptical pattern, similar to how an elliptical galaxy looks.
6. Explain that new galaxies look like a blob, but as it spins around, arms are formed around the nucleus until it finally becomes an elliptical galaxy. Galaxies do not have random shapes, it is the force of the spin that makes them look the way they do.
7. Do this demonstration several times until the students can tell YOU what they are seeing.
8. Once the demonstration is over, it is time to write in the star notebook. Finish all questions.

QUESTIONS POSED BY STUDENTS

1. Which kind of galaxy is the Milky Way?
2. Is that how many stars are in galaxies (in reference to the pepper)?
3. Why is it spinning?

ACTIVITY #3

The intent of this activity is to allow the students to view a model of a spiral galaxy similar to the Milky Way. They will be able to observe the nucleus of the galaxy, the arm of the galaxy, and will discover where our solar system would be located in the galaxy. Then they will view the model from the side so that they can see why the Milky Way looks like a streak of stars across the sky from our vantage point on earth.

CONTENT PREPARATION BY THE TEACHER BEFORE TEACHING THE LESSON

Teachers should be able to fully answer each of the following questions:

1. What type of galaxy is the Milky Way?
2. What are the parts of the galaxy?
3. How old is the Milky Way?
4. Where is our solar system located in the Milky Way?
5. Why does the Milky Way look the way it does?

DIRECTIONS FOR THE TEACHER

1. Call groups up to view the galaxy model.
2. Show them the nucleus, the arms, and point out where the sun would be on the spiral galaxy.
3. Have the students look at the model from the side view so that they can see how we view the Milky Way galaxy from our vantage here on earth.
4. Give each student a photo of the Milky Way.

QUESTIONS POSED BY STUDENTS

1. How many stars are in this model?
2. How many are really in the Milky Way?
3. Where would the earth be?
4. What color star is the sun?

ACTIVITY #4

The intent of this activity is to allow the students to view real photographs of the galaxies we've learned about. Each student will be given a photograph, and they will have to find a classmate who has the matching photograph. They will be able to differentiate between the three types of galaxies, find the similarities and differences, until they find the matching photograph. Then they will discuss the galaxy's properties with their classmate and then come up to the front of the room and share the photograph with the rest of the class.

CONTENT PREPARATION BY THE TEACHER BEFORE

TEACHING THE LESSON

Teachers should be able to fully answer each of the following questions:

1. What are the three types of galaxies, and what do they look like?
2. Which types of galaxies are younger and which are older?

DIRECTIONS FOR THE TEACHER

1. Count the students to make sure you have the right number of galaxy cards.
2. Explain that they will be playing a galaxy matching game.
3. Each student will pick a card that has a photograph of a galaxy on it.
4. Explain that another classmate in the room also has the same card.
5. Explain that the students will walk around the room and look for the person who has the matching card.
6. Once the student has found his or her partner, they will then take a look at the galaxy to determine the shape of the galaxy.
7. When everyone is ready, each student and their partner will come up to the front of the class and share their galaxies with their classmates.
8. They will then tell the class the name of the galaxy, which is on the back of your card, and then tell the class about any other features they have noticed.
9. Once the directions are completed, tell the students that it is time to find their partner! This should take about five minutes to complete
10. After each person has found their partner, begin calling each group up to the front of the class.
11. When everyone has had their turn, collect the cards.

QUESTIONS POSED BY STUDENTS

1. Can we play again?

ASSESSING UNDERSTANDING FOR DAY THREE:

Once day three's lesson is completed, an informal review will take place to assess the students' understanding of the material presented to them.

The Following Questions Should Be Asked:

1. What is a galaxy?
2. How are galaxies formed?
3. What are the three types of galaxies?
4. How old are galaxies?
5. How many stars are in galaxies?
6. How far away are galaxies?

7. What is the name of our galaxy?
8. What type of galaxy is our galaxy?
9. Where is our solar system located in our galaxy?

DAY FOUR:

Activity

Materials

Paper plates
Markers
Stapler
Playground

Directions

This is a outside activity designed to demonstrate the big bang theory. Each students is given two paper plates and instructed to draw stars or nebulas. After they have finish draw on both plates they should be stapled together to form a Frisbee (Astro-Twirler). Before going outside, students are told the rules of the game. Everyone is suppose to stay close together in the middle of the playground. The teacher should be standing in the middle, then you can instruct your students to face away from the center of the circle. Establish a sign (when I say “BANG”) for them to throw their Astro-Twirler. (Note for teacher: to take time instruct students to spin very slowly towards their Astro-Twirler) Once they reach their Astro-Twirler, students should throw it again. Students should always throw away from their starting point. Stop the students after two are three throw and express how far away they are from you. Repeat as many times desired.

ASSESSING UNDERSTANDING FOR STAR MODULE:

After all of the material has been presented to the students, the following quiz will be given to assess the students’ understanding:

Name: ____________________

STAR QUIZ

Circle the best answer for each question.

1. What is a star?
   a. A burning ball of gas.
   b. A glowing, hot ball of gas.

2. What color star is the hottest?
   a. A red star.
   b. A white star.
   c. A blue star.
   d. A yellow star.

3. We can’t see the stars in the day because:
   a. The moon is too bright.
   b. The stars go to sleep during the day.
   c. The sun is too bright.

4. What is a constellation?
   a. A group of stars that form an imaginary pattern.
   b. A group of musicians who play in a band.
   c. A group of monkeys that swing in a tree.

5. Who invented the constellations?
   a. Bankers
   b. Farmers
   c. Football players
   d. Ballerinas

6. Stars in constellations are:
   a. Right next to each other.
   b. Four miles away from each other
   c. Trillions of miles away from each other.
   d. One hundred inches away from each other.

7. What is a galaxy?
   a. A galaxy is a large group of planets.
   b. A galaxy is a large group of stars, dust and gas.
   c. A galaxy is a large group of moons.
   d. A galaxy is a large group of comets.

8. What are the three kinds of galaxies?
   a. Square, rectangle and triangle
   b. Purple, green and pink
   c. Irregular, spiral and elliptical
   d. Spiky, Squishy and Slimy

9. What is the name of our galaxy?
   a. Snickers
   b. Twix
   c. The Milky Way
   d. Starburst

10. What is the Universe?
   a. A wide-open space that contains everything from the smallest particle to the biggest galaxy.
   b. The Milky Way galaxy.
   c. Our sun and planets

11. Draw the correct shape of a star in the box below.

12. Follow the directions in the boxes below.

 Look at the size of the earth.	Draw the size of the smallest star.	Draw the size of the largest star.

13. Draw the three types of galaxies in the boxes below.

RESOURCES AND REFERENCES

THE FOLLOWING REFERENCES WERE HELPFUL IN DESIGNING THIS MODULE:

BOOKS

Chaisson, Eric and McMillan, Steve. *"Astronomy Today: Fourth Edition,"* Pearson Education, Ltd., ISBN 0-13-091542-4

Eicher, David J., *"The Universe From Your Backyard,"* Kalmbach Publishing Co.,
ISBN 0-913135-05-4

Harwood, William. "*Space Odyssey: Voyaging Through the Cosmos,"* National Geographic Society, ISBN 0-7922-6354-5

Henbest, Nigel, *"Universe: A Computer Generated Voyage Through Time and Space,"* Macmillan Publishing Company, ISBN 0-02-550921-7

Ridpath, Ian, *"Norton's Star Atlas and Reference Handbook,"* Pearson Education, Ltd., ISBN 0-582-31283-3

Sanford, John, *"Observing the Constellations,"* Simon and Schuster, ISBN 0-671-68927-4

Tennant, Catherine, *"The Box of Stars: A Practical Guide to the Night Sky and to its Myths & Legends,"* Bullfinch Press, ISBN 0-8212-2038-1

Vanin, Gabriele, *"A Photographic Tour of the Universe,"* Firefly Books, Ltd., ISBN
1-55209-345-X

Voit, Mark, "*Hubble Space Telescope: New Views of the Universe,"* Harry N. Abrams, Inc., ISBN 0-8109-2923-6

WEBSITES

"Ask A Scientist," www.newton.dep.anl.gov/askasci/ast99/ast99182.htm

"Astronomy for Kids," www.astronomy.com/content/static/AstroForKids

“Astronomy for Kids,” www.frontiernet.net/~kidpower/astronomy.html

“Astronomy for Kids,” www.kidsastronomy.com/fun_index.htm

“Astronomy; Our Place in Space,” www.ology.amnh.org/astronomy

“Astronomy Picture of the Day Archive,” www.antwrp.gsfc.nasa.gov/apod/archivepix.html

“Earth’s Nearest or Closest Stars,” www.essexl.com/people/speer/stars.html

“Nasa Kids,” www.nasakids.com/

“Planets Around Stars,” www.astronomy.mps.ohio-stte.ude/~ryden/ast161_6/notes 26.html

“Space For Kids,” www.gigglepotz.com/space.htm

“SpaceKids,” www.spacekids.com/

“StarChild,” www.starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html

“Stars,” www.library.thinkquest.org/29033/objects/stars.htm

“The Space Place,” www.spaceplace.jpl.nasa.gov/index.shtml

“The Stars,” www.teacher.scholastic.com/researchtools/articlearchives/space/qastars.htm

“The Stars of the Milky Way,” www.members.nova.org/~sol/chview/chv5.htm

“The Sun,” www.geocities.com/capecanareral/lab/2683/sunhome.htm

“The Universe Around Us,” www.mth.uct.ac.za/~ellis/cos5.html

READING CENTER BOOKS

THE FOLLOWING BOOKS ARE THOSE I PUT INTO A READING CENTER SO THAT THE CHILDREN COULD READ ABOUT STARS DURING THE DAY. THIS NOT ONLY REINFORCES WHAT I HAVE TAUGHT THE CHILDREN, BUT ALSO ENABLES THEM TO POSE QUESTIONS THEY MAY HAVE ABOUT

ANY OF THE SUBJECT MATTER THEY ARE LEARNING ABOUT.

Asch, Frank, *"The Sun Is My Favorite Star,"* Scholastic Inc., ISBN 0-439-31231-0

Branley, Franklyn M., *"The Big Dipper,"* HarperCollins Publishers, ISBN 0-06-445100-3

Branley, Franklyn M., *"The Sky Is Full Of Stars,"* HarperCollins Publishers, ISBN 0-06-445002-3

Harwood, William. "*Space Odyssey: Voyaging Through the Cosmos,"* National Geographic Society, ISBN 0-7922-6354-5

Henbest, Nigel, *"Universe: A Computer Generated Voyage Through Time and Space,"* Macmillan Publishing Company, ISBN 0-02-550921-7

Mitton, Jacqueline. and Balit, Christina, "*Once Upon A Starry Night: A Book of Constellations,"* National Geographic Society, ISBN 0-7922-6332-4

Nicolson, Cynthia Pratt, *"The Stars,"* Kids Can Press Ltd., ISBN 1-55074-524-7

Simon, Seymour, *"The Universe,"* Scholastic, Inc., ISBN 0-439-05279-3

Sipiera, P., *"Black Holes,"* Children's Press, ISBN 0-516-20326-6

Sipiera, P., *"Constellations,"* Children's Press, ISBN 0-516-20331-2

Sipiera, P., *"Galaxies,"* Children's Press, ISBN 0-516-20333-9

Sipiera, P., *"Stars,"* Children's Press, ISBN 0-516-20341-X

Vanin, Gabriele, *"A Photographic Tour of the Universe,"* Firefly Books, Ltd., ISBN
1-55209-345-X

Voit, Mark, "*Hubble Space Telescope: New Views of the Universe,"* Harry N. Abrams, Inc., ISBN 0-8109-2923-6