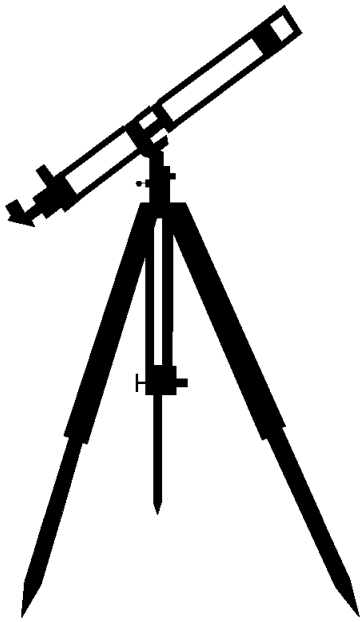
Universe Cycle

The Search for Our Beginnings

FOURTH GRADE

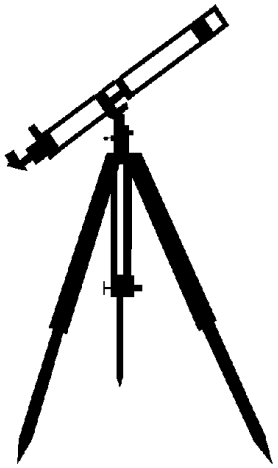
UNIVERSE



1 WEEK
LESSON PLANS AND
ACTIVITIES

UNIVERSE CYCLE

OVERVIEW OF FOURTH GRADE



UNIVERSE

WEEK 1.
PRE: *Comparing astrology and astronomy.*
LAB: *Contrasting the different types of galaxies.*
POST: *Exploring how galaxies evolve.*

SOLAR SYSTEM

WEEK 2.
PRE: *Plotting the relative distances of planets from the Sun.*
LAB: *Observing craters on the surface of planets and moons.*
POST: *Discovering new facts about the Solar System.*

EARTH

WEEK 3.
PRE: *Comparing the surface of the Earth and Moon.*
LAB: *Exploring the Earth/Moon system.*
POST: *Comparing the landscapes of the Earth and Moon.*

GEOGRAPHY

WEEK 4.
PRE: *Exploring the importance of soil on Earth.*
LAB: *Plotting data of soil locations.*
POST: *Deriving information from maps.*

UNIVERSE CYCLE - UNIVERSE (4)

PRE LAB

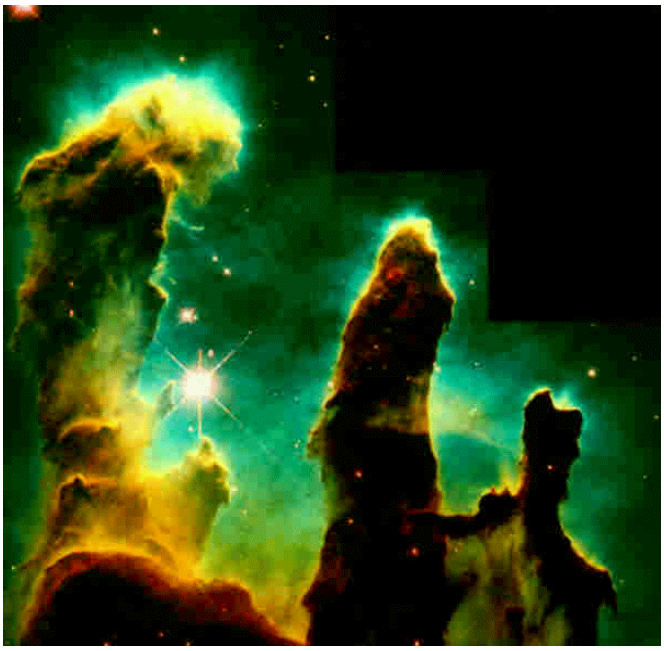
Students compares astrology and astronomy.

OBJECTIVE:

1. Comparing astrology and astronomy.
2. Exploring stars.

VOCABULARY:

astrology
astronomy
constellations
galaxy
star
Sun
zodiac


Orion Nebula

MATERIALS:

worksheet
Inflatable Celestial Globe
Celestial Globe
Constellation Globe
Constellation Placemats

BACKGROUND:

Stars are balls of gas that emit energy created by fusion, a nuclear reaction within the star. There are many sizes and brightness of stars, ranging from super hot, blue-white stars (over 20,000°K) to cool red stars (3,000°K). Our Sun is a medium yellow star, towards the small and cool end of the spectrum. Current theory suggests that stars are born in nebulae, which are interstellar gas clouds. This is happening today. An example is the Orion Nebula (in the sword or bow of the Orion the Hunter constellation). Stars also die. Older stars types include red giants and supergiants.

Constellations are apparent associations of stars and galaxies, as seen from Earth. In reality, these objects are very far away from each other. The stars that make up the constellations are all within our own Milky Way galaxy. The galaxies can be much further away; because of their distance, they appear as points of light to the naked eye.

Constellations were very important to early people. They allowed them to find directions during the night, which helped them navigate on land and at sea. The yearly changes in the constellations also revealed to early farmers when spring and summer were approaching. This was more accurate than watching the Sun rise and set every morning.

One special group of constellations is called the Zodiac. The Zodiac constellations occur in a band that is parallel to the Earth's orbit or called the ecliptic. The ecliptic is the band between the Sun's highest point (summer) and the lowest point (winter) in the sky. The stars in the Zodiac constellations move very slowly compared to the Sun and the rest of the Solar System. They seem to be fixed in the sky.

As the Earth moves around the Sun, the Sun comes between the Earth and each of the Zodiac constellations. Because the Earth always revolves around the Sun in the same direction, the Sun crosses in front of the Zodiac constellations in the same order every year. This means that if you can recognize the Zodiac constellations, you can tell what time of year it is. They work like a calender.

This sky calender and the Zodiac constellations we identify today were first used by Babylonian astronomers about 2500 years ago. Babylon was a Middle Eastern culture that is well-known for its discoveries in astronomy and other sciences. The Babylonians used the Zodiac constellations to tell when spring was coming. This allowed them to tell when it was time to plant crops and to prepare for changes in the weather.

Ancient people who studied the constellations were called astrologists. Today astrologists are pseudo scientists who try and predict the future using the signs of the Zodiac. Astronomy is the study of the origin, movement, and behavior of stars and all other components in the Universe. Astronomy is a science, based on repeated observations of the stars, and accurately predicts their motions and behavior. Some people confuse astronomy with astrology. There is no evidence that astrological predictions are accurate.

Today, we use the ancient constellations to help us locate different sectors of the Universe. Astronomers have divided the celestial globe into 88 constellation, which are listed on a separate sheet.

PROCEDURE:

1. Use the Celestial Globe to illustrate how we see the Universe from Earth. The Earth is in the center and you can easily show that if you live in the United State, the sky you see, is different than the sky you see if you lived in Australia. Compare this to the Inflatable Celestial Globe, which only illustrates the "clear" portion of the Celestial Globe.

2. Discuss the components of the Universe by going over the vocabulary. Emphasize that the Universe includes galaxies, stars, planets, and anything else in space. Explain to the students that there is much that we do not know about stars. If some students are interested in the Universe, recommend that they consult the Internet, books, or magazines on the subject. New information on the Universe is updated, especially as new equipment is developed for space exploration.

3. Give each student a Constellation Placemat and instruct them to try and find different constellations that you can find on the "88 Constellation Chart."

4. Review the constellations of the Zodiac by using the worksheet and compare them with the 88 constellations used by astronomers. You may want students to write a story about one of them.

5. Ask the students if they know the difference between astrology and astronomy. You may want to use the following graphs to help students determine the difference.

	SCIENTIFIC BASIS	PREDICTING FUTURE	ZODIAC SIGNS	CONSTELLATIONS
ASTROLOGY	none	yes	yes	12
ASTRONOMY	yes	no	no	88

6. Make clear to the students that constellations refer to a grouping of stars that we see from Earth. Explain the Zodiacal constellations.

7. See if students can determine the dates of the different Zodiac signs by asking all the students their birthdays and if they know their "sign." This is a fun way of finding the student's birthday and perhaps discover the dates of each of the signs.

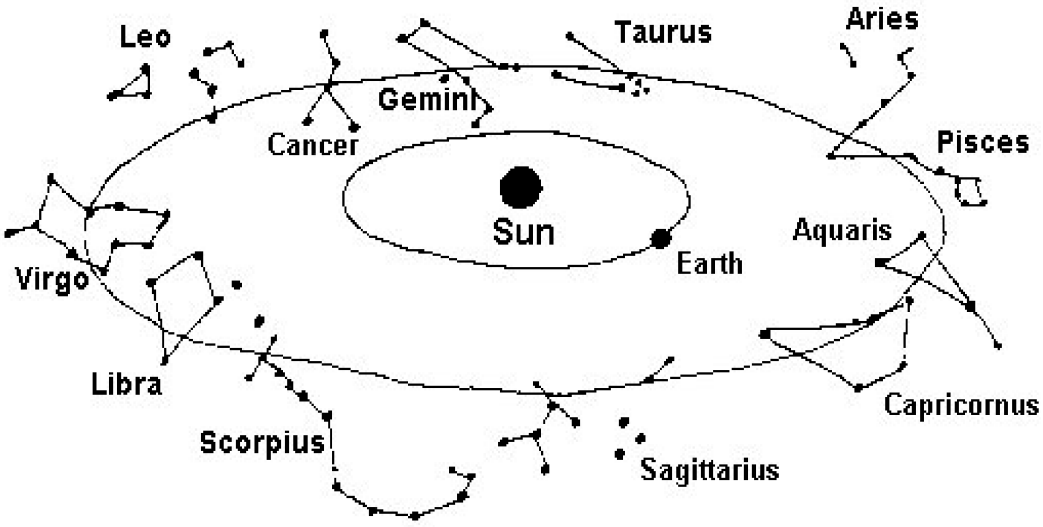
Capricorn (December, 22 - January, 19)
Aquarius (January, 20 - February, 18)
Pisces (February, 19 - March, 20)
Aries (March, 21 - April, 19)
Taurus (April 20 - May, 20)
Gemini (May, 21 - June, 20)
Cancer (June, 21 - July, 22)
Leo (July, 23 - August, 22)
Virgo (August, 23 - September, 22)
Libra (September, 23 - October, 22)
Scorpio (October, 23 - November, 21)
Sagittarius (November, 22 - December, 18)

LIST OF THE 88 CONSTELLATIONS

ANDROMEDA (Princess)
ANTLIA (Air Pump)
APUS (Bird of Paradise)
AQUARIUS (Water Bearer)
AQUILA (Eagle)
ARA (Altar)
ARIES (Ram)
AURIGA (Charioteer)
BOOTES (Herdsman)
CAMELOPARDALIS (Giraffe)
CANCER (Crab)
CANES VENATICI (Hunting Dog)
CANIS MAJOR (Big Dog)
CANIS MINOR (Little Dog)
CAPRICORNUS (Sea Goat)
CARINA (Keel of Ship)
CASSIOPEIA (Queen)
CENTARUS (Centaur)
CEPHEUS (King)
CETUS (Whale)
CHAMAELEON (Chameleon)
CIRCINUS (Compass)
COELUM (Graving Tool)
COLUMBA (Dove)
COMA ABERENIES (Bernice's Hair)
CORONA AUSTRA. (Southern Crown)
CORONA BOREALIS (Northern Crown)
CORVUS (Crow)
CRATER (Cup)
CRUX (Southern Cross)
CYGNUS (Swan)
DELPHINUS (Dolphin)
DORADO (Swordfish)
DRACO (Dragon)
EQUULEUS (Horse)
ERIDANUS (Po River)
FORNAX (Furnace)
GEMINI (Twins)
GRUS (Crane)
HERCULES (Hercules)
HORROLOGIUM (Clock)
HYDRA (Sea Serpent)
HYDRUS (Water Snake)
INDUS (Indian)
LACERTA (Lizard)
LEO (Lion)
LEO MINOR (Little Lion)
LEPUS (Hare)
LIBRA (Balance)
LUPUS (Wolf)
LYNX (Bobcat)
LYRA (Harp)
MENSA (Table Mt.)
MICROSCOPIUM (Microscope)
MONOCEROS (Unicorn)
MUSCA (Fly)
NORMA (Level)
OCTANS (Octant)
OPHIUCHUS (Serpent Holder)
ORION (Hunter)
PEGASUS (Winged Horse)
PAVO (Peacock)
PERSEUS (Perseus)
PHOENIX (Legendary Bird)
PICTOR (Easel)
PISCES (Fishes)
PISCIS AUSTR. (Southern fish)
PUPPIS (Stern of Ship)
PYXIS (Compass of ship)
RETICULUM (Net)
SAGITTA (Arrow)
SAGITTARIUS (Archer)
SCORPIUS (Scorpion)
SCULPTOR (Sculptor's tools)
SCUTUM (Shield)
SERPENS (Serpent)
SEXTANS (Sextant)
TAURUS (Bull)
TELESCOPIUM (Telescope)
TRIANGULUM (Triangle)
TRIANGULUM AUS. So. (triangle)
TUSCANA (Toucan)
URSA MAJOR (Big Bear)
URSA MINOR (Little Bear)
VELA (Sail of Ship)
VIRGO (Virgin)
VOLANS (Flying Fish)
VULPECULA (Fox)

UNIVERSE CYCLE - UNIVERSE (4) PRE LAB

1. See if you can find the constellations on the picture below, on the Constellation placemat.



2. An association or group of stars is called a constellation. Why do you think ancient people created constellations?

_____
_____
_____
_____

3. Find out the date of each zodiac sign by asking your classmates what their "signs" are. Match this with their birthdays. Record the information below.

_____
_____
_____
_____
_____
_____
_____
_____
_____

UNIVERSE CYCLE - UNIVERSE (4)

LAB

Students classify different galaxies.

OBJECTIVE:

1. Contrasting the different types of galaxies.
2. Exploring the shapes of galaxies.

VOCABULARY:

galaxy
gravitational attraction
light year
stars
nebula
nucleus
spiral

Galaxies may evolve in appearance through time.

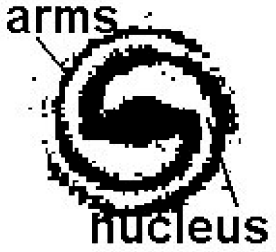
MATERIALS:

galaxy pictures
celestial globes
Internet

BACKGROUND:

A galaxy is a large collection of stars, dust, and nebulae (gas clouds) which are held together by gravitational attraction. The amount of space that these galaxies take up is immense. They are measured in light years (the distance that light travels in one year, about 9.4 trillion km). It is difficult if not impossible to accurately measure the distances to galaxies. The Magellanic Clouds are 160,000 light years from the Milky Way, and have a diameter of 30,000 light years. The Andromeda Galaxy is 870,000 light years away, and has a diameter of 45,000 light years. Our own galaxy is estimated to be 250,000 light years in diameter with a height of 100,000 light years, but this changes depending on the astronomer who does the measurements.

More than 100 ball shaped clusters of stars, called globular clusters, surround the Milky Way. These globular clusters appear to be composed of very old stars. Their origin is unclear. Omega Centauri and 47 Tucanae are examples of clusters.



Edwin Hubble, a well known astronomer, classified galaxies into four major groups, ellipsoidal, spiral, and irregular, based on their shape and origin. The core of a galaxy, where most of its stars

are concentrated, is called the galaxy's nucleus. The spiral arms of spiral galaxies are concentrations of stars that seem to spin from the nucleus.

Ellipsoidal Galaxies - Symmetrical structures ranging from spheres to flattened ellipsoids (in cross section). Usually the type of stars are older type of stars called Population II.

Spiral Galaxies - A galaxy that has a distinct nucleus and one or more spiral arms. The arms extend outward from the nucleus and are composed of stars, dust, and gas. Population I stars are found in the arms and Population II in the nucleus, between arms and probably in the halo. Population I are considered younger stars. There are 2 distinct classes of spirals.

Normal

Normal Spiral - Several arms radiate from center (top view)
Barred Spiral - Have elongated centers, called bars, with arms, coming from each end .

Barred

Irregular Galaxies - No regular shape, includes nebulas.

Elliptical galaxies seem to be more common than spiral galaxies, and tend to be composed of older stars. However, spiral galaxies contain more than 75% of the bright stars observed in the Universe. Irregular galaxies are rare, accounting for only 3% of known galaxies.

There is some evidence that galaxies evolve in shape through time. However, this idea is currently hypothetical, given the short time span we have been able to observe galaxies.

A nebula - an irregular galaxy

PROCEDURE:

In this lab, students classify the different types of galaxies by using as many pictures as possible. You can use the Internet, pictures from a magazine, or the worksheets that are provided.

1. Review the parts of a galaxy with the students. Show students on the Inflatable Celestial Globe the difference between a star and a galaxy by using the following example.

Galaxies tend to cluster together within the Universe. For example, two companion galaxies to our Milky Way galaxy are the Magellanic Clouds and the Andromeda Galaxy. They can be seen on the celestial globe, but most people mistake them for stars,

because they seem so small. Magellanic Clouds are near the -70° between 6h - 5h as a purple cloud. Andromeda is also called M31 and is located +40 between 1h and 0h.

2. Using the pictures on the worksheets, show students the different types of galaxies. These pictures will help the students get a visual feeling for the general forms of galaxies. Remind them that they cannot go outside and see galaxies without a high powered telescope. Some of the pictures on the worksheet were taken through high powered ground telescopes or the Hubble Space Telescope.

3. See if the students can sort these galaxies into ellipsoidal, spiral, and irregular types. The students may be confused by the angle at which some of these pictures are taken; they are not always edge on, so the shape of the galaxy may be unclear at first. Have them cut out the pictures and sort them. You may want to start developing a collection of different galaxies and laminate the pictures. You can use these as a permanent sorting exercise.

4. If you have access to the Internet, there are many web sites where the students can find great pictures and animations of galaxies. These sites change frequently, so some of the links below may be out of date. You may want students to conduct a search and find other useful sites.

http://oposite.stsci.edu/pubinfo/Anim.html

Animations of planets and galaxies. The home page for this site contains links to many, many Hubble Space Telescope pictures.

http://www.damtp.cam.ac.uk/user/gr/public/

Cambridge Relativity of Cambridge University. Discusses Cosmology, Black Holes, Inflation, Cosmic stings, and more. Good illustrations and graphics.

http://www.nationalgeographic.com/features/97/stars/

Star Journey - a National Geographic site which includes star charts of the night time sky.

http://www.astro.wisc.edu/~dolan/constellations/

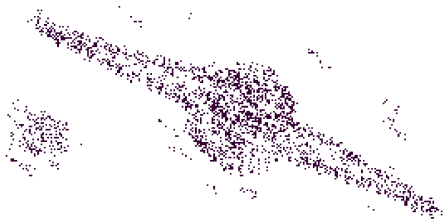
The Constellations and their Stars. A detailed website that includes interactive sky charts and pictures of stars and galaxies.

5. Guide to the types of galaxies: spiral (A ,E, G, I, J, L); Ellipsoidal (F, M, N, O); and Irregular (B, C, D, H, K)

Answers: 1. Stars and dust clouds; 2. Gravity; 3. Universe; III. Note these answers may be subjective to children. Many of the spirals are confusing. If a student is consistent in their answer, that should be sufficient.

UNIVERSE CYCLE - UNIVERSE (4) LAB

PROBLEM: How are galaxies classified?
PREDICTION: _____
PROCEDURE:
Part I. Answer the following questions:
1. Galaxies are a group of_____.
2. The galaxies stay together because _____.
3. Galaxies are part of the _____.
Part II. Label the following diagram using the terms stars, arms, dust, and nucleus



Part III. On the following pages there are actual pictures of different galaxies. Group the pictures using the classification explained by your teacher. Cut the pictures out, paste them into their groupings, and label them. In the space below, draw and/or describe the characteristics of each group.

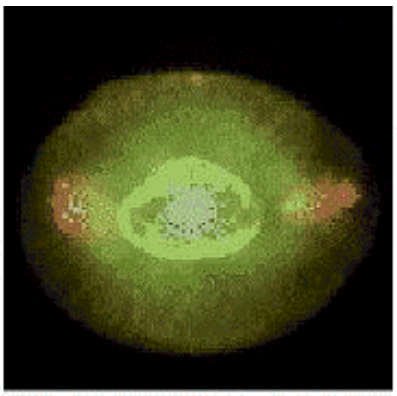
galaxy	list the pictures that belong in group; sketch a general picture of the group
ellipsoidal galaxy	
spiral galaxy- barred	
spiral galaxy - normal	
irregular galaxy	

Do you see any relationship between the shape of the galaxies and how they may have evolved? Look closely at the shapes._____
_____
Look on a celestial globe. How can you identify a galaxy from a star?
_____
CONCLUSION: Do all the pictures of galaxies fit into defined groups or do you think the classification of galaxies is nebula (not clear)!
_____

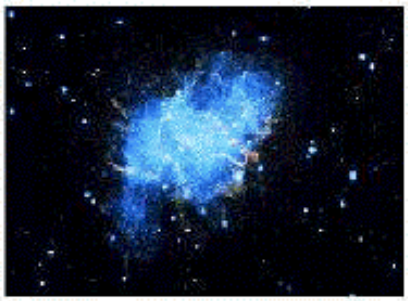
UNIVERSE CYCLE - UNIVERSE (4)

A

B



C

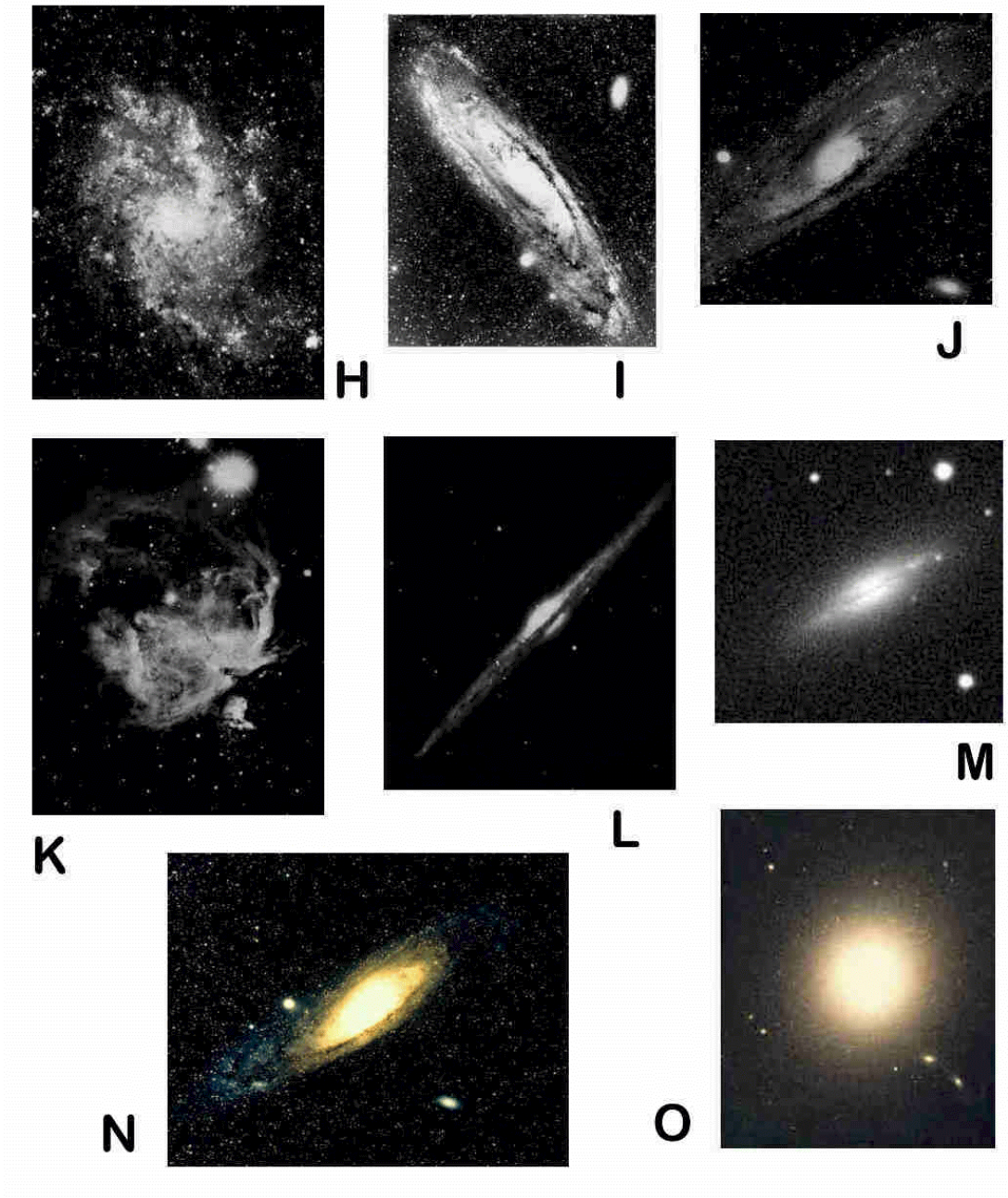


D

E

F

G


H
I
J
K
L
M
N
O

UNIVERSE CYCLE - UNIVERSE (4)

POST LAB

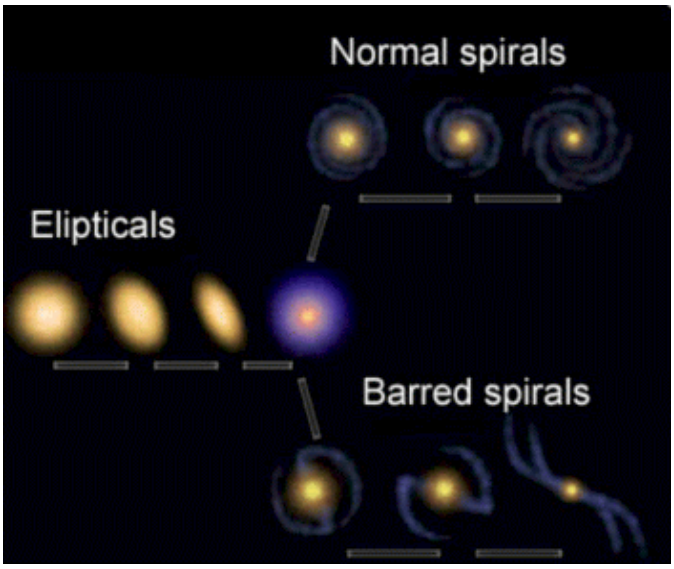
Students determine if galaxy formation theory is still valid.

OBJECTIVES:

1. Exploring how galaxies evolve.
2. Comparing other components within galaxies.

VOCABULARY:

black hole
neutron star
supernova



MATERIALS:

worksheet
Internet

BACKGROUND:

The names of many celestial objects are used in our everyday language. People talk about black holes, quasars, pulsars, neutron stars, supernova and many other things. Even candy, like Milky Way, is named for a galaxy.

The unit of a galaxy is a very dynamic place, in some areas stars can be born, die, and even explode! The evolution of galaxies also can be seen within the Universe. Not all galaxies were created at the same time. All of the stars that are grouped together did not all form at the same time. However it seems that some galaxies contain older stars, like the ellipsoidal galaxies. This can mean that they either didn't have that much fuel in each of the stars or that it formed the earliest and is now aging. In 1993, some astronomers felt that evidence on ellipsoidal galaxies leaned toward two galaxies that have merged.

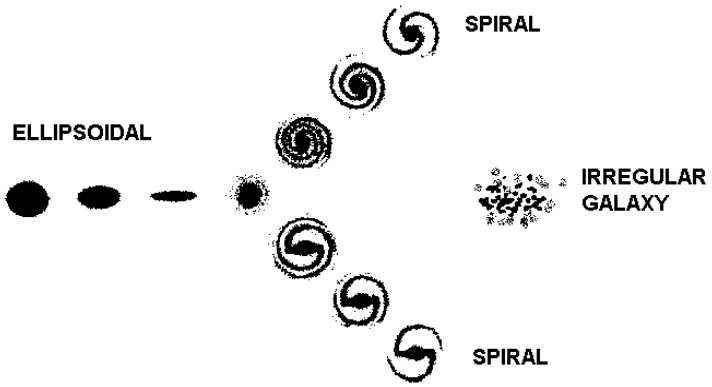
Galaxies are composed of stars. A *star* is a ball of hot gas held together by its own gravity. A star forms a diffuse cloud of interstellar gas condenses due to gravity, and begins to undergo nuclear fusion. The energy release associated with fusion causes the star to shine. The energy of fusion balances the star's gravity, preventing it from collapsing. However, when a star's internal energy dwindles, the star may fade from sight into a *white dwarf* star, or a *neutron star*, an extremely high density object composed of 99% neutrons. Neutron stars are probably remnants from supernova explosions.

All phases of the stars seem to be present in galaxies and not between the empty

space between the galaxies. A *pulsar* is a rapidly spinning neutron star. For reasons that are not fully understood, pulsars emit regular bursts “pulses” of radiation. The collapse of a super massive star may form a *black hole,* an object whose gravitational pull is so strong that nothing can escape its pull, not even light. A *globular cluster* is a roughly spherical group of hundreds of thousands to about a million stars. Globular clusters seem to be made of very old stars. A *quasar (short for quasistellar radio source)* is a point source, no more than one light year in diameter that emits tremendous amounts of energy, as much as hundreds of galaxies. Current hypotheses suggest that quasars are powered by super massive black holes.

PROCEDURE:

1. The worksheet has the students look at the "evolution" of some of the shapes of the galaxies. This theory claims that the spiral galaxies with large arms were probably formed with a greater burst of energy than an ellipsoidal galaxy. Go over the sequence given by this scientist (Dr. Hubble) as he explained how the evolution of the galaxies may have occurred.



2. Science however, may change with more data. This diagram has been modified with new information. As the students looked at the different sites, they may read that new information changes this theory. If so, they should record this information on the worksheet. This worksheet tries to get the students to realize that information on the Internet can help them update their knowledge base in science.

3. Have the students research galaxy formation on the Internet. As they do this, they will discover that the evolution they saw in the diagram is unlikely. This will help students to realize that science changes with new data and insights, and that information on the Internet can help them update their knowledge about science.

UNIVERSE CYCLE - UNIVERSE (4) POST LAB

EVOLUTION OF GALAXIES