EARTH’S PLACE in the UNIVERSE

Science Booklet Unit 11

NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ HOUR\_\_

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GOALS for Unit 11.

The Earth in Space The universe is orderly in structure, finite, contains all matter and energy and has been continually expanding at an increasing rate since its formation about 13.7 billion years ago.

Goals and Scale

4- I can write an Essay explaining the formation of the solar system, galaxy, and universe including all information below

3- I can differentiate between the position, motion, scale, structure and age of our solar system in our galaxy to that of the universe and explain how it came into existence.

2- I can explain how observations of the cosmic microwave background and light waves have helped determine the age and scale of the universe.

1- I can tell how the Big Bang theory accounts for the formation of the universe.

0- I cannot yet tell how the Big Bang theory accounts for the formation of the universe.

Evidence of Growth

A\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date\_\_\_\_\_

B\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date\_\_\_\_\_

C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date\_\_\_\_\_

D \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date\_\_\_\_\_

E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date\_\_\_\_\_

F\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date\_\_\_\_\_

4

3

2

1

0

a b c d e f

Critical Content

Objective 1

Describe the position and motion of our solar system in our galaxy and the overall scale, structure, and age of the universe.

Assignment 1

Use the Document below (howbiguniverse) to answer the following Questions

How far away?

How far are the sun and planets?

How far away are the stars?

How far is it across the milky way?

How far are the distant galaxies?

How far can we see?

How big is the universe?

Assignment 2

Pinwheel Galaxy -What did you learn? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Assignment 3

First things first: What is the universe? Speaking generally, universe means everything—all we see and cannot see. When astronomers speak of the universe, they usually mean the observable universe—what technology has enabled us to see, or what physical laws will permit us to see as technology advances. How big is the observable universe? Astronomers usually measure the far reaches of space in light-years. A light-year is the distance that light travels in one year, about 6 trillion miles. Our farthest views of space have come to us from the Hubble Space Telescope, launched by NASA in 1990. Hubble revealed galaxies more than 10 billion light-years away, or 60 billion trillion miles. Light in the form of radio waves has come to us from another few billion lightyears beyond those galaxies. What is a galaxy? A galaxy is an assembly of stars and related matter and gas, all held together by mutual gravity. We might think of a galaxy as a super megalopolis of stars. A more common analogy is that a galaxy is a vast island in space, separated from the others by millions of light-years. Less than a century ago, we could speak of the galaxy, our own Milky Way, without ever pluralizing the word. The Milky Way got its name from its appearance to the naked eye. The galaxy has a disk shape. We are within the disk. Overhead, we get a sideways view: we see the disk as a band of so many stars that they appear as a creaminess of light. Scientists early in the twentieth century, Albert Einstein among them, believed that these stars—this galaxy—made up the whole of the universe. Beyond the galaxy was a void. In 1917, the Wilson Observatory in Pasadena, California, erected a hundred-inch-wide telescope, the largest in the world. Missouri-born astronomer Edwin Hubble, namesake of the Hubble Space Telescope, went to Pasadena to study a nebula, a fuzzy patch of gas and dust. Using the new telescope, he discovered that the fuzz was far more distant than anyone imagined. It contained not only gas and dust, but also stars. What was considered a small part of our galaxy, and called the Andromeda nebula, became the Andromeda galaxy. It was another island altogether, millions of light-years from ours. It is now estimated that there are more than 170 billion galaxies in the observable universe, each containing tens or hundreds of billions of stars. What is a star? We can turn to rock and roll for a concise definition of a star. A star is a great ball of fire. It is necessarily a ball: like a planet, it forms from a spinning cloud of dust and gas that collapses under its own gravity, pulling inward equally in all directions. And it is necessarily great: unlike the smaller planets, its sheer mass exerts a pressure that sets off a nuclear fire, which in most cases burns for billions of years. The closest star, our own star, is the Sun. As stars go, ours is quite average: middle-aged, of medium build, moderately bright. The difference between the Sun’s blaze in our sky and the cool twinkle of the other stars is the difference of distance. If our galaxy is a megalopolis, our star is the core city of a metropolitan area, with its solar system as the suburbs. Earth, the third planet from its star, is in the toniest of inner suburbs, enjoying the heat and light of the star but not too much of it. What is a planet? As with galaxy, the meaning of planet has changed considerably, and even more recently. For decades, a planet could be safely defined as any of nine bodies that revolve around the Sun. Outward from the Sun, they are Mercury, Venus, Earth, and Mars (the “terrestrial,” or Earth-like, planets), Jupiter, Saturn, Uranus, and Neptune (the “gas giants”), and Pluto. American astronomer Clyde Tombaugh discovered the icy misfit Pluto in 1930, and thus made possible a catchy first-letter memory aid: My Very Educated Mother Just Served Us Nine Pizza

Use EMSEARTHSCIENCE.WEEBLEY.COM and hand out to work through SIZING UP THE UNIVERSE.

Assignment 4.

DRW HANDOUT See website

LABEL AND DRAW THE THREE TYPES OF GALAXIES

Assignment Five See webite

Create a Mobile –Organize types of Galaxies Using Hubble Tuning fork.

What did you Learn?

Objective 2 BIG BANG

Describe how the Big Bang theory accounts for the formation of the universe.

Assignment #1

DRW Reading Questions

**Section: The Big Bang Theory Page 793-796 Assignment 1 Objective 2 Unit 11**

1. What is cosmology?

a. the study of the distance, mass, and time of the universe

b. the study of the origin, structure, and future of the universe

c. the study of the stars, planets, and people of the universe

d. the study of how the stars affect Earth and the universe

2. Like all scientific theories, the theories about the origin and evolution of the universe

a. are well-established.

b. must constantly be tested against new observations and experiments.

c. are occasionally tested against old observations and experiments.

d. are considered to be true.

3. Many current theories of the universe began with observations made

a. more than 300 years ago.

b. more than 100 years ago.

c. less than 100 years ago.

d. less than 10 years ago.

**HUBBLE’S OBSERVATIONS**

4. What did Hubble discover near the end of the 1920s?

5. What did Hubble find out about the most distant galaxies?

6. What do the spectra of distant galaxies collected today say about Hubble’s original findings?

**THE BIG BANG THEORY EMERGES**

7. Define the big bang theory.

8. If you trace the expanding universe back in time, what would you find?

9. In terms of expansion, what is true of the universe today?

10. What is cosmic background radiation?

11. When do astronomers think cosmic background radiation formed?

12. What would the universe have been like soon after the big bang compared with now?

13. What is the temperature of the energy of the background radiation from the big bang?

14. What are the ripples in the cosmic background radiation, and what caused them?

Directed Reading *continued*

15. What may the ripples in the cosmic background radiation indicate about the early universe?

**A UNIVERSE OF SURPRISES**

16. Analyzing the ripples in cosmic background radiation tells us that the kinds of matter that humans, the planets, the stars, and matter between stars are made of

a. makes up only 73% of the universe.

b. makes up only 23% of the universe.

c. makes up only 4% of the universe.

d. makes up only 32% of the universe.

17. What is the type of matter called that does not give off light?

a. dark energy

b. darkness

c. dark matter

d. dark elements

18. What is dark energy?

a. Scientists think that it acts as a force that opposes gravity.

b. Scientists think that it is matter that does not give off any light.

c. Scientists think that it acts as a dark force that opposes reality.

d. Scientists think that it acts as a force that opposes magnetism.

19. Recent evidence suggests that distant galaxies are

a. closer to Earth than current theory would indicate.

b. moving faster than current theory would indicate.

c. farther from Earth any theory is able to describe.

d. farther from Earth than current theory would indicate.

20. Because of dark energy, the universe’s rate of expansion

a. seems to be slowing.

b. seems to be undetectable.

c. seems to have stopped.

d. seems to be accelerating.

Objective 3 Evidence of the BIG BANG

1. Explain how observations of the\_cosmic background radiation have helped determine the age of the universe and

2. Differentiate between the cosmological and Doppler red shift. (The Doppler Redshift results from the relative motion of the light emitting object and an observer. If the source of light is moving away from an observer the wavelength of the light is shifted towards the red due to an apparent increase in wavelength from that perspective. If the source of light is moving toward an observer, the wavelength of the light is shifted toward the blue due to an apparent shortening of wavelength. These effects, called the redshift and the blueshift, respectively are together known as doppler shifts.

The Cosmological Redshift (or Hubble Redshift) is a redshift caused by the expansion of space. The wavelength of light increases as it traverses the expanding universe between its point of emission and its point of detection proportional to the expansion of space during the crossing time.)

Assignment #1 Expanding Universe

ANALYSIS

1. Did the distance between A and B, between B and C, or between A and C show the greatest rate of change?

2. Suppose dot A represents Earth and that dots B and C represent galaxies. How does the rate at which galaxies are moving away from us relate to how far they are from Earth?

Assignment #2 Universe Adventure - Cosmic Background Radiation

Website: universeadventure.org

Click on green evidence button then click next until you reach the Cosmic Microwave background radiation page

Website Questions

1. What was the accidental discovery of Penzias and Wilson?

2. Why was this discovery important?

3. How long after the Big Bang was the CMB formed?

4. What were the conditions of the early universe at the time the CMB formed?

5. What is the temperature of the CMB now?

6. What has made the Universe cool down as demonstrated in the CMB?

7. What do the differenced in the color in the CMB represent?

8. The light from the CMB really came from a process called decoupling in which \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ separated from \_\_\_\_\_\_\_\_\_\_\_\_\_. This separation occurred because the Universe \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which cooled the Universe enough that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_could form when electrons bond to nuclei.

9. The original light at a temperature of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ K (\_\_\_\_\_\_\_ degrees F) .

10. Sketch what happened to the wavelength of light as the temperature cooled due to the expansion of the Universe on the line below.

Earlier hot universe ------------------------------------------------------------------------today

11. The age of the universe is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12. The anisotropies on the CMB represent tiny \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which are really Fluctuations in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

13. The Colder areas are more dense and denser areas have more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ so \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ they can attract more matter leading to the formation of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

14. Explain why the CMB and maps of the Earth are shaped like ovals.

15. Why is the CMB so important?

16. Why are the anisotrophies so significant?

Objective 4

Explain how the solar system formed from a nebula of dust and gas in a spiral arm of the Milky Way Galaxy about 4.6 Ga (billion years ago).

Assignment #1

Create a google poster of the formation of our solar system

It should include:

Nebula, Sun Formation, Plantesimal, Protoplanets, planet formation, moon formation,age of solar system.

Use the poster for help and as a guide-->

OR

Download textbook pages

You may copy images but you may not copy another completed poster you must make your own with google draw.

Or Use a Text book

Glue your work to the back of the booklet ..