Name_____ Date_____

Period_____

Lab # _____

Introduction:

In the 1920s astronomer Edwin Hubble used the red shift of the spectra of stars to determine that the universe was expanding. By carefully observing the light from galaxies at different distances from Earth, he determined that the farther something was from Earth, the faster it seemed to be moving away. This relationship has become known as Hubble's Law, and it is just one piece of a bigger puzzle known as the Big Bang theory.

Developed over many years and by many people, the theory states that about 15 billion years ago the universe was compressed into an infinitely small space, known as the primordial atom. It exploded in a sudden burst of energy and created a small, super dense, extremely hot universe that began to expand in all directions. Over time things cooled, and tiny bits of matter clumped together to form stars and galaxies. As a result of this explosion, all of these objects are still moving away from each other. In this experiment, you'll create a simple model to learn how the universe expands over time.

Materials:

12-inch (30-cm) round latex balloon

24-inch (60-cm) piece of string

Permanent felt-tip marking pen

Metric ruler

Directions: The purpose of this lab is to simulate the Big Bang theory of the universe expanding. ***Carefully follow these directions*** and answer the questions that follow.

1. Inflate your balloon until it is about 4 inches (10 cm) in diameter, but do not tie the end.

2. Using the felt-tip marker, make six dots on the balloon in widely scattered locations. Label one dot "home" and the others A-E. The home dot represents the Milky Way galaxy, and the others represent galaxies formed in the early universe.

3. Without letting air out of the balloon, use the string and ruler to measure the distance from home to each dot. Record the distances in the worksheet table under the heading "Time 1."

4. Inflate the balloon so that its diameter is about 2 inches (5 cm) bigger. Again measure the distances to each of the dots, and record the distances under "Time 2" on the worksheet.

5. Inflate the balloon in 5-cm increments three more times. After each inflation, measure and record the distances in Data Table 1.

6. Answer the follow-up questions on the worksheet.

The Universe

Big Bang Balloon Worksheet

Distance from Home	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Dot A					
Dot B					
Dot C					
Dot D					
Dot E					

Questions: Use complete sentences and your knowledge of the Big Bang Theory to answer the following questions OR choose the letter of the best answer to the question.

1. How did the distance from the home dot to each of the other galaxies change each time you inflated the balloon?

2. Did the galaxies near home or those farther away appear to move the greatest distance? Explain your answer.

3. How could you use this model to simulate the "Big Crunch" a time when all the galaxies might collapse in on themselves?

4. Which statement best describes how galaxies generally move?
   a. Galaxies move toward one another.
   b. Galaxies move away from one another.
   c. Galaxies move randomly.
   d. Galaxies do not move.

5. Billions of stars in the same region of the universe are called
   a. solar systems
   b. asteroid belts
   c. constellations
   d. galaxies

6. The Big Bang Theory, describing the creation of the universe, is most directly supported by the
   a. redshift of light from distant galaxies
   b. presence of volcanoes on Earth
   c. apparent shape of star constellations
   d. presence of craters on Earth's Moon