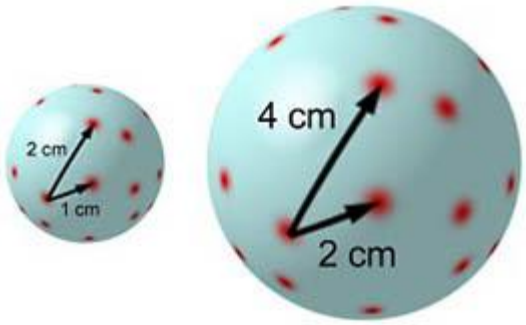
Big Bang Balloon Lab

Research Question:

Can a balloon be used to model the expanding a universe?



Purpose (why are we performing this lab?):

To create a model that illustrates how the universe expands.

Background information:

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's 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.

Hypothesis (an educated prediction of what is going to happen and why)

If a balloon can be a model of the expanding universe, then the locations marked on the balloon will

_____ as the balloon is inflated, because _____

_____

_____

Variables

Independent variable (what you manipulate/change) _____

Dependent variable (what you measure/count) _____

3 Constants (what is kept the same in the model) _____

_____

_____

Control (what are you comparing to) _____

Expanding Balloon Universe

Procedure

1) Inflate your balloon until it is about 10 cm in *diameter*, but **do not tie** the end.
2) Using the marker, make six dots on the balloon in widely scattered locations. Label one dot "home" and the others A-E.
3) Without letting air out of the balloon, use the string and a ruler to measure the distance from “home” to each dot. Record the distances in the table as "Balloon Circumference # 1."
4) Using your tape measure (or string & ruler), determine the circumference of the balloon. Record the circumference in the table as “Balloon Circumference # 1.”
5) Repeat steps 3 & 4 two more times.
6) Inflate the balloon so that its diameter is about 10 cm bigger (≈ 20 cm total).
7) Measure the distances to each of the dots and the balloon’s circumference. Record these measurements as "Balloon Circumference # 2" in the table. Repeat your measurements two more times and record in the table.
8) For the last time, inflate the balloon 10 cm bigger (≈ 30 cm total).
9) Measure the distances to each of the dots and the balloon’s circumference. Record these measurements as "Balloon Circumference # 3" in the table. Repeat your measurements two more times and record in the table.

Data and Observations

_____ (must have a title)

Independent variable		Dependent Variable				
		Distance from “Home” to “A” (cm)	Distance from “Home” to “B” (cm)	Distance from “Home” to “C” (cm)	Distance from “Home” to “D” (cm)	Distance from “Home” to “E” (cm)
Balloon Circumference # 1						
Averages						
Balloon Circumference # 2						
Averages						
Balloon Circumference # 3						
Averages						

Analysis & Conclusion Questions:

Discuss these questions with your group and answer them in complete sentences. (You may agree or disagree with your group, but the answers should be in your own words, and not identical to your group members.) You will need a separate sheet of paper to write out your answers. Assume that the home dot represents the Milky Way galaxy, and the others represent galaxies formed in the early universe.

1. How did the distance from the "home" dot to each of the other galaxies change each time you inflated the balloon? (reference your data and what the data indicates)

2. Did the galaxies near "home" or those farther away appear to move the greatest distance? (reference your data and what the data indicates)

3. Is the circumference of the balloon important to this experiment? Explain your answer.

4. What is the conclusion your group can draw from your results?

5. Was your hypothesis supported (correct) or rejected (wrong) by the results? Explain

6. Every lab has room for some errors. They may be caused accidentally by humans, or they may be a mechanical error that we cannot prevent from happening.
   a. What were some possible errors in this experiment?

   b. How could you improve this experiment?

Pick one of the following and answer on a separate sheet of paper. Be sure to write the number of the question you are choosing to answer.

7. What are some new research questions that this experiment or observations could lead to? Design an experiment to answer one of these new questions?

OR

8. Design another experiment that could potentially answer the same research question we focused on in this lab. (Can a balloon be used to model the expanding a universe?)