

QUICK LAB DIRECTED Inquiry

Modeling the Expanding Universe

In this lab, you will use a rubber band and a ruler to model the expanding universe.



OBJECTIVES

- Model the expanding universe.
- Calculate modeled expansion rates.

Compare and contrast the model to the actual expanding universe.

MATERIALS

- For each group
- pen, ballpoint
 - rubber band, thick
 - ruler, metric

- scissors
- For each student**
SAFETY GOOGLES

PROCEDURE

- 1 Use **scissors** to cut a **thick rubber band**. Spread the rubber band against a **ruler** *without stretching the band*.
- 2 Use a **ballpoint pen** to mark the rubber band at each centimeter from 1 cm to 6 cm.
- 3 Hold the first mark (1 cm) in place next to the ruler while stretching the rubber band until the second mark (2 cm) aligns with the 3 cm mark on the ruler.
- 4 Observe and measure how many centimeters each mark has moved from its original location. Record your observations in the table below.

Original mark (cm)	New placement when stretched		5 Answer below
	Distance moved (cm)		
1	1	0	Carefully examine your data. Using the space below, Answer the following question: Did the marks all move the same distance? Compare the distances moved, and describe the differences.
2	3	1	
3	4.9	1.9	
4	6.9	2.9	
5	8.8	3.8	
6	10.6	4.6	

SAMPLE ANSWER:

No. The farther a mark was from the 1 cm mark, the farther away it moved when the band was stretched

Quick Lab continued

- 6 How could you calculate the rates at which the marks moved when you stretched the rubber band? Calculate the rate of movement for each mark if the rubber band was stretched for 2 seconds, and record your calculations in the table below.

Original mark (cm)	Solve for Rate - Sample data Rate of movement (cm/s)	
1	0/2	0
2	1/2	0.5
3	1.9/2	0.95
4	2.9/2	1.45
5	3.8/2	1.9
6	4.6/2	2.3

- 7 What do the expansion rates tell you about the rate of movement relative to the distance from the stretching point?

SAMPLE ANSWER:

The farther a mark moved from its original location (position), the more quickly (faster) it moved.

Quick Lab continued

8 How is the rubber band model similar to the expanding universe? How is it different?

SAMPLE ANSWER:

In the case of the rubber band and the universe (both cases), more distant objects move more than less distant objects.

But, the rubber band expanded in only one direction,

9 Make two sketches that show galaxies in an area of space. Galaxies can be spiral galaxies, elliptical galaxies, and irregular galaxies. The first sketch will show galaxies as they appear now. The second sketch will show the same galaxies as they will appear at some time in the future.

