Name:_______________________________ Class: ________ Date: __________

Analyzing Parallax

Learner Outcomes:

- Describe and apply techniques for determining the position and motion of objects in space.
    - Describing in general terms how parallax and the Doppler effect are used to estimate distances of objects in space and to determine their motion.

Key Terms:

Parallax   Triangulation

Background Information: Parallax is the apparent shift in position of a nearby object when the object is viewed from two different places. Astronomers use a star's parallax to determine what angles to use when they triangulate a star's distance from earth.

Research Question:

Which show greater parallax; near objects or distance objects?

Hypothesis:

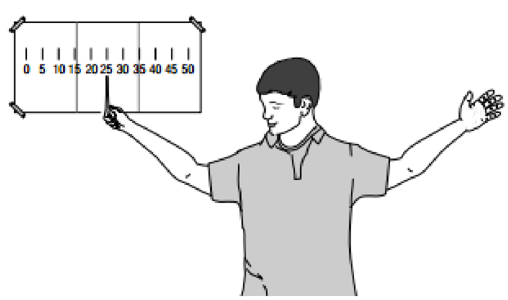
Materials:

unlined paper	tape	marker
pencil	meter stick	
index card	graph paper	

This investigation / activity has been adapted from:
Mah K, Martha J, McClelland L, et al. *Science in Action 9.* Toronto, ON: Addison Wesley.

Procedure:

1. Tape three sheets of unlined paper to the wall horizontally, at eye level. Use a marker to draw 11 vertical marks 5 centimeters apart on the paper, as shown in Figure 1. The marks represent a distant background against which you will view a closer star. Label the marks in multiples of five from left to right, starting with 0 and ending with 50.
2. Facing the sheets of paper, stand directly in front of the 25-cm mark. Then, use a meter stick to measure a perpendicular distance of 7 m from the mark. Move to that spot and face toward the 25-cm mark. You must remain at this position until you have finished collecting all data.
3. Have a partner hold a pencil vertically at your eye level, as shown in Figure 1. The pencil should be 1 m in front of you. Your partner should use a meter stick to measure this distance. The pencil represents a nearby star.
4. Hold an index card over your left eye and look at the pencil with your right eye. Your right eye represents Earth's position at one point in its orbit. Move your head so the pencil lines up with the mark labeled 0.
5. Now, without moving your head, hold the index card over your right eye and look at the pencil with your left eye. Your left eye represents Earth's position at the opposite end of its orbit six months later. Note the number of the mark that lines up with the pencil. If the pencil is between two marks, estimate its position to the nearest whole number. Your partner should record this number in the appropriate place in the data table.
6. To determine the parallax, subtract the right-eye measurement (zero, in this case) from the left-eye measurement. Record the parallax in the appropriate place in the data table.
7. Repeat steps 3-6 with your partner holding the pencil 0.5 m closer to the marks.
8. Repeat step 7 until the parallax is less than 1 cm.



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Observations:

Distance to Star (m)	Left Eye (cm)	Right Eye (cm)	Parallax (cm)
1.0			

Analysis:

1. Construct a graph of the distance to the star (pencil) against the parallax you calculated. Plot the parallax on the horizontal axis and the distance on the vertical axis.
2. What is the relationship between the distance to an object and parallax?

3. Parallax can only be used to measure the distances to nearby stars. Why can't this method be used to find the distances to far-away stars?

4. Astronomers usually make two measurements of the position of a star six months apart, when Earth is at opposite sides of its orbit. How is this useful in determining the star's parallax?

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Conclusion: Is parallax more useful for measuring near objects or distant objects? Explain.

Extension:

How do you think parallax could be used to measure distances on the ground?
What are the limitations of using parallax to use distances on Earth?

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