Physics Lab – Vector Treasure Hunt

OBJECTIVES

- Create a series of directions that lead to a specific object.
- Follow directions to locate a specific object.
- Develop a standard notation for writing direction symbols.
- Generate a scale map.

Materials

- 16 index cards
- pen or pencil
- compass
- trundle wheel
- clipboard

Procedure - DAY 1 - Giving directions

1. In this lab, you will select a large, fixed object at your school and use standard physics notation to direct other students to the object. Your teacher will define the starting point and the physical boundaries for this activity. Select an object within the boundaries; the object you choose should be large and obvious, and it should be fixed in place so that other students will be able to find it by following your directions.

2. Plot out a course from the starting point to the chosen object. Remember to work quietly and to avoid disrupting classes and school traffic. Use a meterstick or trundle wheel to measure the distances along the course.

3. You will break up the course into 15 different segments, and you will write each separate segment as a distance and a direction on an index card. Each card must contain a complete description of that segment, including the magnitude of the distance in meters and the direction. DO NOT NUMBER YOUR CARD. The direction must be specified using only these terms: north, south, east, west, up, and down. Your teacher will tell you where north is located for the purposes of this lab.

4. Keep in mind that the cards may be used to describe the most direct path from the starting point to the object, broken up into 15 segments, or they may describe a complicated path with many changes of direction. MAKE YOUR PATH DIFFICULT – this is for competition after all!

5. When you have completed 15 cards that give an accurate description of a path between the starting point and the chosen object, write your name on an index card, and place the card on top of the 15 cards. On a separate piece of paper, write your name and a description of the object you chose, including a description of its location. Give this paper and your deck of direction cards to your teacher. Your teacher will keep the paper with the name of the object until the end of the lab.

6. Answer the Analysis Questions for Day 1 on the last page.

Procedure – DAY 2 – Following directions

6. When you turn in your cards, your teacher will shuffle them well and give the shuffled cards to another lab group. You will receive a shuffled deck of direction cards made by another group.

7. Devise a plan to use the directions on the cards you have been given to find the object chosen by the other group, then attempt to find the object.

8. When you find the object, go back through the cards to make sure you have correctly identified the object selected by the other group.

9. When you are sure that you have found the correct object, report your results to your teacher. Your teacher will confirm whether you have correctly identified the object. If not, review the cards and try again.

*YOU WILL GO BACK TO THE CLASSROOM TO FINISH THE REST OF THE PROCEDURE.

Mapping the course

10. In this section of the exercise, you will use the directions on a set of 15 cards (the set you received on the 2nd day) to draw a map of the path from the starting point to the object. You will generate a map of the complete set of directions you used to find the object.

11. You will make the map by drawing each direction indicated on a card as an arrow. The arrow will be drawn to scale to represent the length in meters and it will point in the direction specified on the card. In a scale drawing such as this, it is important for all the objects in the drawing to have the same size relationship as the actual objects. For example, the arrow representing 2.0 m will be drawn twice as long as an arrow representing 1.0 m.

12. Draw the first arrow so that its tail is at the starting point, the point of the arrow is pointing in the direction specified on the card, and the length of the arrow represents the distance on the card.

13. Draw the second arrow on your map so that its tail starts at the point of the first arrow. The second arrow should also point in the direction specified by the card, and its length should represent the distance on the card.

14. Continue through the entire set of 15 cards. Draw the arrows tip-to-tail so that each arrow begins where the preceding one ends.

15. Make sure that the map is very neat. Include a legend, or key, that gives the directions and defines the scale of the map. You may wish to indicate specific landmarks, such as rooms or doors.

<u>Analysis Questions</u> – Attach map to this complete sheet of questions and hand it in as your lab report.

DAY 1

A. Do your cards describe the straight-line path to the object divided into 15 parts, or do they describe a winding path to the object?

B. What was the most difficult part of plotting the path to the object?

C. Are you confident that another group will be able to find the object using your direction cards? Explain why or why not.

D. Would another group be able to find the object using your direction cards if your cards were placed out of order? Explain your answer.

DAY 2

E. Did shuffling the deck make it more difficult for you to locate the object? Explain why or why not.

F. Would you be able to place the cards in their original order? Explain why or why not.

G. Did you find the object described by the other group's cards? If not, explain what happened.

H. Explain the method you used to find the object, and include any tricks you discovered while you were working.

I. Was the other group able to correctly identify the object described by your direction cards?

Questions about map

J. Does the map accurately reflect the path you took to find the object? If not, explain any differences.

K. Explain how shuffling the cards affected the way you represented the directions from the starting point to the object. Use examples from your map to support your answer.

M. Use the graphical method and trigonometry to find the total displacement of your set of directions. Show your work and results below.