Velocity of Traffic on Highway 26
Teacher's Guide

Objectives:
In this lab, students will:
1. Become familiar with velocity as a relationship between distance and time.
2. Use distance versus time graphs to analyze data.
3. Determine the average velocity of traffic on the highway.

Materials:

Each group must have:
2-3 stopwatches and at least 1 calculator

The class must have:
1 tape measure

In this lab, your class will be working as a group to determine the velocity of 5 cars on the highway. Before going outside, divide the class into 5 groups and give the instructions. Make sure that each group has at least two stopwatches, preferably 3. When you are outside, each group must stand 20 yards apart. These distances can be measured ahead of time to make the lab go faster. To record times, you stand at the beginning (i.e. 20 yards from Group 1), and wave your arms when a car passes to signal the timers in all the groups. They will start timing when they see you wave your arms, and stop when the car reaches their group. They will be recording 2-3 times for each car that passes and then averaging.

When you are done collecting data, bring the class inside, and have the following table on the board. They will average their times for each car and convert the times to hours before filling in the table.

Group	Distance (yds)	Time Car 1 (hr)	Time Car 2 (hr)	Time Car 3 (hr)	Time Car 4 (hr)	Time Car 5 (hr)
1	20					
2	40					
3	60					
4	80					
5	100					

For the analysis, students will create a distance versus time graph for each car to get the average velocity of each car. Some problems may come from the fact that cars may slow down when they see students on the side of the road, so the velocity may not actually be constant. Their graphs may show deceleration. Also, there is plenty of room for error in measurements of distances and times. Students should be able to see these possibilities for error and account for them in the questions following the lab.

Velocity of Traffic on Highway 26

Objectives:
The goals of this lab are to:
1. Become familiar with velocity as a relationship between displacement and time.
2. Find velocity from displacement vs. time graphs.
3. Determine the average velocity of traffic on the highway.

Materials:

Your group will need 2-3 stopwatches and at least 1 calculator

Procedure:

As a class, you will be determining the velocity of 5 cars on the highway. Your group will be collecting data that will be used by the class. There will be 5 groups in the class. Your teacher will give your group a number, 1 through 5.

1. In your group, choose at least two people carry stopwatches, and have one person be the recorder.

2. Your teacher will stand at the side of the highway, at least 100 yards from the intersection. Group 1 will stand 20 yards toward the intersection from the teacher. Group 2 will stand 20 yards from Group 1 (total of 40 yards from teacher). Continue until Group 5 is standing 100 yards away from your teacher.

3. When a car passes your teacher, she will wave her hands, signaling all timers in every group to start their stopwatches. When the car passes your group, have your timers stop timing, and the recorder will record the times on Table 1.

4. Do this for 5 cars, and record all data.

Table 1. Times recorded by your group.

Car Number	Time 1 (s)	Time 2 (s)	Time 3 (s)	Average Time (s)	Average Time (hr)
1st car					
2nd car					
3rd car					
4th car					
5th car					

5. In your group, average the two or more times taken for each car so that you have only one time for each car. Record in Table 1, and convert to hours.

6. Return to the classroom, and collect the data from all groups on a table on the chalkboard.

7. Record the class data on Table 2.

Table 2. Class Data

Group	Distance (yds)	Distance (miles)	Time Car 1 (hr)	Time Car 2 (hr)	Time Car 3 (hr)	Time Car 4 (hr)	Time Car 5 (hr)
1	20						
2	40						
3	60						
4	80						
5	100						

8. Create a distance vs. time graph for each car, and determine the velocity of the car by finding the slope of the line. If there is not enough time, just write the data down and graph it later. Attach your graphs to your lab when you hand it in.

9. Enter your velocities calculated for each car in Table 3 and calculate the average velocity of traffic on the highway.

Car	Velocity (mi/hr)
1	
2	
3	
4	
5	
Average Velocity =	

10. Do cars follow the speed limit on the highway?

11. Do you think your results accurately portray traffic on the highway? What might be some causes for error?

Velocity of Traffic on Highway 26
Prelab Questions

1. What are the goals of this lab?

2. If a car is traveling at a constant velocity, draw a sketch of what a distance versus time graph should look like below.

3. How will you get the average velocity of a car from the distance versus time graph?

4. What will your group do when your teacher starts waving her hands around?