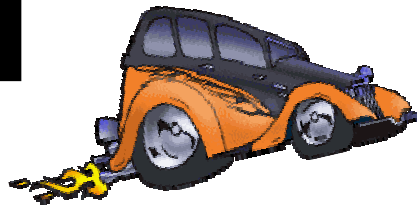


Name: \_\_\_\_\_

## Motion Lab



# FAST & FURIOUS

### DO NOW!!!

1. What is a reference point?
2. What two things must you know to determine speed?
3. What is the difference between speed and velocity?

### Objectives:

- Identify how to determine an object's speed
- Determine lab procedure to calculate an object's average speed
- Understand the difference between speed and velocity

### Materials:

- One toy car per person
- One ramp per team
- One stopwatch per team
- One meter stick per team
- Sandpaper Waxed paper for the ramp
- Masking tape (one roll)
- Washers



### Procedure:

#### Part 1: Height of ramp

1. With the ramp flat on a table or floor, place the back of the car's wheels at one end of the ramp and measure the distance from the front of the car to the end of the ramp. Record this distance on the data sheet.
2. Raise the ramp up onto a book. Measure the height in centimeters and record.
3. Place the back of the car's wheels at the top end of the ramp.
4. Release the car as you start the stopwatch.
5. Stop timing when the front of the car gets to the bottom of the ramp. Record this time on the data sheet.
6. Repeat steps 3-5 two more times then calculate the average time and record on the data sheet.
7. Calculate the average speed of your car by using the formula:  
$$\text{speed} = \frac{\text{distance}}{\text{time}}$$
8. Raise one end of the ramp on two books and repeat steps 2-7.

9. Raise one end of the ramp on three books and repeat steps 2-7.

**Part Two: Mass of Car (Height stays the same, mass changes)**

1. Raise one end of the ramp on three books. Measure the height in meters and record on the data sheet.
2. Place the back wheels of the car at the top end of the ramp.
3. Time how long it takes to reach the bottom of the ramp. Record on the data sheet.
4. Repeat steps 2 and 3 two more times then calculate the average time and record on the datasheet.
5. Add a known mass (washer) to the car then repeat steps 2 - 4 recording all measurements on the datasheet.
6. Add a second known mass to the car then repeat steps 2- 4 recording all measurements on the data sheet.
7. Record observations in your journal.

**Part Three: Surface of the ramp (Height of ramp changes, mass stays same)**

1. Raise one end of the ramp on 3 books. Measure the height in meters and record on the data sheet.
2. Place the back wheels of the car at the top end of the ramp.
3. Time how long it takes to reach the bottom of the ramp. Record on the data sheet.
4. Repeat steps 2 and 3 two more times, then calculate the average time and record on the data sheet.
5. Cover the surface of the ramp with a higher friction material such as a towel or sandpaper.
6. Repeat steps 2 - 4 two more times then calculate the average time and record on the data sheet. NOTE: If the car stops before it reaches the bottom of the ramp, measure the distance from the top of the ramp to the back wheels and record this distance on the data sheet.
7. Cover the ramp with waxed paper.
8. Repeat steps 2 - 4 two more times then calculate the average time and record on the data sheet.
9. Record observations in your journal.



**Part 1: Does the height of the ramp affect the average speed of the car?**

| Distance Traveled (m) | Height of Ramp (m) | Time (s) | Average Time (s) | Average Speed (m/s) |  |
|-----------------------|--------------------|----------|------------------|---------------------|--|
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**Part 2: Does the mass of the car affect the average speed of the car?**

| Distance Traveled (m) | Mass on Car (g) | Time (s) | Average Time (s) | Average Speed (m/s) |  |
|-----------------------|-----------------|----------|------------------|---------------------|--|
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**Part 3: Does the surface of the ramp affect the average speed of the car?**

| Distance Traveled (m) | Surface of Ramp (m) | Time (s) | Average Time (s) | Average Speed (m/s) |  |
|-----------------------|---------------------|----------|------------------|---------------------|--|
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## Conclusion:

1. Does the height of the ramp affect the average speed of the car?
2. Does the mass of the car affect the average speed of the car?
3. Does the surface of the ramp affect the average speed of the car?
4. How can a driver figure out the car's speed if the car's speedometer is not working?
5. How does a race car driver change the speed of the car?
6. What is the difference between velocity and speed?

