Hot Wheels Kinematics Lab 1 Name: ________________________

Materials: long straight ramp, hot wheels car, stop watch, meter stick, calculator

Instructions:

Part 1

Begin by measuring the diagonal length of the ramp from where the car begins until where it reaches the bottom. You must be consistent throughout the experiment about where the car begins and ends.

Distance of the car's diagonal path: ________ meters

Measure and record the amount of time it takes the car to travel down the ramp. Complete three trials and write the times in the spaces below. Find the average of the three trails.

$t_1 =$ ________ $seconds$ $t_2 =$ ________ $seconds$ $t_3 =$ ________ $seconds$

$$t_{average} = \frac{t_1 + t_2 + t_3}{3} = \_\_\_\_\_\_\_\_ \quad seconds$$

Determine the acceleration of the hot wheels car in m/s/s by using the information you have gathered about distance and time. You will need the following kinematic equation: $\Delta x = v_i t + \frac{1}{2}\bar{a}t^2$

Hint: distance = Δx and $v_i = 0\frac{m}{s}$. $\bar{a} =$ ____________ m/s/s Show your work.

Determine the final velocity of the car at the bottom of the ramp in two ways. Show your work.

1. Use $v_f = \bar{a}$t + v_i
2. Use $v_f^2 = v_i^2 + 2\bar{a}\Delta x$

v_f =________ m/s

v_f =________ m/s

3.

Check your final velocity by calculating the distance traveled using $\bar{v} = \frac{v_f + v_i}{2}$ and $\Delta x = \bar{v}t$ to verify the calculated distance is the same as the distance you measured at the beginning of the lab.

Part 2

4.

Using the premeasured distances on the ramp (e.g. .5 m, 1 m, 1.5 m, and 2 m) record the time required for the car to travel each of those distances; fill in the time column below. Square the times and enter them into the table below. Determine the constant acceleration of the car by using the $d = \frac{1}{2}\bar{a}t^2$ formula. Determine velocity by multiplying acceleration by the time.

Table 1

Distance	time	$time^2$	Acceleration	Velocity
0.5				
1				
1.5				
2				

5. Create a distance v. $time^2$ graph based on the data in your table. Distance should be on the y-axis and $time^2$ on the x-axis.

$time^2$

6.

Complete the following sentences:

a. *"The slope of a position-time graph tells us the ________________________ of the object."*

b. *"The slope of a velocity-time graph tells us the ________________________ of the object."*

c. *"For an object moving at a non-zero constant speed, we would expect to see a position-time graph with a __________________ shape and a velocity-time graph with a __________________ shape."*

d. *"For an object moving at a non-zero constant acceleration, we would expect to see a position-time graph with a __________________ shape and a velocity-time graph with a __________________ shape."*

e. *"For an object moving at a non-zero constant acceleration, the relationship between distance and* $time^2$ *is ____________ because the two quantities create a straight line, positively sloped diagonal when graphed against one another.*

f. *When two variables (e.g. distance and* $time^2$*) are directly proportional, they create a graph with a__________________ shape.*

Word Options: diagonal, curved, flat, acceleration, velocity, directly proportional

7. Which of the following variables should you control (i.e. not change) when collecting data?

a. The incline angle of the ramp

b. The car's initial velocity when released

c. Use the same car and ramp for each trial

d. All of the above should have been controlled

8. If you were asked to create a hypothesis for an experiment relating time, distance, velocity and acceleration for an object accelerating down an incline plane, which of the following would be acceptable?

a. Distance traveled is directly proportional to time^2.

b. The slope of the distance-time graph is velocity.

c. The slope of the velocity-time graph is acceleration.

d. All the above are acceptable hypotheses.

9.

Create stacked kinematic graphs of the car's motion. Qualitative graphs on the left, quantitative on the right. Be sure to use equal interval lengths when creating the quantitative graphs on the right.

Assume the top of the ramp is 0 meters and down the ramp is the positive direction.