

Procedure:

CAUTION! DON'T HOLD THE WHEELS WHEN THE SWITCH IS ON! THIS MAY DAMAGE THE CAR!

1. Place a physics book or other object under the track to elevate the end with the wood block taped to it. The wood block will serve as a fixed starting point for the ball.
2. Hold the ball against the wood block. Start the car on the lab table alongside the high end of the track and a little behind the starting point. When the front end of the car is even with the front end of the ball, release the ball and observe the "race."
3. Adjust the height of the track (adjust position of book, or use magazines as necessary) until the ball passes the car approximately 70 cm from the starting point. **KEEP THIS TRACK HEIGHT FOR THE REST OF THE EXPERIMENT!**
4. With the ball at the starting point, lay a meter stick on the table alongside the track with the zero end of the meter stick at the front end of the ball. Release the ball from the starting point and time it for 10 cm. Do timings to nearest 0.1 second. Repeat the measurement a couple of times and use the approximate average. Be sure to release the ball from EXACTLY the same point each time.
5. Repeat the timings for 20 cm, 30 cm, etc., to 100 cm.
6. Repeat the timings for the 4 x 4 car for the same intervals on the table.

Data:

BALL		CAR					
d (cm)	t (s)	d (cm)	t(s)	d(cm)	t(s)	d(cm)	t(s)
0	0.0	60		0	0.0	60	
10		70		10		70	
20		80		20		80	
30		90		30		90	
40		100		40		100	
50				50			

Graph:

1. Graph your results for both the ball and the car on the SAME displacement-time graph. Orient graph paper **LONG SIDE VERTICALLY**, and use displacement for y-axis and time for x-axis. USE DIFFERENT SHAPED "POINT PROTECTORS" FOR THE BALL AND THE CAR.
2. Using a **REGULAR PENCIL**, draw a horizontal DASHED line from the "crossover" point on the graph to the displacement axis, and a vertical DASHED line from the "crossover" point to the time axis. Where these dashed lines intersect the respective axes, use a REGULAR PENCIL to write the values for displacement (to whole cm) and time (to 0.1 s). Put a **BOX** around each of these two values.
3. Using a **RED PENCIL**, draw a tangent to the BALL graph at the crossover point.
4. Locate the point on the graph for the ball where the speed of the ball is the same as the speed of the car (hint: consider slopes!).
 - (a) Using a **BLUE PENCIL**, draw a tangent to the graph for the ball at this point.
 - (b) Using a BLUE PENCIL, draw a vertical dashed line from this point to the time axis. Where this dashed line intersects the time axis, use a BLUE PENCIL to write the value for time (to 0.1 s). Put a **BOX** around this value.

Lab Partners (first & last names):
 1. _____
 2. _____
 3. _____
 4. _____

Name _____
 Date _____ Period _____

5. _____
 6. _____

Title: **COMPARISON OF MOTION OF A 4X4 CAR AND A ROLLING BALL**

Purpose: To compare the motion of a 4x4 car moving at constant speed on a level surface with a ball rolling down an inclined track.

Procedure: see other side

Data: see other side

Graph: see other side for instructions; see attached graph

Analysis/Questions/Conclusion:

1. From the GRAPH, at what DISTANCE did the ball overtake the car?....._____cm
2. From the GRAPH, at what TIME did the ball overtake the car?....._____s
3. Use the values for distance and time in 1 & 2 to find the speed of the **CAR** at the instant it was overtaken by the ball. SHOW STANDARD 4-PART SAMPLE CALCULATION (see poster in class for format).

4. (a) ON THE GRAPH, use a RED PENCIL to draw a large slope triangle which will allow you to find the speed of the BALL at the instant it overtook the car. NEATLY AND CLEARLY LABEL THE RISE AND RUN OF THE SLOPE TRIANGLE WITH VALUES AND UNITS (**cm to nearest whole cm; seconds to nearest 0.1 s**).

(b) Use the values for distance and time in 4(a) to find the speed of the **BALL** at the instant it overtook the car. SHOW STANDARD FOUR-PART SAMPLE CALCULATION (see poster in class for format).

5. From the GRAPH, at what time did the ball have the same speed as the car?....._____s
6. Describe the car's speed in a single word: _____
7. What is the value of the car's acceleration? _____cm/s/s

8. THINK ABOUT THE FOLLOWING QUESTIONS. NO WRITTEN ANSWER NECESSARY. THEY WILL BE DISCUSSED IN CLASS.

- a) Describe the displacement, velocity and acceleration of the ball.
- b) How would you go about determining the acceleration of the ball if the only information available to you was your displacement-time graph, and the only things you were allowed to do were to find slopes and make graphs?