Reaction Time Lab

Objective: Determine your reaction time using the uniform acceleration equations
Equipment ruler (at least 30 cm in length)

Experimental Method
1. Have your partner hold a ruler vertically above the table so that the zero mark is on the bottom.
2. Place the thumb and index finger of your preferred hand at the zero mark of the ruler (the bottom). Open your thumb and index wide enough apart so the ruler can fall through.
3. Have your partner drop the ruler. Your partner must not give indication of when they will drop it.
4. As the ruler is falling, use your thumb and index finger to pinch the ruler as fast as possible. Make sure the ruler does not hit the table before you pinch it; if it does, hold the ruler higher.
5. Record the distance the ruler travelled before being stopped by looking at point where your thumb and index finger pinched.
6. Complete the table by making a total of five measurements and calculating the average.

Distance (cm)				
Trial 1	Trial 2	Trial 3	Trial 4	Trial 5

Analysis and Discussion
Find the average distance that the ruler falls before you are able to catch it using $\frac{T_1+T_2+T_3+T_4+T_5}{5}$.

Use the average distance travelled and the equation $d = v_i t + \frac{1}{2}at^2$ to calculate your reaction time (i.e. the time that the ruler was falling before being stopped). List your givens, use the correct +/- signs, and include units. Show all your algebra.

More Uniformly Accelerated Motion

1. A car slows from 60 km/h (16.7 m/s) to rest in 4.00 s. How far does it travel in this time?

2. A light plane must reach 30.0 m/s for takeoff. Its acceleration is 3.0 m/s². How long must the runway be?

3. A car travelling at 90 km/h (25.0 m/s) strikes a tree. The driver comes to rest after travelling 0.80 m.
   a. What was the average acceleration?
   b. A human can survive approximately 45 g forces in the event of an accident, where 1 g = 9.80 m/s². How many g's did this driver sustain? Did they survive?

4. A foul ball is hit straight up with a speed of 25.0 m/s.
   a. How high does it go?
   b. How long is it in the air?

5. A helicopter is ascending at 5.40 m/s. At a height of 105 m, a package is dropped. At what speed does it impact the ground?

6. A ballplayer catches a ball 3.3 s after throwing it vertically upward.
   a. With what speed did he throw it?
   b. What maximum height did it reach?

7. Suppose you adjust your garden hose nozzle for a fast stream of water. You point it vertically upward from 1.8 m above the ground. When you turn it off, you hear the water striking the ground 2.5 s later. What was the water speed as it left the nozzle?

8. A rock is thrown upward at 20.0 m/s from the top of a 100 m cliff.
   a. Find its speed just before hitting the ground.
   b. Calculate the time it takes to hit the ground.
   c. If the rock is thrown downward, instead of upward, at what speed would it need to be thrown at to hit the ground at the same final velocity?

9. A student drops a textbook from rest from the top of a cliff. The time from release until the textbook hits the ground is measured to be 5.00 s.
   a. How high is the cliff?
   b. If sound travels at $v_{sound} = 343$ m/s, use $d = vt$ to calculate the time it takes for the sound to travel back up to the top of the cliff.
   c. What is the total time from release until the student hears the impact?

10. A rocket rises vertically from rest with an acceleration of 3.2 m/s² until it runs out of fuel at an altitude of 775 m.
   a. What is its velocity when the fuel runs out?
   b. How long does it take to reach this point?
   c. What maximum altitude does it reach?
   d. How long to reach maximum altitude?
   e. With what velocity does it strike the Earth?
   f. How long is it in the air?

11. Consider the following combinations of signs and values for the velocity and acceleration of a car. Describe what the car is doing in each case.
       a. Velocity: Is the car moving forward, backwards, or not moving.
       b. Acceleration: Is the car speeding up, slowing down, or maintaining its speed.

	Velocity	Acceleration
a	Positive	Positive
b	Positive	Negative
c	Positive	Zero
d	Negative	Positive
e	Negative	Negative
f	Negative	Zero
g	Zero	Positive
h	Zero	Negative