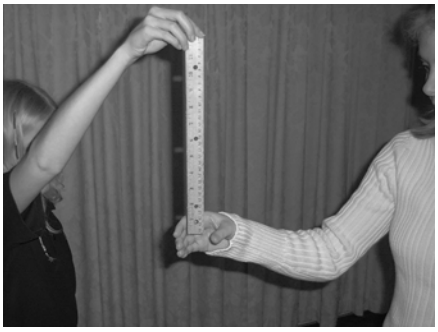
Physics 151 Class Exercise: Reaction Time



Devise a procedure for measuring the reaction time of a student by dropping a ruler between their fingers. You should take into account the variations among students and the inconsistencies in one student's reaction time. Your procedure should not allow anticipation of the ruler drop.

1) Record your position measurements in the table below.

Student	Trial #1	Trial #2	Trial #3	Trial #4	Trial #5	Average
Student #1	14 cm	12 cm	15 cm	11cm	13 cm	13 cm
Student #2						
Student #3						
Student #4						
Final Value						13 cm

2) Determine the average reaction time of a student. Clearly illustrate the freefall equations you are using.

The reaction time will vary considerably based on the procedures used – for example some students hold their fingers 4 inches apart while others only about 1 inch apart. However, the freefall equations supplied should be the same.

Let's assume that on average the ruler falls 13 cm. I will point the y-axis up.

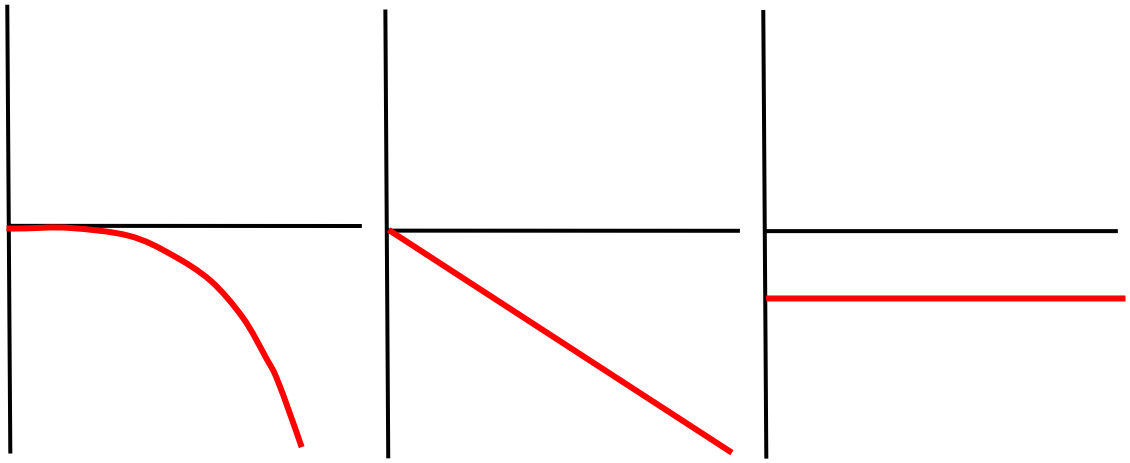
Known:	Solve:	Not Involved:
y = -0.13 m	t	v
$v_0 = 0$		
$a = -9.8\ m/s^2$		

$$y = v_{oy}t + \frac{1}{2}at^2$$

$$t = \sqrt{\frac{2y}{a}} = \sqrt{\frac{2(-0.13m)}{\left(-9.8\frac{m}{s^2}\right)}} = 0.16s$$

3) Draw and label the position, velocity, and acceleration vs. time graphs for the falling ruler. Be sure to describe your coordinate system -- location of the origin and the positive direction.

Position vs. Time Velocity vs. Time Acceleration vs. Time



4) Application: You are driving on a country road 52.0 mph. A deer runs out onto the road and stops in your path 65 m ahead. When you slam on the breaks the car decelerates at a rate of 4.20 m/s^2. Can you react and stop in time?

Clearly show all of your work and assumptions.

Note that this problem has two separate parts since there are two values of acceleration – a = 0 m/s^2 while you are reacting to seeing the deer and pressing the brake and a = -4.2 m/s^2 after pressing the brake.

$$52.0\frac{mi}{hr}\left(\frac{1609m}{1mi}\right)\left(\frac{1hr}{3600s}\right)=23.2\frac{m}{s}$$

Distance Traveled While Reacting (a = 0 m/s^2)

$$x=vt=\left(23.2\frac{m}{s}\right)(0.16s)=3.7m$$

Distance Traveled While Decelerating (a = -4.2 m/s^2)

Known:
- v_0 = 23.2 m/s
- v = 0
- a = -4.2 m/s^2

Solve: x

Not Involved: t

$$v^2=v_0^2+2ax$$

$$x=\frac{v^2-v_0^2}{2a}=\frac{-v_0^2}{2a}=\frac{-\left(23.2\frac{m}{s}\right)^2}{2\left(-4.2\frac{m}{s^2}\right)}=64m$$

64 m + 3.7 m > 65 m Venison for dinner!