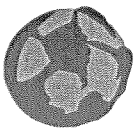
MTA Physics

Rick Steffe
name



Throwing Up at School

Introduction:

For this outdoor activity, pairs of students will throw a ball into the air and perform calculations to determine the height of the throw. This will involve the distance (height) formula for a free-falling object:

$$\Delta d_y = \tfrac{1}{2} g \Delta t^2$$

which can be used to determine how far an object will fall from rest in a given amount of time.

In our case, the ball will not begin at rest, since we are going to throw it. But it will come to "instantaneous" rest at the *apex* of its trajectory. What does *apex* mean?

Apex is the pinnack or highest point the Ball Reaches being thrown up, reaching the highest point on the Y-axis

Recall that the gravitational constant (g) at the surface of the earth is -9.8m/s^2 or -32.2 ft/s^2 for a freely falling object. If we measure the "hang time", we can solve the equation above for Δd_y to determine the height of your throw. Note that, even though we're timing *two* trips (one up and one down), in order to use the Free Fall equation above, we will only consider the second half of the trajectory, when the ball is on its way down from the apex. So our reading should be fairly accurate if we divide our stopwatch value in half.

Each team will need a *designated thrower upper, a timer/recorder* to collect the data for this assignment. List your team's assignments below:

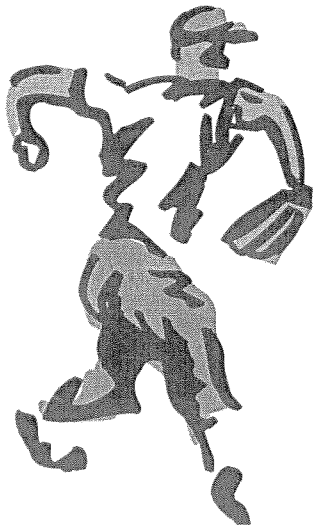
thrower upper: Kurt

timer/recorder: Rick

Procedure:

The thrower will throw the ball high into the air while the timer records the total time that the ball was aloft. The recorder will write down the time that the ball was in the air and both group members will contribute to the calculations. Practice a couple of times before collecting the actual data. Use the space below to gather your data and make your calculations.

time aloft (Δt) = 3.49 s



$\Delta d_y = \frac{1}{2} g \Delta t^2$ formula with variables replaced:

$\Delta d_y = \frac{1}{2} \cdot 9.8 \cdot 3.49^2$

height of highest team throw = 59.7 m

Now, you can "back calculate" the launch speed using the velocity formula:

$v_i = - v_f = gt$. $-9.8 \cdot 3.49 = 112.3$ $V_i = -V_f = 112.378$

Remember that, in this case, we're only considering one of the two trips (the trip down) so remember to cut your value for t in half before you plug it into the formula.

Compare your answer with the other teams to see whether your launch speed and height make sense.

cut t in half

Launch speed of your team's highest throw= 54.2 m/s