

AP Physics - Kinematics - Day 6

Note Title

8/29/2007

Projectile Motion: 1-D

There is a limited number of questions I could ask related to the 1-D flight of a ball:

How high? (Δx from launch to top)

Time to top? (Δt from launch to top)

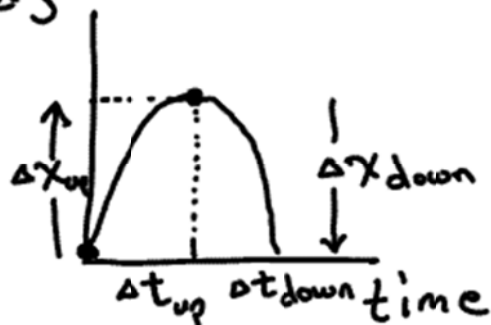
Time of flight? (Δt from launch to landing)

Initial speed? (v_i)

Speed on impact? (v_f at landing)

Example: If I throw a ball up from ground and it lands 10 seconds later, how high did it go?

Picture
height



Assume that ball is launched from ground

1. Recognize that flight is symmetrical:

$$\Delta t_{up} = \Delta t_{down}$$

and

$$\Delta x_{up} = -\Delta x_{down}$$

$$\rightarrow \Delta t_{up} = \frac{1}{2} \text{ of total} = 5 \text{ seconds}$$

2. If we try to use problem solving technique right now, we get

(assume up = positive)

Givens

$$\Delta t_{\text{up}} = 5 \text{ s}$$

$$a = -9.8 \text{ m/s}^2$$

$$v_f = 0 \text{ m/s at top of flight}$$

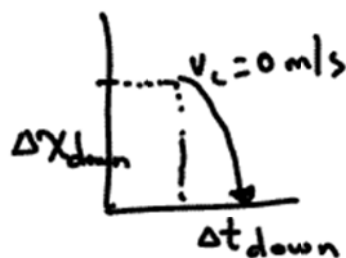
Unknown

$$\Delta X_{\text{up}} = ?$$

The problem is that there is no single equation we have learned to solve this in one step.

So what do we do?

→ Use the trip down instead of up:



Given

$$\Delta t_{\text{down}} = 5 \text{ s}$$

$$a = -9.8 \text{ m/s}^2$$

$$v_i = 0 \text{ m/s}$$

Unknown

$$\Delta X_{\text{down}} = ?$$

Equation

$$\Delta X_{\text{down}} = v_i t + \frac{1}{2} a t^2$$

Solution:

$$\Delta x_{\text{down}} = (0)(5) + \frac{1}{2}(-9.8)(5)^2$$

$$\Delta x_{\text{down}} = -122.5 \text{ m}$$

\therefore Max height $\approx 120 \text{ m}$