Answer on Question #49875, Physics, Mechanics | Kinematics | Dynamics

Question:

If a ball is thrown vertically upward from the roof of 58.8 m , when will it fall on the earth?? the solution is like this let the upper direction is positive then we can write $h = ut - 1/2gt^2$ and t=6s .

My question is why h =10 is used here. i have thrown the ball from 58.8m upward. then it should have a height to the up and when it will fall downward then after crossing the roof it should have a height of 58.8m. so why in these case that upper height is not used .

My same question is also for projectile thrown from a height. there, also the upper height is not counted why?? why only the given height is used to solve the problems.

Solution:

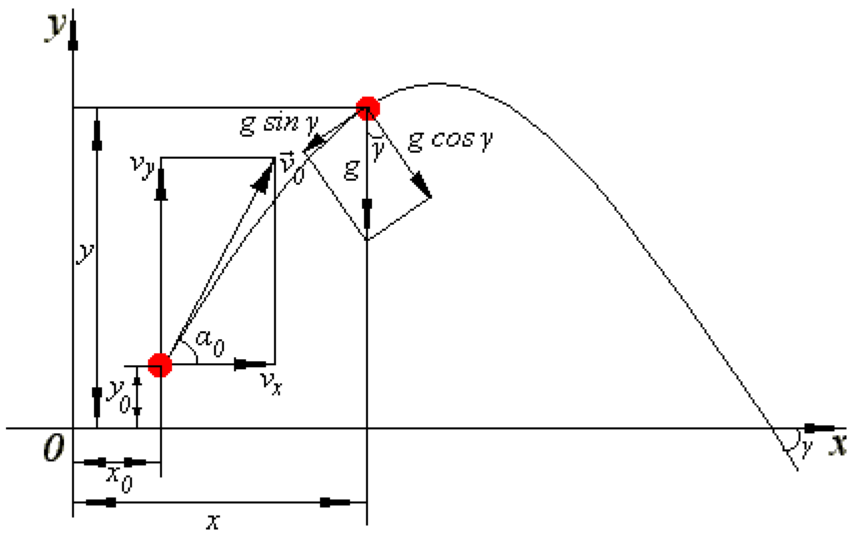

Fig. 1

We use the Cartesian coordinate system to answer to your question (see Fig. 1). Here (x_0, y_0) are the initial coordinates; v_0 is the initial velocity.

The velocity projections on the coordinate axes are given by Eq. (1).

$$\begin{cases} v_x = v_0 \cos\alpha_0 \\ v_y = v_0 \sin\alpha_0 - gt \end{cases}, \qquad (1)$$

where g is gravitational acceleration; α is the angle between the initial velocity vector and the axis of abscissas.

The variation of ball`s coordinates with time can be given by Eq.(2).

$$\begin{cases} x(t) = \int v_x dt = \int v_0 \cos\alpha_0 dt = A + v_0 \, t \cos\alpha_0 \\ y(t) = \int (v_0 \sin\alpha_0 - gt) dt = B + v_0 t \sin\alpha_0 - \dfrac{gt^2}{2} \end{cases} \quad (2)$$

where A and B are integration constants. We find them from the initial conditions ($x(0) = x_0$, $y(0) = y_0$).

Then

$$\begin{cases} x(0) = A = x_0 \\ y(0) = B = y_0 \end{cases} \quad (3)$$

From Eq. (2) – (3) we get:

$$\begin{cases} x(t) = x_0 + v_0 \, t \cos\alpha_0 \\ y(t) = y_0 + v_0 t \sin\alpha_0 - \dfrac{gt^2}{2} \end{cases} \quad (4)$$

According to the Eq. (4) we do not need to know the height of the maximum lift, to find the time of motion. When the ball falls to the ground the ordinate value will be zero (see Eq. (5)).

$$y_0 + v_0 t \sin\alpha_0 - \frac{gt^2}{2} = 0 \quad (5)$$

Equation (5) analogous to the equation that you have written.

Answer:

Hence, to determine the time of motion we need only y_0, v_0 and α_0.