Answer on Question #44990-Physics-Mechanics-Kinematics-Dynamics

A projectile is thrown with a speed v at an angle θ with upward vertical. Its average velocity between the instants at which it crosses half the maximum height

Solution

The displacement between the instants when it crosses half the maximum heights is only horizontal ($h_1 = h_2 = \frac{h_{\text{maximum}}}{2}$): $h_2 - h_1 = 0$. Means the y-component of displacement is zero between these two instants.

Means the y-component of the average velocity is zero:

$$h_2 - h_1 = \bar{v}_y(t_2 - t_1) = 0 \rightarrow \bar{v}_y = 0.$$

It means there is only x-component (horizontal) of average velocity will remain:

$$\bar{v} = \bar{v}_x.$$

But the x-component of the velocity of a projectile does not change. So average velocity is

$\bar{v} = \bar{v}_x = v_x = v \sin\theta$, horizontal and in the plane of projection.