

Question #16215

Let v_0 denote the velocity at horizontal part of the track, and v_0' denote the velocity at the end of the upward part of the track. First, let's find v_0' , using the law of conservation of energy:

$$\frac{m v_0^2}{2} = \frac{m v_0'^2}{2} + mgh \Rightarrow v_0'^2 = v_0^2 - 2gh \quad (1)$$

Then, for the movement from the end of the upward part of the track:

$$S_x = v_0' \cos \varphi t$$

$$S_y = v_0' \sin \varphi t - \frac{gt^2}{2} \quad (2)$$

Find the maximum of S_y : $\frac{dS_y}{dt} = v_0' \sin \varphi - gt = 0 \Rightarrow T = \frac{v_0' \sin \varphi}{g}$ (3)

At this moment of time, the skateboarder will reach the maximum height.

Plugging (3) into (2), obtain: $H_{max} = \frac{v_0'^2 \sin^2 \varphi}{2g}$. Plugging (1) into latter formula, finally obtain:

$$H_{max} = \frac{(v_0^2 - 2gh) \sin^2 \varphi}{2g} = 0.35 \text{ m} .$$