**a boy starts at rest and slides down a frictionless slide. the bottom of the track is a height h above the ground. the boy then leaves the track horizontally, striking the ground at a distance d. using energy methods calculate the initial height H of the boy in terms of h and d**

A boy has a potential energy:

$$W_p = mgH$$

which converts to the kinetic energy:

$$W_k = \frac{mv^2}{2}$$

Initial height:

$$\frac{mv^2}{2} = mgH \rightarrow H = \frac{v^2}{2g}$$

To strike the ground at a distance d:

Time:

$$h = \frac{gt^2}{2} \rightarrow t = \sqrt{\frac{2h}{g}}$$

Boy's speed at the bottom of the track:

$$v = \frac{d}{t} = \frac{d}{\sqrt{\frac{2h}{g}}}$$

Finally:

$$H = \frac{1}{2g}\left(\frac{d}{\sqrt{\frac{2h}{g}}}\right)^2 = \frac{d^2}{4h}$$

**Answer:** $H = \frac{d^2}{4h}$, where $H$ – is the initial height of the track.