

Answer on Question #46908, Physics, Mechanics | Kinematics | Dynamics

A boy throws a ball vertically upward with a speed of 40 m/s and it reaches the maximum height H, If he throws the same ball vertically downward from a height of H with initial speed of 40m/s, The ball will reach ground with speed nearly:

The maximum height H is:

$$H = \frac{v_0^2}{2g}$$

If the ball will be thrown with initial speed then:

$$H = v_0 t + \frac{gt^2}{2}$$

Where $t = \frac{v_{end} - v_0}{g}$

$$H = v_0 \frac{v_{end} - v_0}{g} + \frac{g \left(\frac{v_{end} - v_0}{g} \right)^2}{2} = \frac{v_0^2}{2g}$$

$$2v_0(v_{end} - v_0) + (v_{end} - v_0)^2 = v_0^2$$

$$(v_{end} - v_0)^2 + 2v_0(v_{end} - v_0) - v_0^2 = 0$$

$$(v_{end} - v_0 + v_0)^2 - 2v_0^2 = 0$$

$$(v_{end})^2 = 2v_0^2$$

$$v_{end} = v_0 \sqrt{2}$$

$$v_{end} = 40 \frac{m}{s} \sqrt{2} \approx 57 \frac{m}{s}$$

Answer: The ball will reach ground with speed nearly $v_{end} \approx 57 \frac{m}{s}$