**Description:** The initial speed and time of flight for a flea's leap are calculated.

Constants | Periodic Table

In this problem, you will apply kinematic equations to a jumping flea. Take the magnitude of free-fall acceleration to be 9.80 $\mathrm{m/s^2}$ . Ignore air resistance.

## Part A

A flea jumps straight up to a maximum height of 0.460 $\mathrm{m}$ . What is its initial velocity $v_0$ as it leaves the ground?

**Express your answer in meters per second to three significant figures.**

**View Available Hint(s)** (3)

ANSWER:

$v_0 = \sqrt{2gh} = 3.00 \quad \mathrm{m/s}$

## Part B

How long is the flea in the air from the time it jumps to the time it hits the ground?

**Express your answer in seconds to three significant figures.**

**View Available Hint(s)** (3)

ANSWER:

time in air = $2\sqrt{\frac{2h}{g}} = 0.613 \quad \mathrm{s}$

Notice that the time for the flea to rise to its maximum height is equal to the time it takes for it to fall from that height back to the ground. This is a general feature of projectile motion (any motion with $a = -g$) when air resistance is neglected and the landing point is at the same height as the launch point.

There is also a way to find the total time in the air in one step: just use

$$y = y_0 + v_0 t + \tfrac{1}{2} a_y t^2$$

and realize that you are looking for the value of $t$ for which $y = y_0$.