Answer on Question #51067, Physics, Mechanics | Kinematics | Dynamics

A monkey in a perch 20 m high in a tree drops a coconut above the head of a zoo keeper as he runs with a speed 1.5 m/s beneath the tree actually intending to hit the toes of the zoo keeper. How early in seconds should the coconut be dropped by the monkey?

Solution:

We consider the downward motion of the coconut:

$$h = v_0 t + \frac{1}{2} g t^2$$

We also can note the given data according to the condition of the task, h= 20 m, v = $1.5 \frac{m}{s}$ $g = 9.8 \frac{m}{sec^2}$, $v_0 = 0$.

Now we can determine the time for the coconut to hit the ground.

$$h = \frac{1}{2} g t^2$$

We express t from the noted above formula.

$$\frac{g t^2}{2} = h => g t^2 = 2h$$

Thus the value of time will be equal to.

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

We substitute the given values into the formula.

$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \cdot 20m}{9.8 \frac{m}{sec^2}}} = \sqrt{4.0816 sec^2} = 2.0203 \text{ sec}$$

This mean the monkey should drop the coconut 2.0203 seconds before zoo keeper will run beneath the tree.

The distance covered by the zoo keeper will be equal to

$$s = vt$$

We substitute the obtained value of the time into the formula noted above.

$$s = 1.5 \frac{m}{s} \cdot 2.0203 \text{ sec} = 3.0305 \text{ m}.$$