Answer on Question #56978, Physics / Other

A fisherman has caught a very large, 5.0 kg fish from a dock that is 2.0 m above the water. He is using lightweight fishing line that will break under a tension of 53 N or more. He is eager to get the fish to the dock in the shortest possible time.

If the fish is at rest at the water's surface, what's the least amount of time in which the fisherman can raise the fish to the dock without losing it?

Solution:

Given:

$m = 5.0\ \text{kg},$

$d = 2.0\ \text{m},$

$T = 53\ \text{N},$

$t = ?$

The magnitude of tension force is equated to the product of the mass times the acceleration:

$$T = m(a + g)$$

where g = 9.81 m/s^2.

Thus,

$$a = \frac{T - mg}{m} = \frac{53 - 5.0 \cdot 9.81}{5} = 0.79\ \text{m/s}^2$$

Kinematics equation

$$d = v_0 t + \frac{at^2}{2}$$

where $v_0 = 0\ m/s$ is initial speed.

Thus time is

$$t = \sqrt{\frac{2d}{a}} = \sqrt{\frac{2 \cdot 2.0}{0.79}} = 2.25\ \text{s}$$

Answer: $2.25\ \text{s}$