Practice Motion Problem

PSC 100

A 155 pound diver (1 kg = 2.20 pounds) steps off a diving platform 25 meters above the water.

a. How long before he hits the water? (note below using y not x because motion is vertical)

y = at2/2 so t = t = (on the bottom is m/s2 but my word processor won’t

t = 2.26 sec do that)

b. What is his average velocity on the way down to the water and what is the instantaneous

velocity when he hits the water?

vavge  = y/t = 25m/2.26 sec = 11.1 m/sec

a = Δv/Δt so aΔt = Δv (9.8m/s2)(2.26 s) = t = 22.1 m/sec

Upon hitting the water, a frictional force of 3000N, pointing upward, is applied to the diver’s body.

c. Calculate the acceleration of the diver due to this force.

a = F/m 155 pounds x 1kg/2/20 pounds =70.5 kg

a = 3000N/70.5 kg = 42.6 m/sec2 (note this is more than 4 g’s!)

technically, a = -42.6 m/sec2 because the diver is slowing down.

d. How long will it take for his body to come to a stop?

a = Δv/Δt so Δt = Δv/a Δt = (22.1m/s)/(42.6m/s2) = 0.52 sec

e. Will he hit his head on the bottom of the pool, which is 4.0 meters deep?

y = at2/2 x = (42m/s2)(0.52sec)2/2 (I’m using y because motion is vertical)

y = 5.7 m Yes, he hits his head on the bottom of the pool!

f. Graph a, v and y versus t for this event.