Solutions

Physics 6A Midterm II 8 am Quarter: Fall 2011 Instructor: Sue Carter

1a -- 12 pts) You are Dave are just about to plunge over a cliff, but you land on a spider web-like net. The net, with a spring constant of 120 N/m stretches 1 m, and propels you (mass=60 kg) upwards. What is your initial velocity after release?

$\Delta K = \Delta U$ $\quad \frac{1}{2}kx^2 = \frac{1}{2}mv^2$

or $v = \sqrt{\frac{kx^2}{m}} = \sqrt{\frac{120\ N/m \cdot (1m)^2}{60\ kg}} = \sqrt{2}\ m/s$ or $1.414\ m/s$

Note: -2 is he didn't take square root

Note: If the force of gravity was completely applied to the spider net $F_{sp} = F_g$ or $Kx = mg$

$x = \frac{mg}{K} = \frac{60\ kg \cdot 9.8\ m/s^2}{120\ N/m} = 5\ m$ => so the entire mass is not used to stretch the spring.

1b – 13 pts) Safely landing, you find yourself at the entrance of what was once a luxurious hotel that was sunken in an earthquake. The old hotel is powered at night by a reservoir which holds 1 x 10^5 kg of sea water at a height of 100 m above the ocean floor. The generators located at the ocean floor produce 10 kW of power. How long can the generators run before the reservoir is empty?

$\Delta U = mgh = \Delta E$

$P = \frac{\Delta E}{\Delta t}$ so $\Delta t = \frac{\Delta E}{P} = \frac{mgh}{10\ kW}$

$\Delta t = \frac{1 \times 10^5\ kg \times 9.8\ m/s^2 \cdot 100\ m}{10\ kW}$

$= 9800\ s$ or 2.72 hours