

Answer on Question 57618, Physics, Other

Question:

A 70 kg person falls from a height of 5.0 m onto a concrete surface. The person lands stiff legged on his feet so that it only takes 0.0020 s for him to decelerate. What impulse does the person receive?

Answer:

By the definition of the impulse we have:

$$J = m\Delta v = mv_2 - mv_1 = m(v_2 - v_1),$$

here, m is the mass of the person, v_1 is the initial velocity of the person, v_2 is the final velocity of the person (just before the landing).

We can find the velocity of the person just before the landing from the Law of Conservation of Energy:

$$PE = KE,$$

$$mgh = \frac{1}{2}mv_2^2,$$

$$v_2 = \sqrt{2gh} = \sqrt{2 \cdot 9.8 \frac{m}{s^2} \cdot 5.0 m} = 9.9 \frac{m}{s}.$$

Then, substituting v_2 into the first formula we get:

$$J = m(v_2 - v_1) = 70 kg \cdot \left(9.9 \frac{m}{s} - 0 \frac{m}{s}\right) = 693 kg \frac{m}{s}.$$

Answer:

$$J = 693 kg \frac{m}{s}.$$