

## Physics 10154 - Exam #6A

Answer the following two questions. Be sure to clearly indicate your answer with a circle or box. Show all work. If I cannot see how you arrived at an answer, I will deduct points!

1. A 725-N diver jumps horizontally off of a platform and falls 7.50 meters into the water. He comes to a stop in 2.20 seconds after hitting the surface. What average force did the water exert on the man?

$$m = \frac{725}{9.8} = 74 \text{ kg}$$

Fall

$$\Delta y = 7.50 \text{ m} \quad v^2 = v_0^2 + 2a\Delta y$$
$$v_0 = 0 \quad = 0 + 2(9.8)(7.5)$$
$$v = ? \quad v = 12.1 \text{ m/s}$$
$$a = 9.8 \text{ m/s}^2$$
$$t = ?$$

Water

$$\Delta y = ?$$
$$v_0 = 12.1 \text{ m/s}$$
$$v = 0$$
$$a = ?$$
$$t = 2.2 \text{ s}$$
$$F_{\text{avg}} = \frac{mv - mv_0}{\Delta t}$$
$$= \frac{74(0) - 74(12.1)}{2.2}$$

$$= 408 \text{ N}$$

or 408 N, ↑

2. On a frictionless track, a 5.0-kg cart with a magnetic bumper strikes a 7.0-kg metal cart initially at rest. The carts stick together after the impact and run into a relaxed spring ( $k = 250 \text{ N/m}$ ), compressing the spring by a maximum amount of 1.2 m. What was the initial speed of the 5.0-kg cart?

Collision

$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

$$5 v_{1i} + 0 = 12 v_f$$

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Spring

$$\Sigma W_F = W_{spr} = 0 - \frac{1}{2} m v_0^2$$

$$- \frac{1}{2} k x^2 = - \frac{1}{2} m v_0^2$$

$$v_0^2 = \frac{k x^2}{m}$$

$$= \frac{(250)(1.2)^2}{12}$$

$$v_0 = 5.47 \text{ m/s} = v_f \text{ from pt 1}$$

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$$5 v_{1i} = 12(5.47)$$

$$v_{1i} = 13 \text{ m/s}$$