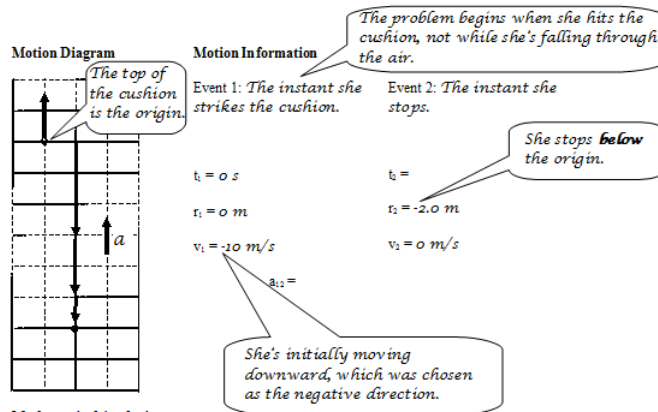


A pole-vaulter, just before touching the cushion on which she lands after a jump, is falling downward at a speed of 10 m/s. The pole-vaulter sinks about 2.0 m into the cushion before stopping.



Mathematical Analysis

$$v_2 = v_1 + a_{12}(t_2 - t_1)$$

$$0 = -10 + a_{12}(t_2 - 0)$$

$$a_{12} = \frac{10}{t_2}$$

Now substitute this expression into the other equation:

$$a_{12} = \frac{10}{0.4}$$

$$a_{12} = 25 \text{ m/s}^2$$

The acceleration is positive, as it should be since the jumper is moving downward and slowing down.

$$r_2 = r_1 + v_1(t_2 - t_1) + \frac{1}{2}a_{12}(t_2 - t_1)^2$$

$$-2 = 0 - 10(t_2 - 0) + \frac{1}{2}a_{12}(t_2 - 0)^2$$

$$-2 = -10t_2 + \frac{1}{2}a_{12}t_2^2$$

$$-2 = -10t_2 + \frac{1}{2}\left(\frac{10}{t_2}\right)t_2^2$$

$$-2 = -10t_2 + 5t_2$$

$$-2 = -5t_2$$

$$t_2 = 0.4 \text{ s}$$

Substitute this result back into the original equation: