20-R-IM-PT-8

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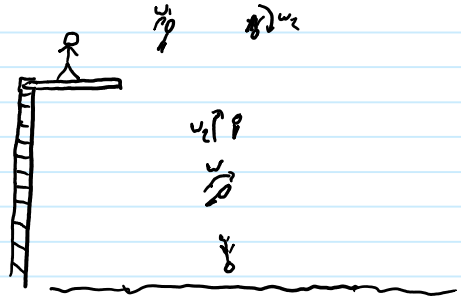
A high diver jumps from their diving board 23m from the water, starts the dive fully extended, with an angular momentum of 1.4 rad/s. Then they bring in their body to complete a several rotations before extending once again , and landing in the water. If the persons center of mass is 25.4 m above the water when they start to tuck, and 0.6m above the water when they complete the tuck, how much revolutions can they complete before they have to extend into the water? Assume that, when fully extended the divers body can be considered as a rod with 1.85m, and when they tuck, their body can be considered as a rod of half that length, with a mass of 83kg. Also assume that at the top of their jump, their velocity is 0 in the vertical direction.



$(H_{sys})_1 = (H_{sys})_2$

$I_1 w_1 = I_2 w_2$

$w_2 = \frac{I_1 w_1}{I_2}$

$I_1 = \frac{1}{12} m L_1^2 \qquad L_1 = 1.85m \quad m = 83kg$

$I_1 = \frac{1}{12}(83)(1.85)^2 = 23.67$

$I_2 = \frac{1}{12} m L_2^2 \qquad L_2 = 0.925m \quad m = 83kg$

$= \frac{1}{12}(83)(0.925)^2 = 5.918$

$w_1 = 1.4 \text{ rad/s}$

$w_2 = \frac{23.67 \cdot 1.4}{5.918} = 5.599 \text{ rad/s}$

$w_2 = \frac{5.599 \text{ rad/s}}{2\pi} = 0.891 \text{ rev/s}$

$N_{rev} = t \cdot w_2$

$d = v_0 \cdot t + \frac{1}{2} a t^2 \qquad v_0 = 0$

$d = \frac{1}{2} a t^2 \qquad t = \sqrt{\frac{2 \cdot d}{a}} \qquad d = 25.4 - 0.6 = 24.8 m \qquad a = 9.8 m/s^2$

$t = \sqrt{\frac{2 \cdot 24.8}{9.81}}$

$t = 2.25s$

$N_{rev} = 2.13 \cdot 0.89 = 2.001 = 2$

The diver completes 2 revolutions