

Dynamics problems

1. A bicycle is moving at 10 m/s. What is the angular speed of its tires if their radius is 30 cm? (33 s^{-1})
2. A tension of 6000 Newtons is experienced by the elevator cable of an elevator moving upwards with an acceleration of 2 m/s^2 . What is the mass of the elevator? (500 kg)
3. A man drops a 10 kg rock from the top of a ladder of height 5 m. What is its speed just before it hits the ground? What is its Kinetic Energy when it reaches the ground? ($v = 10 \text{ m/s}$, $E = 500 \text{ J}$)
4. The heart pumps 5.6 l blood through the aorta of 1 cm radius in one minute. What is the average flow velocity of the blood in the aorta? (30 cm/s)
5. What wavelengths correspond to the 27 MHz and 2.37 GHz frequency of the heat therapy generators? (11 m and 12.6 cm respectively)
6. If a spring has a spring constant of 400 N/m, how much work is required to compress the spring 25.0 cm from its undisturbed position? (12.5 J)
7. A compressed spring that obeys Hooke's law has a potential energy of 18 J. If the spring constant of the spring is 400 N/m, find the distance by which the spring is compressed. (30 cm)
8. Collagen fiber is stressed with 12 N force. The cross-sectional area of the fiber is 3 mm^2 , its coefficient of elasticity is 500 MPa. Give the percentage of relative extension. (0.8 %)
9. The length of an elastic thread used in orthodontics is 6 cm, its cross-sectional area is 1 mm^2 , its coefficient of elasticity is 5 MPa. We extend the thread with 40 %. How large is the retracting force and what is the amount of elastic energy stored in the thread? ($F = 2 \text{ N}$, $E = 24 \text{ mJ}$)