

Physics 290 – Winter 2004

Assignment 2

Due January 22, 2004

1. If you press down on a flat surface with your hand and palm, your forearm acts as a class 1 lever. (See picture with Problem 3.6 on page 50 of Cameron). Find the tension in the tricep and the force on your humerus if your palm exerts a downward force of 100 N (about 22 lbs). Is the humerus in compression or tension?
2. The tricep muscle exerts the force on the ulna by way of the tension in the muscle as it contracts. Estimate the cross sectional area of your tricep and use this to estimate the force exerted by one myosin II fiber on an actin fiber. To make this estimate, assume each actin–myosin II fiber pair occupies a cylinder with 10 nm radius.
My femur can be represented as a 0.6 m long, 1.5 cm radius, shaft of compact bone with Young's modulus, compression and tensile strength given in table 4.2, page 97 of Cameron. Assume that 50 kg of my body mass is in my upper body, but that I am carrying a 30 kg back pack, for a total of 80 kg.
3. Imagine me standing on one leg, then shifting ALL MY WEIGHT to the other leg. How much does my femur compress as it bears all my weight?
4. If I jump from a height of 1 meter with stiff legs onto an unyielding solid rock ledge, how much must my shoes, feet, and the cartilage in my knee “give” to prevent a compression fracture of the femur?
5. Actually the femur would not be the most likely leg bone to break. Why would you expect the tibia to be more likely to break. (To answer this you may want to consult a book on skeletal anatomy to see the sizes and placement of the bones in the leg.)