Exercises lecture 8

Exercise 8.1

Imagine a game character weighting $80\ kg$ standing straight on a flat ground. His feet are both represented by 15cmx5cmx3cm boxes (3 cm is the height).
What is the stress produced by a foot on the floor over the contact surface?

Exercise 8.2

Muscles can stretch and compress along a preferred direction, the fiber. Imagine a game character doing pushups. At rest the medial axis of his biceps is 25 cm long and during maximal contraction is 17 cm long.
What is the strain of the muscle during maximal contraction?

Exercise 8.3

If the internal force occurring in the muscle of exercise 8.2 during the pushups is -100 N and the average cross section area of the biceps is 4 cm^2, what is the Young's modulus of the muscle?

Exercise 8.4

Imagine a game character is celebrating his birthday and is blowing candles on a jello cake. The force of the blow is directed towards the top surface of the cake and is of magnitude 0.1 N. The cake is a cylinder of radius 8 cm and height 10 cm. During the blow, the top of the cake has moved 2 cm in the direction of the force, and the candles have been extinguished!
What is the shear modulus of the jello cake?

Exercise 8.5

A game character needs to operate a water gun. For that, an air compartment is designed in the cylindrical barrel of the gun of radius 2 cm and length 10 cm. The character has to compress the air before release (the air will push the water out of the gun). The Bulk modulus of air is 10^5 Pa.
What force is needed to compress the air within half of the barrel?