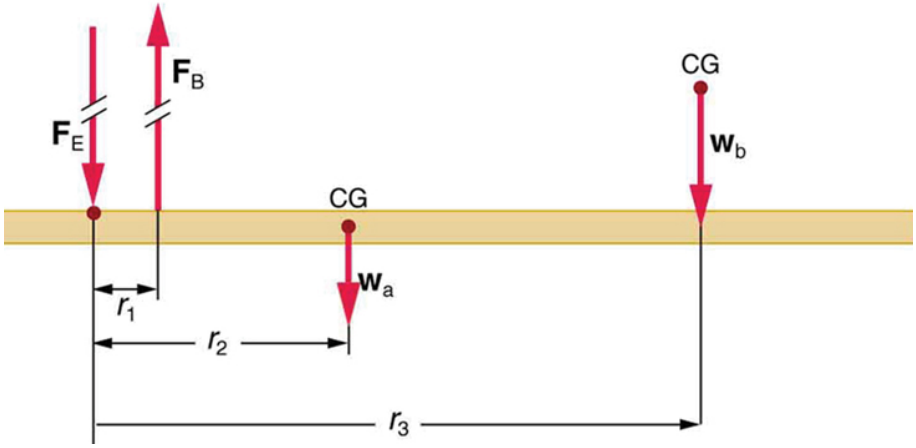
Answer on Question #72486-Physics-Other

How much force Fb must an athlete's biceps apply to a 0.38m forearm to support a 39.2N weight held at 90 degrees? Assume that the forearm weight is 21.56N and that muscle is attached to the bone 0.05m from the joint.

Solution



$$r_1 = 0.05\ m, r_2 = \frac{r_3}{2} = 0.19\ m, r_3 = 0.38\ m.$$

From the equilibrium:

$$F_b = W_a + W_b + F_e$$

$$F_e r_1 = W_a(r_2 - r_1) + W_b(r_3 - r_1)$$

$$F_b = W_a + W_b + W_a\left(\frac{r_2}{r_1} - 1\right) + W_b\left(\frac{r_3}{r_1} - 1\right)$$

$$F_b = \frac{W_a r_2 + W_b r_3}{r_1} = \frac{(21.56)(0.19) + (39.2)(0.38)}{0.05} = 380\ N.$$

Answer: 380 N.

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