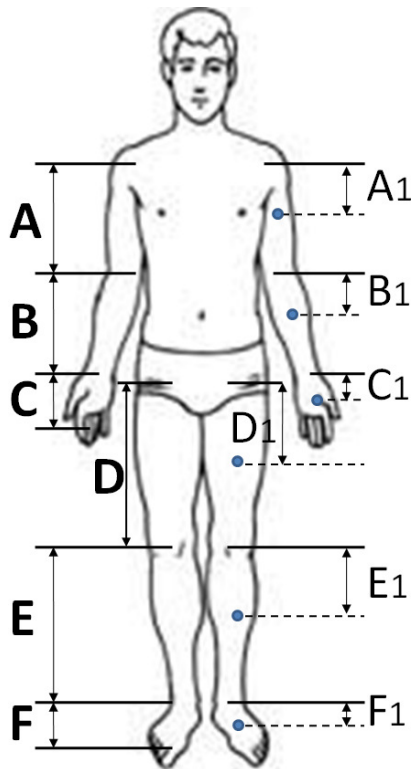


EGBE260: Week 7 Homework (Biomedical Applications)

Useful Data that will be provided in Exams:

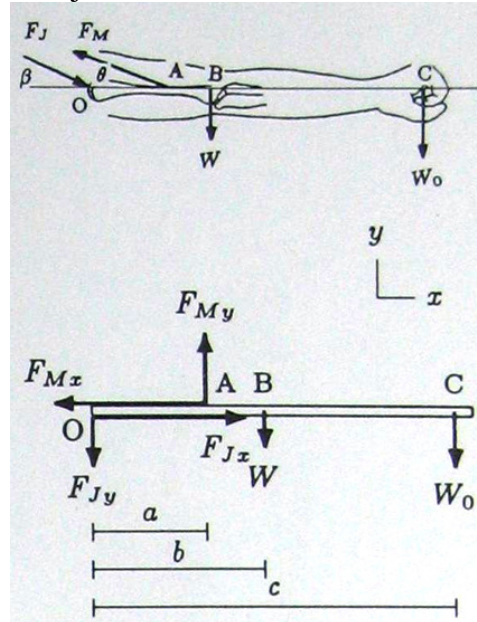
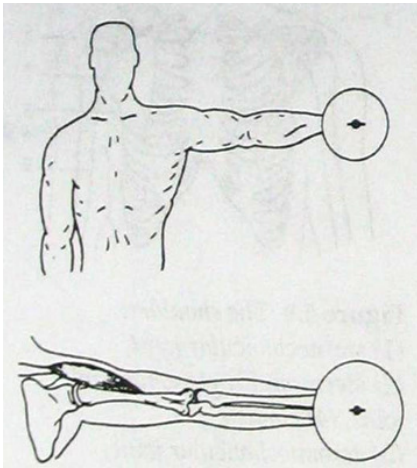


| Segment | Segment Weight / Total Body Weight | Segment Length / Height | Proximal COM / Segment Length |
|-------------|------------------------------------|-------------------------|-------------------------------|
| Upper Arm | 2.8% | A 18.6% | A1 43.6% |
| Forearm | 1.6% | B 14.6% | B1 43.0% |
| Hand | 0.6% | C 10.8% | C1 50.6% |
| Thigh | 10.0% | D 24.5% | D1 43.3% |
| Shank | 4.7% | E 24.6% | E1 43.3% |
| Foot | 1.5% | F 3.9% | F1 50.0% |
| Trunk | 49.7% | G 34.0% | G1 50.0% |
| Head & Neck | 8.1% | H 18.2% | |

5.2. Consider a person doing arm exercises.
 He weighs 145 kg and he is 218 cm tall (he is a giant!)
 $\theta=15^\circ$.

W_0 (weight of the dumbbell) = 60N
 $a=15$ cm, $c=60$ cm.

What is the magnitude of FM exerted by the deltoid muscle, and what is the magnitude and direction of the reaction force at the shoulder joint?



Answers: (Preliminary answers: $W=40$ N, $b=30$ cm), $F_M=1236$ N, $F_J=1214$ N, $\beta=10^\circ$.

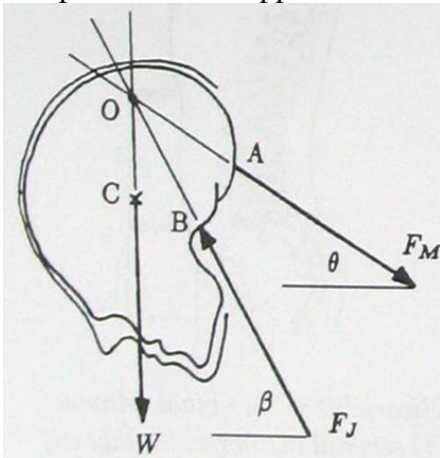
5.3. Consider the head and neck shown below.

W is 50 N.

$\theta=30^\circ$

$\beta=60^\circ$

What tension must the neck flexor muscles exert to support the head? What is the compressive force applied on the first cervical vertebra at the atlantooccipital joint?

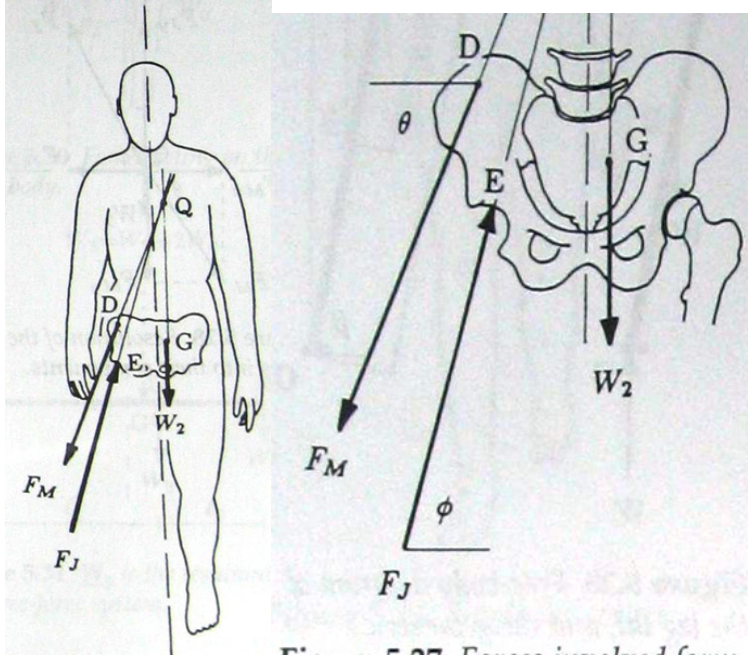


Answers: $F_M=50$ N, $F_J=86$ N.

5.5. Determine the force exerted on the hip abductor muscles and the joint reaction force at the hip to support the leg and the hip in the position shown. The person weighs 80 kg.

$\theta = 70^\circ$

$\phi = 74.8^\circ$



Answers: $F_M = 2040\text{N}$, $F_J = 2670\text{N}$.

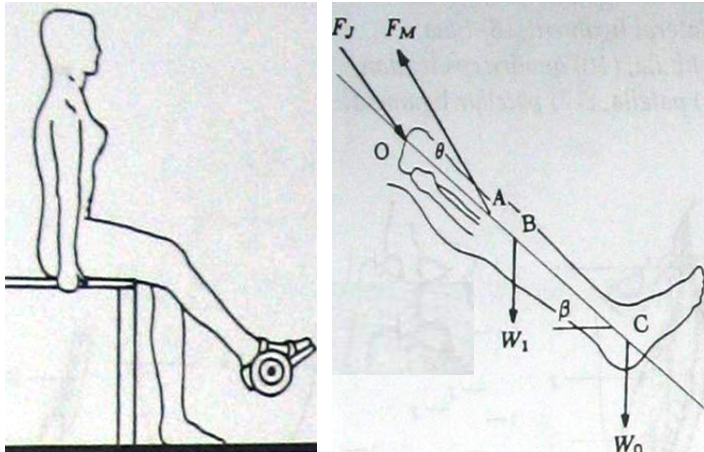
5.6. Consider a 94kg, 198 cm tall person wearing a weight belt around their ankle.

$OA = 12\text{cm}$, $OC = 50\text{cm}$

W_0 (weight belt) = 100N

$\theta = 15^\circ$, $\beta = 45^\circ$

Determine F_M and F_J .



Answers: $F_M = 1381\text{N}$, $F_J = 1171\text{N}$