

## G.A.M.E.S. Structures Camp: Biomechanics Class

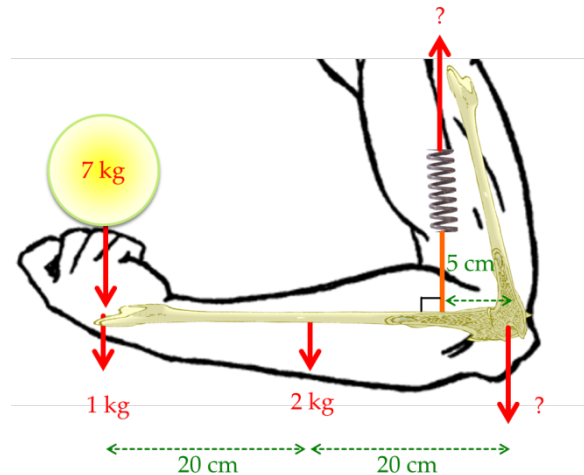
Name: \_\_\_\_\_

What is biomechanics?

Brainstorm... How does physical activity relate to biomechanics?

### Biomechanics Problem

What assumptions are made when modeling the arm and ball?

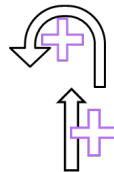


Find the forces in the bicep muscle and humerus bone that result from holding a weight. Here are some things you'll need:

Force = mass  $\times$  acceleration =  $m \times g$

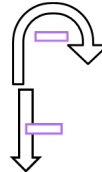
Moment = Force  $\times$  distance =  $F \times d$

$\Sigma M$  = sum of the moments = 0



$kg \times m/s^2 = N$

$\Sigma F$  = sum of the forces = 0



$g = 10 m/s^2$

Distance is measured in meters! (not centimeters)

First find the force in the bicep by summing the moments about the elbow.

### Step 1: Find forces

Known

Unknown

$F_{\text{ball}} =$	$F_{\text{bicep}} = ?$
$F_{\text{hand}} =$	$F_{\text{bone}} = ?$
$F_{\text{forearm}} =$	

### Step 2: Find moments

Known

Unknown

$M_{\text{ball}} =$	$M_{\text{bicep}} = ?$
$M_{\text{hand}} =$	$M_{\text{bone}} = ?$
$M_{\text{forearm}} =$	

### Step 3: Plug in

$\Sigma M = 0$
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### Step 4: Solve

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Next, solve for the force in the bone by summing the forces in the vertical direction.

**Step 5: Find the forces using Step 1 and Step 4**

Known

Unknown

$F_{\text{ball}} =$	$F_{\text{bone}} = ?$
$F_{\text{hand}} =$	
$F_{\text{forearm}} =$	
$F_{\text{bicep}} =$	

**Step 6: Plug in**

$\Sigma F = 0$
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**Step 7: Solve**

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**Biomechanics problem using your measurements**

<p>Find X by measuring the distance from the middle of your palm to the back of elbow and dividing by 2.</p> <p>X = _____</p>	
<p>Find Y by measuring your upper arm just above your elbow and dividing by 2.</p> <p>Y = _____</p>	
<p>Choose your own mass</p> <p>Mass = _____</p>	

First find the force in the bicep by summing the moments about the elbow.

**Step 1: Find forces**

Known	Unknown
$F_{\text{ball}} =$	$F_{\text{bicep}} = ?$
$F_{\text{hand}} =$	$F_{\text{bone}} = ?$
$F_{\text{forearm}} =$	

**Step 2: Find moments**

Known	Unknown
$M_{\text{ball}} =$	$M_{\text{bicep}} = ?$
$M_{\text{hand}} =$	$M_{\text{bone}} = ?$
$M_{\text{forearm}} =$	

**Step 3: Plug in**

$\Sigma M = 0$
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**Step 4: Solve**

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Next, solve for the force in the bone by summing the forces in the vertical direction.

**Step 5: Find the forces using Step 1 and Step 4**

Known

Unknown

$F_{\text{ball}} =$	$F_{\text{bone}} = ?$
$F_{\text{hand}} =$	
$F_{\text{forearm}} =$	
$F_{\text{bicep}} =$	

**Step 6: Plug in**

$\Sigma F = 0$
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**Step 7: Solve**

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Conclusions from biomechanics problems

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How does exercise relate to biomechanics?

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