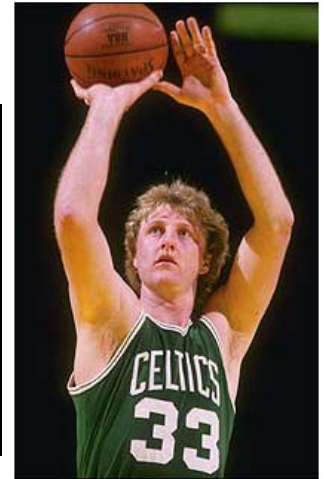


Name _____ Section _____

ES204
Examination III
February 13, 2006

Problem	Score
1	/24
2	/36
3	/40
Total	/100



Show all work for credit
AND
Turn in your signed help sheet
AND
Stay in your seat until the end of class

Name _____
ES204 Examination III **Problem 1**

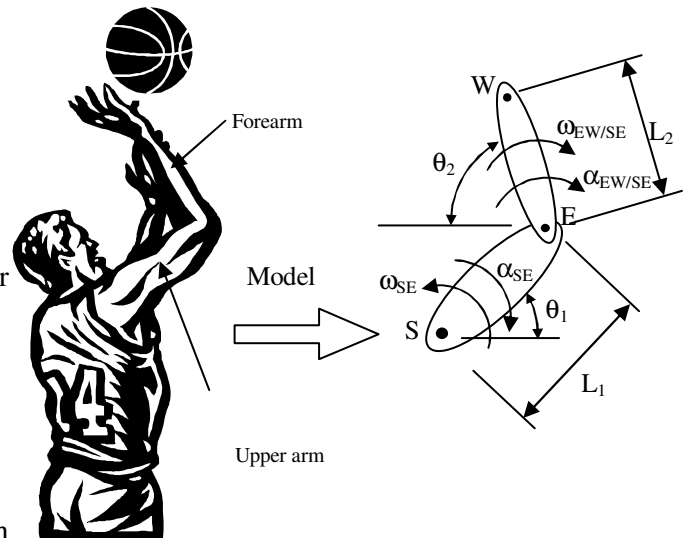
24 pts
Feb. 13, 2006

Short answer not available for putting on the web.

While shooting a jump shot an NBA player has agreed to have sensors placed on his shoulder and elbow joints that measure angle, angular velocity, and angular acceleration. The player is jumping straight up and at the instant shown the player is at the top of his shot. The body of the player has no angular velocity or angular acceleration. Therefore, $\mathbf{V}_s = \mathbf{0}$.

At this instant the shoulder sensor indicates the upper arm has an angle of θ_1 degrees from horizontal, an angular velocity of ω_{SE} CCW and an angular acceleration of α_{SE} CW.

At the elbow joint the sensor indicates that the forearm has an angle of θ_2 degrees as shown, a relative angular velocity of $\omega_{EW/SE}$ CW of the forearm compared to the upper arm, and a relative angular acceleration of $\alpha_{EW/SE}$ CW of the forearm compared to the upper arm. The length from shoulder to elbow is L_1 and the length from the elbow to the wrist is L_2 .



Determine the equations necessary to find the acceleration of the shoulder, S, elbow, E, and wrist, W. **DO NOT SOLVE THE EQUATIONS. You should have a list of SCALAR equations (not vector equations) and a clear list of unknowns.**

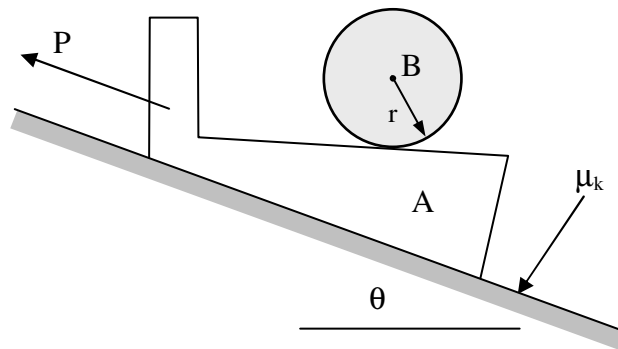
Name _____
ES204 Examination III

Problem 2 (cont.)

36 pts
Feb. 13, 2006

Sled A is being used to transport heavy barrel, B, to the top of a hill. Unfortunately, the barrel was not tied down, so when known force P is applied B rolls without slipping on A. The mass of the barrel, m_B , the mass of the sled, m_A , and the applied force, P , are known.

- Immediate after P is applied **determine the equations necessary** to determine the acceleration of A, the angular acceleration of B and the friction force between A and B. Your answer should consist of a clear list of equations and unknowns. (35 points)
- How would you check to see if your assumption of no slipping is correct? What information would you need to be given. (5 pts)



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Problem 3 (cont.)

36 pts
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