HSS 409/537: Kinesiology/Biomechanics
Lecture Exam 1
Name_____

Please circle the correct response(s). There may be 0-4 correct responses for each item. For all projectile motion problems, assume no air resistance.

1. For a football field goal, kicked at an initial angle of 45^o off of the ground and <u>just</u> passing over the uprights at 10' high:
    a. Vt at peak = 0 (NO; Vt MUST EQUAL Vox SINCE Vty = 0 AT PEAK)
    b. Vt at uprights < Vo (YES; UPRIGHTS ARE HIGHER THAN TAKE-OFF POINT SO THE Vt MUST BE LOWER AT THE UPRIGHTS THAN Vo)
    c. Vox = Vtx at peak (YES; VELOCITY IN THE X-DIRECTION DOES NOT CHANGE)
    d. Vo under these conditions is the lowest possible Vo at any angle to clear the uprights (NO; P.286; IF OBJECT LANDS ABOVE RELEASE HEIGHT, INITIAL ANGLE SHOULD BE MORE THAN 45^o TO OPTIMIZE RANGE)

2. Acceleration for the ball in 1. above:
    a. Changes at a constant rate in the x-direction (NO; ACCELERATION IN THE X-DIRECTION DOES NOT CHANGE AT ALL; IT EQUALS 0)
    b. Changes at a constant rate in the y-direction (NO; ACCELERATION IN THE Y-DIRECTION IS CONSTANT , AT 9.8 M/S^2)
    c. At peak in the y-direction, equals 0 (NO; ACCELERATION IN THE Y-DIRECTION IS CONSTANT, AT 9.8 M/S^2; IT IS NEVER 0)
    d. At the uprights, equals 9.8 m/s^2 (YES; BECAUSE ACCELERATION IN THE X-DIRECTION EQUALS 0 AND ACCELERATION IN THE Y-DIRECTION EQUALS 9.8 M/S^2 SO THE RESULTANT EQUALS 9.8 M/S^2)

3. For a basketball foul shot with a take-off height of 6'and the ball landing at 45^o when passing through the hoop at 10':
    a. Vt at the hoop must be less in magnitude than Vo (YES; IF OBJECT LANDS ABOVE RELEASE HEIGHT THEN Vty < Voy AND, SINCE Vx NEVER CHANGES, THEN Vt < Vo)
    b. Voy = -Vty when passing through the hoop (NO; THIS ONLY HAPPENS IF TAKE-OFF AND LANDING ARE AT THE SAME HEIGHT)
    c. At the hoop, Vty = -Vox (YES; LAB 3, SINCE X AND Y COMPONENTS ARE THE SAME (ONLY NEGATIVE OF EACH OTHER) GOING THROUGH THE HOOP, AND Vtx = Vox, THEN Vty = -Vox)
    d. The initial Vo angle must be less than 45^o (NO; P.286; MUST BE LARGER THAN 45^o)

4. In a world class sprinting event:
    a. Acceleration is probably maximal at the start (YES; LAB 2 – MAURICE GREEN AND DONOVAN BAILEY)

b. A negative acceleration happens only in the second half of the race though velocity never actually decreases (NO; LAB 2, VELOCITIES DO DECREASE – INDICATIVE OF A NEGATIVE ACCELERATION)
c. A steadily decreasing acceleration always means that velocity is decreasing (NO; IF ACCELERATION IS STILL POSITIVE, NO MATTER HOW SMALL, VELOCITY IS STILL INCREASING)
d. Acceleration likely reached zero at some point during the race (YES; VERBATIM FROM LAB 2 – SOMEWHERE AROUND THE 65m MARK)

5. For a triceps extension static scenario (hands anterior to the elbows), if all other dimensions, angles, and forces stay the same, the following will always require more muscle force (consider each one individually):
    a. Longer insertion point distance (NO; THIS WILL DECREASE FORCE NECESSARY TO KEEP MUSCLE TORQUE THE SAME)
    b. Longer distance from the elbow axis to the muscle line of pull on the anatomical pulley (NO; P.299, THIS IS THE SAME AS A LARGER RADIUS OF THE ANATOMICAL PULLEY. THIS WILL DECREASE FORCE NECESSARY SINCE THE ROTARY COMPONENT GETS LARGER RELATIVE TO THE ACTUAL FORCE NEEDED)
    c. 20% increase in resistance force and 20% decrease in forearm length (NO; THESE WILL CANCEL EACH OTHER OUT IN THE RESISTANCE TORQUE)
    d. Decrease in the elbow-to-forearm CG distance (YES; THIS WILL DECREASE THE HELPING TORQUE THAT THE FOREARM WEIGHT PROVIDES, THEREBY INCREASING THE MUSCLE FORCE REQUIRED)

6. Compared to the hamstrings, the quadriceps:
    a. Have a constant muscle line-of-pull angle with the leg axis (YES; QUADS HAVE THE ANATOMICAL PULLEY WHICH KEEPS THE ANGLE CONSTANT. HAMSTRINGS DO NOT)
    b. Need to be capable of much more force generation in eccentric movements (YES ; BECAUSE OF THE IMPULSE FORCE OF LANDING AND THE UNFAVORABLE MUSCLE LINE OF PULL ANGLE)
    c. Need to be capable of much more force generation in concentric movements (YES; BECAUSE OF THE UNFAVORABLE MUSCLE LINE OF PULL ANGLE)
    d. Are capable of less maximal torque due to the nature of the anatomical pulley (NO; QUADS STILL ARE CAPABLE OF MUCH MORE TORQUE – THINK OF THE ECCENTRIC DEMANDS)

7. In a muscle static exercise using relatively heavy weights, the torque due to the weight of the segment:
    a. Is always positive (NO; DEPENDS ON THE ORIENTATION OF THE SEGMENT)
    b. Is usually greater in magnitude than that of the muscle (NO; SEGMENT WEIGHT WHEN HEAVY WEIGHTS ARE USED IS ALWAYS MUCH SMALLER THAN EITHER RESISTANCE TORQUE OR MUSCLE TORQUE)

c. Is usually greater in magnitude than that of the resistance (NO; SEGMENT WEIGHT WHEN HEAVY WEIGHTS ARE USED IS ALWAYS MUCH SMALLER THAN EITHER RESISTANCE TORQUE OR MUSCLE TORQUE)
d. Usually has a greater distance from the axis of rotation than the insertion point (YES; THAT'S BEEN THE CASE FOR EVERY PROBLEM WE'VE DONE)

8. According to Dr. Wayne Westcott:
    a. Determining one's fiber type distribution can be done with a simple field test (YES; MAX REPS @ 75% OF ONE'S 1RM; 3-5 REPS WOULD BE FAST TWITCH, 12-15 WOULD BE SLOW TWITCH)
    b. For typical adults in the U.S., aging increases % body fat faster than it increases body weight (YES; BECAUSE FAT MASS GROWS AND LEAN MASS TENDS TO DECREASE)
    c. Strength training's positive effect on weight loss (above cardio) is primarily due to the extra calories burned during exercise (NO; IT'S BECAUSE OF THE INCREASED RESTING METABOLIC RATE DUE TO THE MORE ACTIVE AND LARGER LEAN (MUSCLE) TISSUE)
    d. One should not strength train to failure for each set since this impairs recovery (NO; HE RECOMMENDS A REPETITION MAX FOR EACH SET – THIS, BY DEFINITION, IS FAILURE)

9. According to the impulse equation in the maximum vertical leap:
    a. In the take-off, Vi = 0 (YES; P.306; STARTS AT THE BOTTOM OF THE LEAP WHEN THE BODY'S CG IS AT ITS LOWEST)
    b. In the landing, Vi = 0 (NO; p.306; NO; Vi EQUALS LANDING VELOCITY
    c. The magnitude of Vf at take-off > that of Vi at landing (NO; SINCE TAKE-OFF AND LANDING ARE AT SAME HEIGHT, THESE VELOCITIES MUST BE THE SAME)
    d. The forces required for take-off and landing are quite different due to the time variable (YES; P.306, MASS AND VELOCITIES ARE NO DIFFERENT – THE ONLY VARIABLE THAT CAN BE DIFFERENT IS TIME)

10. The impulse equation can be used to calculate the following (assume that you can measure the key variables as appropriate):
    a. Determine the force of the racket hitting a tennis ball in a serve (YES; P.306, YOU HAVE VELOCITIES, TIME AND MASS OF THE BALL)
    b. Forces in a muscle statics problem (NO; YOU DON'T HAVE ANY TIME OR VELOCITY VARIABLES)
    c. Take-off velocity in a vertical leap (YES; YOU CAN MEASURE FORCE, TIME, AND BODY MASS)
    d. Friction force for an automobile skidding to a stop (YES; YOU HAVE THE VELOCITIES, THE MASS OF THE CAR, AND THE TIME TO STOP)