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NPTEL

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Courses » Mechanics of Human Movement

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Unit 8 - Week 6

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Assignment 6

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2018-09-12, 23:59 IST.

1) Internal forces contribute to the acceleration of the system. The statement is *1 point*

- True, muscle forces are internal forces and they contribute to acceleration of the system.
- True, internal forces do not cancel out each other.
- False, internal forces do not appear in the resultant system of forces.
- False, ground reaction forces contribute to acceleration of centre of mass of human body

No, the answer is incorrect.
Score: 0

Accepted Answers:
False, internal forces do not appear in the resultant system of forces.

2) A standing gymnast raises her arms such that the Centre of Mass (COM) of her body moves upwards by 6cm. The new location of the COM of the arms is higher by *1 point*

Given:
Mass of the person = 90kg
Mass of each arm = 4kg
Height of the person = 180cm

- 73.5 cm
- 67.5 cm
- 6 cm
- 135 cm

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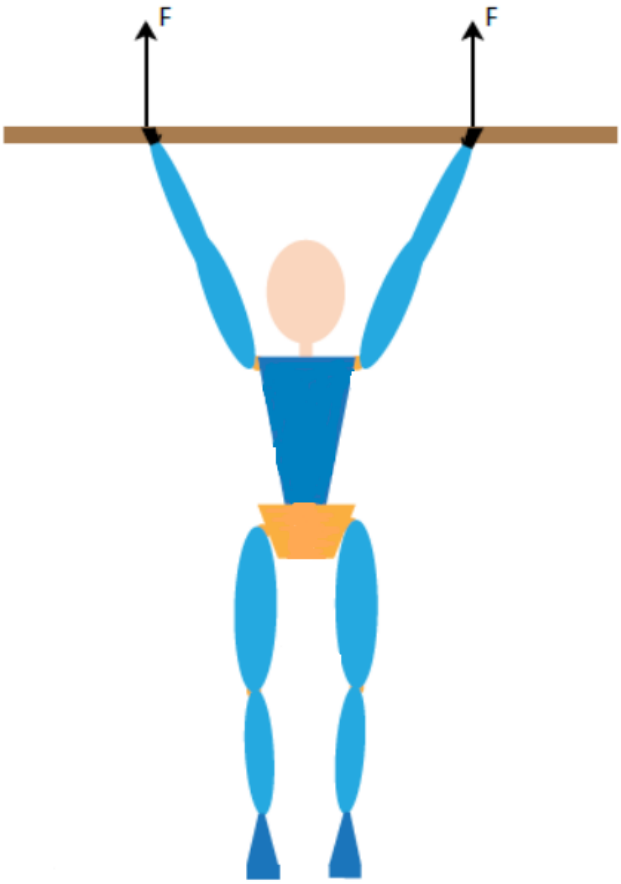


An athlete is working out her biceps by doing pull ups. During the rising phase, if the athlete's acceleration reaches a peak of 6m/s^2, the contact force (F) exerted by the bar on the athlete is:

Given: Mass of the athlete is 80kg; g = 10m/s^2

- 160N
- 517N
- 640N
- 269N

No, the answer is incorrect.
Score: 0

Accepted Answers:
640N

4) In solving the previous question, the following is/are considered as internal force(s) to the system. ***1 point***

- Reaction force exerted on the hand by the bar
- Reaction force exerted by the bar on the hand
- Muscle forces on the forearm and upper arm
- Gravitational pull of earth on the athlete

No, the answer is incorrect.

Score: 0

Accepted Answers:
Muscle forces on the forearm and upper arm

5) When we analyse the human body by analyzing the mechanics of the CoM, we are analysing it as a **1 point**

- Single rigid body
- Single particle
- Multiple particles
- Multi-segmented rigid body

No, the answer is incorrect.
Score: 0

Accepted Answers:
Single particle

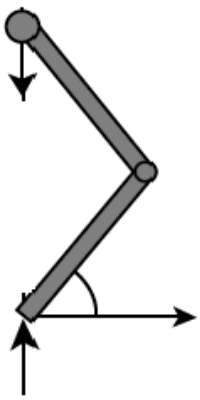
6) Joint reaction forces in multi segment bodies connected through joints are plotted on the free body diagrams using ------- **1 point**

- Newton’s first law of motion
- D’Alembert’s principle
- Principle of virtual work
- Newton’s third law of motion

No, the answer is incorrect.
Score: 0

Accepted Answers:
Newton’s third law of motion

7) Assume the human body is represented as the planar system below with the COM of the upper body mounted on the segments representing the lower limbs. If the foot cannot slide on the ground but can lift off it, the number of degrees of freedom of this system is **1 point**



- One
- Two
- Three
- Four

No, the answer is incorrect.
Score: 0

Accepted Answers:
Three

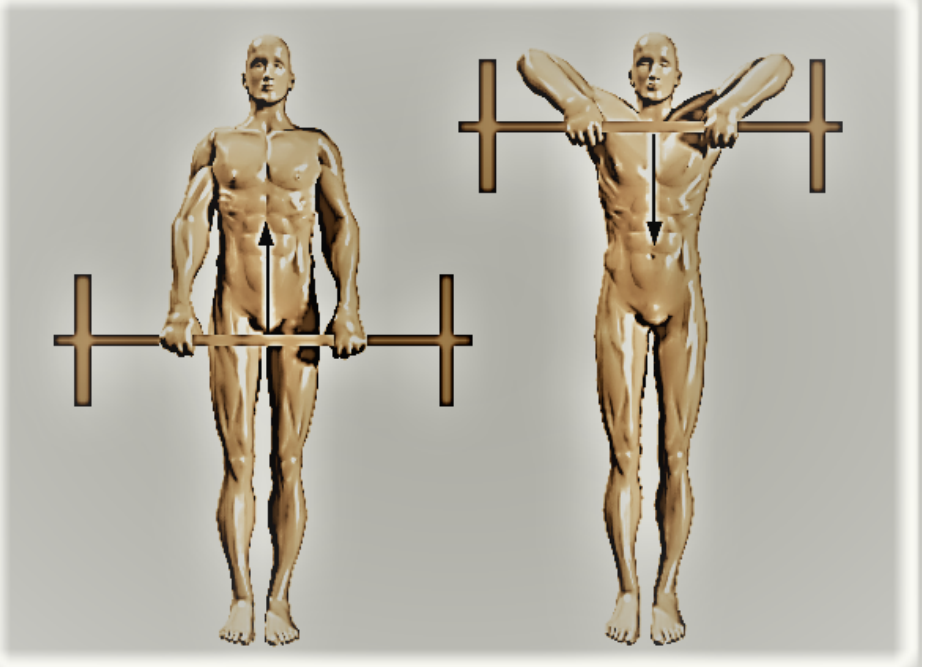
8) When a person is airborne, the person CANNOT **1 point**

- [ ] Change the body's centre of mass (COM) by moving their arms
- [ ] Change the moment of inertia about the COM by moving their arms
- [ ] Change the acceleration of the COM by moving their arms
- [ ] Change the angular velocity by moving their arms

No, the answer is incorrect.
Score: 0

Accepted Answers:
Change the body's centre of mass (COM) by moving their arms
Change the acceleration of the COM by moving their arms

9) **1 point**



Using a palms down grip and hands close together, an athlete holds a barbell at the thighs at 0.7m above the floor as shown below. Then he pulls the barbell up to his chin with an acceleration of 6m/s^2 upward. Compute the force the ground exerts on the athlete at the initiation of motion. The athlete is 75kg and the barbell weighs 20kg. Assume the centre of mass of the athlete remains at 0.8m above the floor during the exercise and g=10m/s^2.

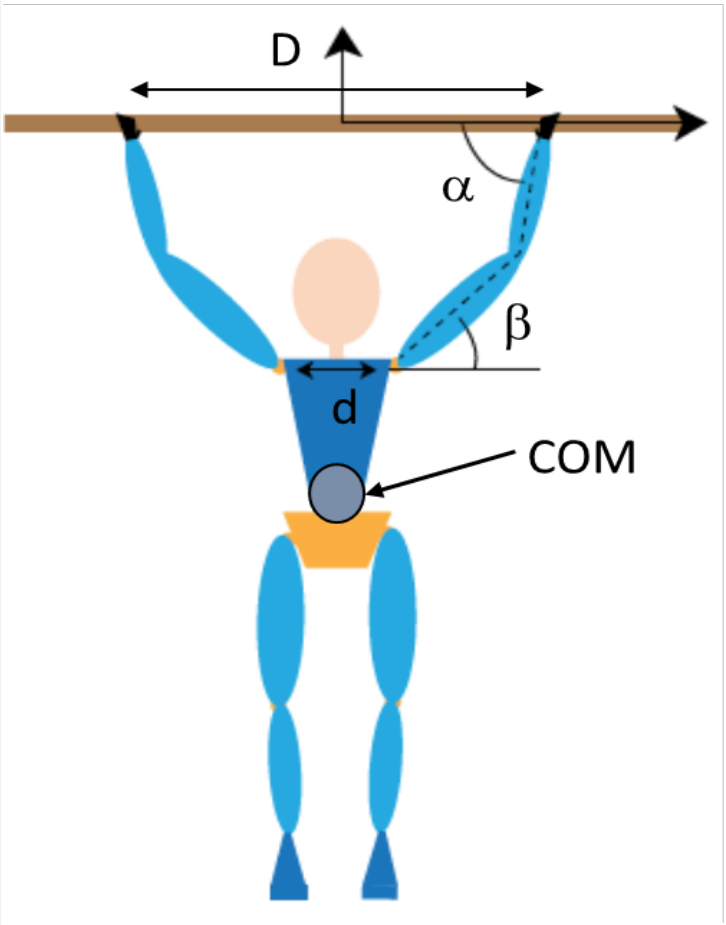
- ( ) F_{ground} = 940N
- ( ) F_{ground} = 1070N
- ( ) F_{ground} = 1360N
- ( ) F_{ground} = 6700N

No, the answer is incorrect.
Score: 0

Accepted Answers:

$F_{ground} = 1070N$

10) A man doing chin-ups by gripping a bar and pulling himself up toward it is modelled as shown in the figure. Let α and β be the angles the forearm and the upper arm, weightless and each of length L, make with the horizontal axis. The COM of the man is located at a distance L below the level of his shoulders. Answer questions 10-12. **1 point**



The relationship between the angles α and β at any instant is given by:

- D-d = $2(Lcos\alpha + Lcos\beta)$
- D-d = $2(Lsin\alpha + Lsin\beta)$
- D-d = $(Lsin\alpha + Lsin\beta)$
- D-d = $(Lcos\alpha + Lcos\beta)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
D-d = $2(Lcos\alpha + Lcos\beta)$

11) At an instant where $\alpha = 60^0$, $\beta = 30^0$ and the angular velocity of the upper arm is -0.1 **1 point**

rad/s, the angular velocity of the forearm is

- 0.6 rad/s
- 0.06 rad/s
- 0.6L rad/s
- 0.06L rad/s

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.06 rad/s

12) At that same instant, the velocity of the COM is **1 point**

- 1 m/s
- L m/s
- 0.06 m/s
- 0.06L m/s

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.06L m/s

13) During a triple axel, a skater covers a horizontal distance of 3m and achieves a height of 0.6m. Determine the initial velocity as she lifts off the ice, where V_h and V_v are the velocities of the skater in the horizontal and vertical directions ($g=9.8m/s^2$) **1 point**

- V_h=4.3m/s V_v=3.4m/s
- V_h=3.2m/s V_v=7.4m/s
- V_h=2.5m/s V_v=7.3m/s
- V_h=2.5m/s V_v=1.9m/s

No, the answer is incorrect.
Score: 0

Accepted Answers:
V_h=4.3m/s V_v=3.4m/s

14) In the mathematical derivation of the angular momentum for a system of particles in space with respect to a point i defined by a Cartesian coordinate system with origin o the following equation is obtained. Which of the following option(s) is/are true? **1 point**

$$\frac{dH_o}{dt} = \sum_{i=1}^{N} \frac{dr_{i/o}}{dt} \times m_i v_i + \sum_{i=1}^{N} r_{i/0} \times m_i \frac{dv_i}{dt}$$

- In the first term, the derivative of the position vector is parallel to the velocity vector, making the first term equal to zero
- In the first term, the derivative of position vector is orthogonal to the velocity vector, making the first term equal to zero

- [ ] In the second term, the derivative of the velocity vector is perpendicular to the velocity vector
- [ ] In the second term, the derivative of the velocity vector is not necessarily perpendicular to the velocity vector

No, the answer is incorrect.
Score: 0

Accepted Answers:
In the first term, the derivative of the position vector is parallel to the velocity vector, making the first term equal to zero
In the second term, the derivative of the velocity vector is not necessarily perpendicular to the velocity vector

15) Using parallel axis theorem, calculate the moment of inertia of a uniform rigid rod of length L and mass M about a point $1/4^{th}$ distance from one end about an axis orthogonal to the link **1 point**

- ( ) $ML^2/3$
- ( ) $3ML^2/26$
- ( ) $7ML^2/48$
- ( ) $9ML^2/42$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$7ML^2/48$

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