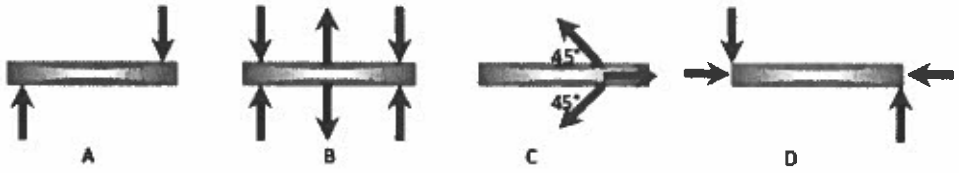
Question 1 (2 points) CHECK IN 29

The applied forces below all have the same magnitude and acts in the directions shown. Which of the objects below is in static equilibrium (Be careful with the components in part C!)

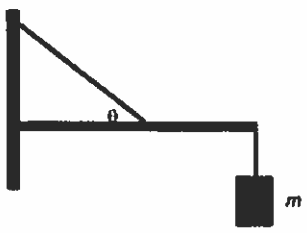


- ◯ a) A only
- ◯ b) B only
- ◯ c) C only
- ◯ d) D only
- ◯ e) More than one

Question 2 (2 points)

An object of mass m is suspended from the end of a rod (of negligible mass) of length L. The rod is supported at one end by a hinge at a wall and at the middle ($L/2$ from the end) by a cable that makes an angle θ from the horizontal.

Consider that the torque from the objects about the hinge has to balance the torque from the cable about the hinge, and we are ignoring the mass of the rod. What is the tension in the cable? (Hint: Look at the sum of torques, not forces!)



○ a) $\frac{mg}{\sin(\theta)}$

○ b) $mg\sin(\theta)$

○ c) $\frac{2mg}{\sin(\theta)}$

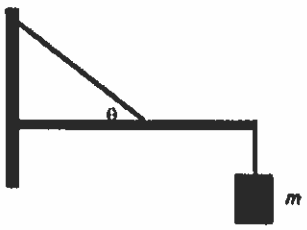
○ d) $\frac{mg}{2\sin(\theta)}$

○ e) $2mg\sin(\theta)$

Question 3 (2 points)

An object of mass m is suspended from the end of a rod (of negligible mass) of length L. The rod is supported at one end by a hinge at a wall and at the middle ($L/2$ from the end) by a cable that makes an angle θ from the horizontal.

Take the pivot to be at the wall. Relative to the pivot, what is the direction of the torque on the beam due to the cable?

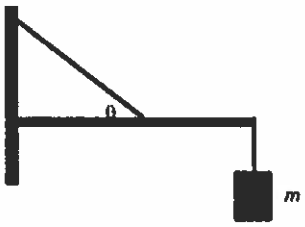


- ◯ a) into the page
- ◯ b) towards the right
- ◯ c) out of the page
- ◯ d) towards the left
- ◯ e) down

Question 4 (2 points)

An object of mass m is suspended from the end of a rod (of negligible mass) of length L. The rod is supported at one end by a hinge at a wall and at the middle ($L/2$ from the end) by a cable that makes an angle θ from the horizontal.

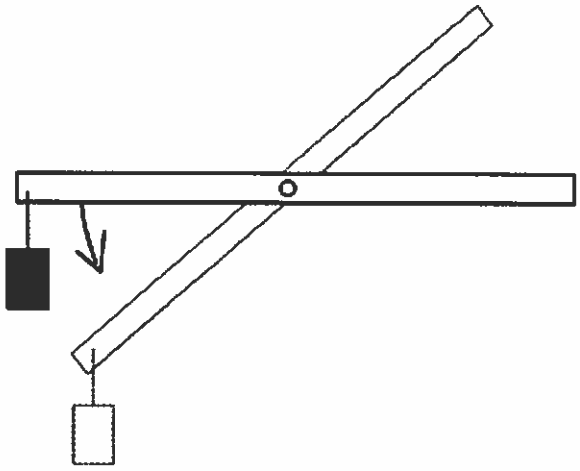
There are forces acting on the rod at the hinge. What is the direction of the x-component of the hinge force on the rod?



- ◯ a) zero horizontal hinge force
- ◯ b) towards the left
- ◯ c) towards the right

Question 5 (2 points)

A mass is hanging from the end of a horizontal bar which pivots about an axis through it center, but it being held stationary. The bar is released from rest and begins to rotate. As the bar rotates from horizontal to vertical, the magnitude of the **angular acceleration** a of the bar...



- ◯ Decreases.
- ◯ Increases.
- ◯ Remains constant.

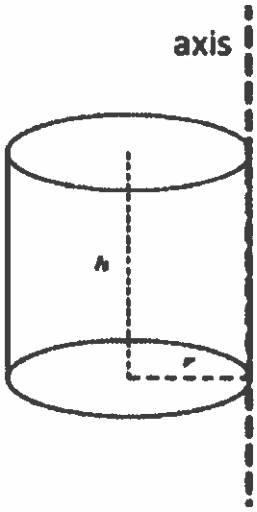
Question 6 (2 points)

A compact CD rotates at an angular velocity $\omega(t) = (1.6\ t^2 + 1.2\ t)$ rad/s, where t is in seconds. The disk starts from rest at t = 0. At the instant $t = 2.0$ s, what is the angular displacement of the disk?

- ◯ 5.20 rad
- ◯ 6.67 rad
- ◯ 8.80 rad
- ◯ 9.67 rad
- ◯ 7.60 rad

Question 7 (2 points)

Consider a solid cylinder of uniform density, total mass M, and radius r that is rotating about the axis shown, which lies along its outer edge. What is the moment of inertia about the given axis?



- ○ $\frac{1}{2}Mr^2$
- ○ Mr^2
- ○ $\frac{3}{2}Mr^2$
- ○ $2Mr^2$
- ○ None of the above.

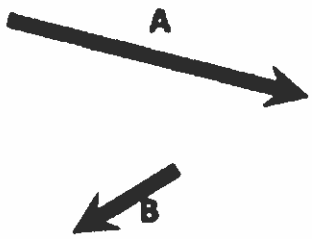
Question 8 (2 points)

Consider a thin rod of nonuniform mass density given by $\lambda = V + Wy^{-4}$, where y is in meters and y = 0 at the axis of rotation. V and W are constants. The rod has a total length L and lies along the y axis. Which is the correct integral for finding the moment of inertia for an axis that passes through the rod at a length L/3 from one end?

- ◯ $\frac{M}{L} W \int_0^L y^2 dy$
- ◯ $\frac{M}{L} W \int_{-L/3}^{2L/3} y^2 dy$
- ◯ $\int_{-L/3}^{2L/3} \left(V + W y^{-4} \right) dy$
- ◯ $\int_{-L/3}^{2L/3} \left(V y^2 + W y^{-2} \right) dy$
- ◯ None of the above.

Question 9 (2 points)

Consider the two vectors shown below. Use the right hand rule for cross product. What is the **vector** direction of **A** x **B**?



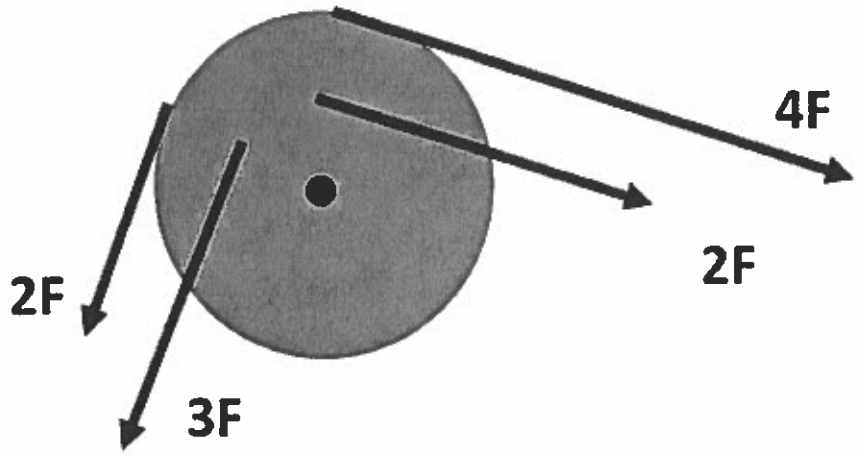
- ◯ Clockwise.
- ◯ Counterclockwise.
- ◯ Into the page.
- ◯ Out of the page.
- ◯ None of the above.

Question 10 (2 points)

A wheel of outer radius R has four forces, each of magnitude indicated, acting tangentially as shown. It is free to pivot about its center. It is a non-uniform density, and you are told it has a

moment of inertia of $\frac{1}{6}MR^2$.

Two of the forces are acting a distance R/2 from the pivot.



What is the equation of motion for the wheel in terms of tangential acceleration at the edge of the wheel, *a*? Simplify your answer to match one of the ones below.

- ◯ 6F = Ma
- ◯ 4F = Ma
- ◯ 3F = Ma
- ◯ 2F = Ma
- ◯ F = Ma
- ◯ 5F = Ma
- ◯ 9F = Ma
- ◯ 15F = Ma
- ◯ none of the above

Question 11 (2 points)

General Review:

Choose ALL of the correct statements below. (Think of each like its own true/false question, and select it if it is true.)

- [ ] If you integrate λdx for a long rod, then you get the moment of inertia.

- [ ] For the parallel axis theorem for a long rod, the I_{cm} term is always $\frac{1}{12}ML^2$ regardless of d.

- [ ] An object is sliding down a rough ramp that makes an angle θ with the horizontal. The magnitude of the friction force acting on it is $\mu_k mg\cos\theta$

- [ ] A ball on a string is being whirled in a vertical circle with speed v and radius R. When it is at the highest point the tension is equal to $\frac{mv^2}{R}$.

- [ ] Work is the change in momentum.

- [ ] You throw a ball up into the air. Neglect air resistance. The acceleration at the very top of the trajectory is zero.

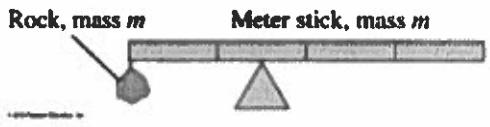
Bonus Questions for Studying

These are not a required portion of your grade. However, you should definitely complete them as study material before the exam.

Question 12 (2 points)

A rock is attached to the left end of a uniform meter stick that has the same total mass as the rock. The meter stick is 1 meter long. Consider that the torque from the rock (relative to the pivot) has to balance the torque from the weight of the meter stick (relative to the pivot). Draw an extended free body diagram.

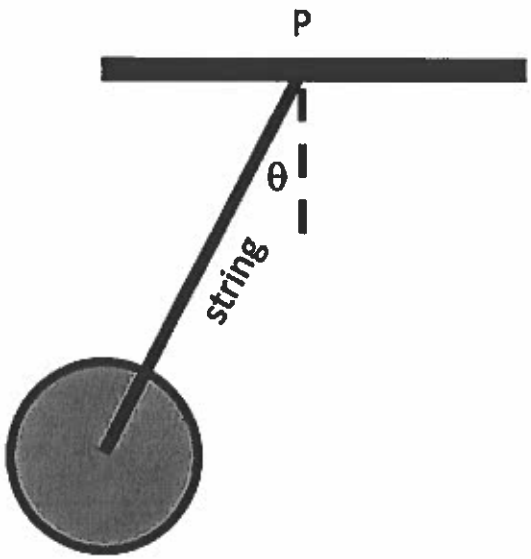
How far from the left end of the stick should the triangular pivot be placed so that the combination of meter stick and rock is in balance? (Hint: Draw the extended free body diagram. Remember to treat the uniform beam as if its entire weight acts at its center of mass.)



- ◯ a) less than 0.25 m
- ◯ b) Exactly 0.25 m
- ◯ c) between 0.25 m and 0.50 m
- ◯ d) Exactly 0.5 m
- ◯ e) more than 0.50 m

Question 13 (2 points)

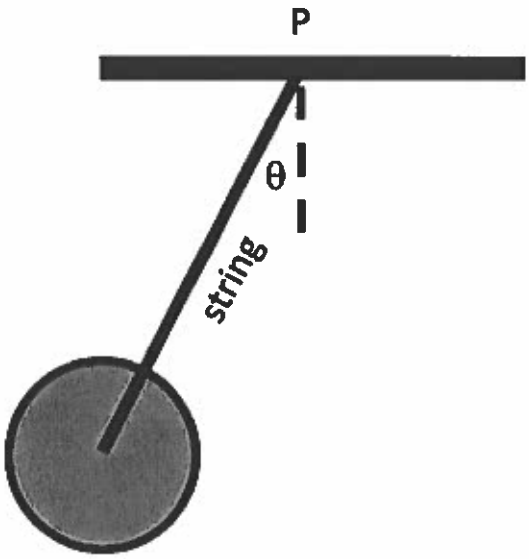
A solid uniform disk of radius R and mass M is hung from the ceiling by a string of length L attached at its center. The tension in the string is T. What is the torque exerted on the disk **by the string RELATIVE TO POINT P**? (Hint: Draw the extended free body diagram showing the tension force, and think carefully about what the direction of the tension force is relative to the vector "r" in the torque equation.)



- ◯ 0
- ◯ Mg
- ◯ MgR sinθ
- ◯ MgL
- ◯ MgL sinθ

Question 14 (2 points)

A solid uniform disk of radius R and mass M is hung from the ceiling by a string of length L attached at its center. The tension in the string is T. What is the torque exerted on the disk **by its own weight, relative to point P**?



- ◯ 0
- ◯ MgR
- ◯ MgR sinθ
- ◯ MgL
- ◯ MgL sinθ

Question 15 (2 points)

Consider three objects:

Object A: A hollow square of mass M and length of side L.

Object B: A solid flat disk of mass M and diameter L.

Object C: A hollow hoop of mass M and diameter L.

Rank their moments of inertia for an axis passing perpendicular to their plane and through their center of mass.

- ◯ A > B > C
- ◯ A > B = C
- ◯ A = B = C
- ◯ B > A = C
- ◯ A > C > B

Question 16 (2 points)

Given two vectors $\vec{A}$ and $\vec{B}$, which of the following is true?

- $\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}$, and $\vec{A} \times \vec{A} = A^2$.
- $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$, and $\vec{A} \times \vec{A} = 0$.
- $\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}$, and $\vec{A} \times \vec{A} = 0$.
- $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$, and $\vec{A} \times \vec{A} = -A^2$.

Submit Quiz *0 of 16 questions saved*