Exam 3

Study Strategy

Doing is better than reviewing. A couple of hours of practicing problems from scratch (quizzes and homework) and working to correct the "sticky spots" is much more efficient and effective than spending hours reviewing.

Learning Goals

Students will be able to:

Identify when an object has an angular acceleration.

Identify the difference between angular acceleration and centripetal acceleration

Identify the rotational equivalent of position, velocity, acceleration, force, mass and momentum. Conversely identify the linear equivalent of revolutions, angular velocity, angular acceleration, torque, moment of inertia and angular momentum.

calculate the rotational motion from the linear values of an object's motion.

Solve problems involving rotational kinematics.

Solve problems involving torque from a force that is applied either perpendicular to the object or at an angle.

Sketch a graph of angular velocity from an angular position graph and vice versa.

Sketch a graph of angular acceleration from an angular position graph and vice versa.

Calculate the center of gravity of either a 1 dimensional or 2 dimensional system.

Use the conditions for static equilibrium (net force and net torque equal zero) to solve problems with multiple forces applied to an object.

Solve problems using Hooke's Law

Describe how the force varies when a spring is either stretched or compressed.

Identify the linear region, elastic region, elastic limit, and the breaking point for a stretched object.

Identify when Hooke's law applies to a stretched object.

describe and identify how different variables are described or not by our model for compressed and stretched objects. $F/A = Y \Delta L/L$ Stress = Young's Modulus x strain.

Use the impulse momentum theorem to predict the force necessary to apply a given impulse to an everyday object.

Solve problems using the impulse-momentum theorem

Solve problems using conservation of momentum in 1 dimension.

Describe why the moment of inertia is different for two given shapes.

Apply the idea of angular momentum to explain or predict how an object will behave when either the direction of angular momentum or the moment of inertia are changed.

$\theta_f = \theta_i + \omega_i \Delta t + \frac{1}{2} \alpha (\Delta t)^2$ $\omega_f = \omega_i + \alpha \Delta t$ $\omega_f^2 = \omega_i^2 + 2\alpha (\Delta \theta)$

$\tau = F_\perp \, r$ $v = \omega \, r$ $a_c = \dfrac{v^2}{r} = \omega^2 r$

$a_t = \alpha \, r$

$X_{cg} = \dfrac{x_1 m_1 + x_2 m_2 + x_3 m_3 + \dots}{m_1 + m_2 + m_3 + \dots}$ $F_{sp} = -k \, \Delta x$ $\dfrac{F}{A} = Y \dfrac{\Delta L}{L}$

$\vec{p} = m\vec{v}$ $\vec{J} = \vec{F} \, \Delta t = \Delta \vec{p} = \Delta m \, \vec{v}$ $\overrightarrow{p_i} = \overrightarrow{p_f}$

$\Sigma \vec{F} = m\vec{a}$ $m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$ $\vec{L} = I\vec{\omega}$

$g = 9.8 m/s^2$

$v_x = \dfrac{\Delta x}{\Delta t} = \dfrac{x_f - x_i}{\Delta t}$ $a_x = \dfrac{\Delta v_x}{\Delta t} = \dfrac{v_{xf} - v_{xi}}{\Delta t}$

$x_f = x_i + v_{xi}\Delta t + \frac{1}{2} a_x (\Delta t)^2$ $v_{xf} = v_{xi} + a_x \Delta t$ $v_{xf}^2 = v_{xi}^2 + 2a_x (\Delta x)$

sin θ = opp/hyp   cos θ = adj/hyp   tan θ = opp/adj

$a^2 + b^2 = c^2$

Moments of inertia of common shapes

MR^2 $\frac{1}{2}MR^2$

$\frac{2}{5}MR^2$ $\frac{1}{3}ML^2$

$\frac{2}{3}MR^2$ $\frac{1}{12}ML^2$

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