Physic² 121:
Phundament°ls of Phy²ics I

December 11, 2006

Review for Final Exam

Possibly Useful Information (Page 2 of Exam)

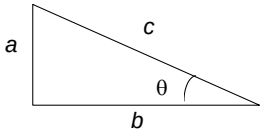
$v = v_0 + at$ $\quad \omega = \omega_0 + \alpha t$

$x = \frac{1}{2}at^2$ $\quad \theta = \frac{1}{2}\alpha t^2$

$x = x_0 + v_0 t + \frac{1}{2}at^2$ $\quad \theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$

$\Delta x = v_0 t + \frac{1}{2}at^2$ $\quad \Delta\theta = \omega_0 t + \frac{1}{2}\alpha t^2$

$v_f^2 = v_i^2 + 2a\Delta x$ $\quad \omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$



$\cos\theta = \frac{b}{c}$ $\quad \sin\theta = \frac{a}{c}$ $\quad \tan\theta = \frac{a}{b}$

$\vec{I} = \vec{F}\Delta t = \Delta\vec{p}$ $\quad \tau = rF\sin\theta$ $\quad \tau_{Net} = I\alpha$

$\vec{p} = m\vec{v}$ $\quad KE_{rotation} = \frac{1}{2}I\omega^2$ $\quad \vec{L} = I\vec{\omega}$

$W = \vec{F}\cdot\Delta\vec{x} = (F\cos\theta)\Delta x$ $\quad s = r\theta$

$W_{Net} = \Delta KE$ $\quad v_t = r\omega$

$KE_{translation} = \frac{1}{2}mv^2$ $\quad a_t = r\alpha$

$PE_{grav} = mgh$ $\quad a_c = \frac{v^2}{r}$

$f_s \le \mu_s |n|$

$f_k = \mu_k |n|$

$P = \frac{F}{A}$ $\quad \rho = \frac{m}{V}$

$A_1 v_1 = A_2 v_2$

$P = P_0 + \rho gh$

$P + \frac{1}{2}\rho v^2 + \rho gy = \text{constant}$

- You may assume that g = 10 m/s^2 throughout the exam.
- **Newton's Laws**
  - An object moves with a velocity that is constant in magnitude and direction, unless acted on by a nonzero net force.
  - The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass:

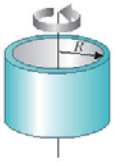
$$\vec{a} = \frac{\vec{F}_{net}}{m}$$

  - If object 1 and object 2 interact, the force exerted by object 1 on object 2 is equal in magnitude but opposite in direction to the force exerted by object 2 on object 1.

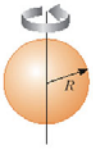
More Possibly Useful Information (Page 3)

Moments of Inertia for Various Rigid Objects of Uniform Composition

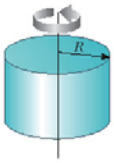
Hoop or thin cylindrical shell
$I = MR^2$



Solid sphere
$I = \frac{2}{5} MR^2$

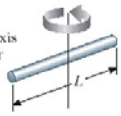


Solid cylinder or disk
$I = \frac{1}{2} MR^2$



Thin spherical shell
$I = \frac{2}{3} MR^2$

Long thin rod with rotation axis through center
$I = \frac{1}{12} ML^2$



Long thin rod with rotation axis through end
$I = \frac{1}{3} ML^2$

Exam Topics, New Material (~1/2 Exam)

- Rotational Motion
  - Angular displacement, θ
  - Angular velocity, ω
  - Angular acceleration, α
- Relationship between linear and angular quantities
- Centripetal acceleration
- Rotational Dynamics
  - Torque
  - Equilibrium problems
  - Moment of inertia
  - Rotational Kinetic Energy
  - Angular Momentum
- Fluids
  - Density, Pressure
  - Variation of pressure with depth
  - Buoyancy, Archimedes's Principle
  - Fluids in motion
    - Equation of continuity
    - Bernoulli's Equation

Exam Topics (Exam 1)

- **Dimensional Analysis**
- Motion
  - Position
  - Velocity
  - Acceleration
- Motion Graphs in 1-D
- Equations of Motion in 1-D
- Newton's Laws
- Gravity as a force
- Free-body diagrams

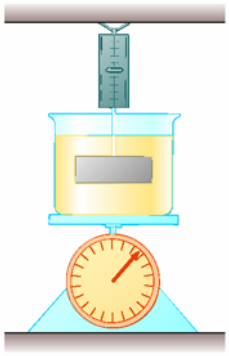
Exam Topics (Exam 2)

- Vectors in more than one dimension
- Motion in 2-D
  - Projectile motion
  - Ramps
- Forces of friction
  - Static friction
  - Kinetic friction
- Momentum
  - Impulse
  - Conservation of Momentum
- Energy
  - Work
  - Kinetic Energy
  - Potential Energy
  - Conservation of Energy

- Plus, Anything covered in tutorial

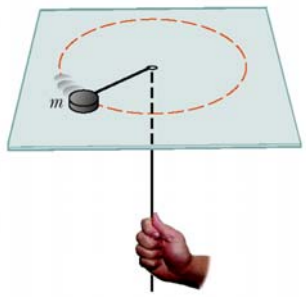
Problem 9.39

- A 1.00-kg beaker containing 2.00 kg of oil (density = 916 kg/m^3) rests on a scale. A 2.00-kg block of iron is suspended from a spring scale and is completely submerged in the oil. Find the equilibrium readings of both scales.



Problem 8.51

- The puck in the Figure has a mass of 0.120 kg. Its original distance from the center of rotation is 40.0 cm, and it moves with a speed of 80.0 cm/s. The string is pulled downward 15.0 cm through the hole in the frictionless table. Determine the work done on the puck. [*Hint:* Consider the change in kinetic energy of the puck.]



Problem 8.33

- A cylindrical fishing reel has a moment of inertia $I = 6.8 \times 10^{-4}$ kg·m^2 and a radius of 4.0 cm. A friction clutch in the reel exerts a restraining torque of 1.3 N·m if a fish pulls on the line. The fisherman gets a bite, and the reel begins to spin with an angular acceleration of 66 rad/s^2.
  a) What is the force exerted by the fish on the line?
  b) How much line unwinds in 0.50 s?