Physics 2414
Final Exam

Instructions: Please sit in the indicated seat. Write your name, student ID, exam version and discussion section on your answer sheet and put all of your answers on the answer sheet. Hand in the answer sheet when you are done.

Area of Sphere= $4\pi r^2$
g=9.8 m/s^2
Volume of Sphere=$\frac{4}{3}\pi r^3$
$G = 6.67 \times 10^{-11} Nm^2/kg^2$
$r_{earth} = 6.38 \times 10^6 m$
$m_{earth} = 5.98 \times 10^{24} kg$

$\vec{v}_{av} = \frac{\Delta\vec{x}}{\Delta t}$
$\vec{v} = \lim_{\Delta t\to 0} \frac{\Delta\vec{x}}{\Delta t}$
$\vec{a}_{av} = \frac{\Delta\vec{v}}{\Delta t}$
$\vec{a} = \lim_{\Delta t\to 0} \frac{\Delta\vec{v}}{\Delta t}$
$\Delta v_x = v_x - v_{ox} = a_x t$
$v_{av,x} = \frac{v_{ox}+v_x}{2}$
$\Delta x = x - x_o = v_{ox}t + \frac{1}{2}a_x t^2$
$v_x^2 - v_{ox}^2 = 2a_x \Delta x$

4 Kinematic equations :

1) $v = v_o + at$
2) $x = x_o + \frac{1}{2}(v + v_o)t$
3) $x = x_o + v_o t + \frac{1}{2}at^2$
4) $v^2 = v_o^2 + 2a(x - x_o)$

Kinematic equations for an object moving in two dimensions with constant acceleration along the y-axis and t_o=0.

$v_x = v_{ox}$
$x - x_o = v_{ox}t$
$v_y = v_{oy} + a_y t$
$\Delta y = v_{av,y}t$
$v_{av,y} = \frac{1}{2}(v_{oy} + v_y)$
$y - y_o = v_{oy}t + \frac{1}{2}a_y t^2$
$v_y^2 - v_{oy}^2 = 2a_y \Delta y$

$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$
$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$
$\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$

$F = \frac{Gm_1m_2}{r^2}$

$f_s \leq \mu_s F_N$
$f_k = \mu_k F_N$
$F = kx$
$\Sigma F_x = ma_x$
$\Sigma F_y = ma_y$
$\vec{F}_{net} = m\vec{a}$
$a_c = \frac{v^2}{r}$
$f = \frac{1}{T}$
$v = \frac{2\pi r}{T} = 2\pi r f$
$T^2 = \text{constant} \times \text{r}^3$

$W = Fd\cos\theta$
$K = \frac{1}{2}mv^2$
$\Delta U = -W_c$
$U = \frac{1}{2}kx^2$
$U = mgh$
$E = K + U$
$\Delta E = \Delta K + \Delta U = 0$
$W_{nc} = \Delta E = \Delta K + \Delta U$
$W_{net} = \Delta K$
$P_{av} = \frac{W}{t}$
$P_{av} = Fv\cos\theta$
$\vec{p} = m\vec{v}$
$\Delta\vec{p}_1 = -\Delta\vec{p}_2$
$\Delta\vec{p} = \vec{F}\Delta t$
$\vec{F} = \frac{\Delta\vec{p}}{\Delta t}$
Impulse = $\vec{F}\Delta t$
$x_{cm} = \frac{m_1x_1+m_2x_2+\ldots+m_nx_n}{m_1+m_2+\ldots+m_n}$

$y_{cm} = \frac{m_1y_1+m_2y_2+\ldots+m_ny_n}{m_1+m_2+\ldots+m_n}$
$\Sigma\vec{F}_{ext} = m\vec{a}_{cm}$

4 Kinematic equations for rotations:

1) $\omega = \omega_o + \alpha t$
2) $\theta = \theta_o + \frac{1}{2}(\omega + \omega_o)t$
3) $\theta = \theta_o + \omega_o t + \frac{1}{2}\alpha t^2$
4) $\omega^2 = \omega_o^2 + 2\alpha(\theta - \theta_o)$

$K_{rot} = \frac{1}{2}I\omega^2$
$I = \Sigma_{i=1}^N mr_i^2$
$\tau = rF\sin(\theta)$
$\Sigma\tau = I\alpha$
$\Sigma\tau = \frac{\Delta L}{\Delta t}$
$K = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$

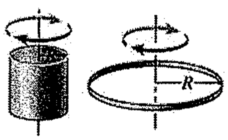
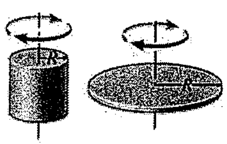
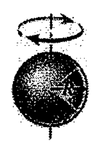
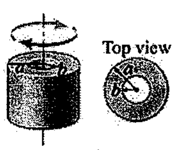
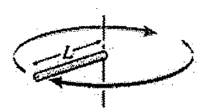
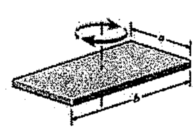
$L = I\omega$

$\rho = \frac{m}{V}$
$P = P_o + \rho g h$
$P = \frac{F}{A}$
$1 \text{ atm} = 1.013 \times 10^5 \text{ Pa}$
Pure water: $\rho = \frac{1g}{cm^3}$
$F_B = M_{fluid} g = \rho_{fluid} g V_{fluid}$
$A_1 v_1 = A_2 v_2$
$P_1 + 1/2 \rho v_1^2 + \rho g y_1 = P_2 + 1/2 \rho v_2^2 + \rho g y_2$

$\vec{v}_{ac} = \vec{v}_{ab} + \vec{v}_{bc}$

Table 8.1

Rotational Inertia for Uniform Objects with Various Geometrical Shapes

Shape		Axis of Rotation	Rotational Inertia	Shape		Axis of Rotation	Rotational Inertia
Thin hollow cylindrical shell (or hoop)		Central axis of cylinder	MR^2	Solid sphere		Through center	$\frac{2}{5}MR^2$
Solid cylinder (or disk)		Central axis of cylinder	$\frac{1}{2}MR^2$	Thin hollow spherical shell		Through center	$\frac{2}{3}MR^2$
Hollow cylindrical shell or disk		Central axis of cylinder	$\frac{1}{2}M(a^2+b^2)$	Thin rod		Perpendicular to rod through end	$\frac{1}{3}ML^2$
				Rectangular plate		Perpendicular to plate through center	$\frac{1}{12}M(a^2+b^2)$