Name ________________________

Physics 201 Third Exam—Practice

Equations:

$x = x_0 + v_0 \cdot t + \frac{1}{2} a \cdot t^2$
$v = v_0 + a \cdot t$
$v^2 = v_0^2 + 2a(x - x_0)$
$\bar{v} = (v - v_0)/2$
$v = \Delta x / \Delta t$
$a = \Delta v / \Delta t$
$a_r = v^2 / r$
$\Sigma \mathbf{F} = m\mathbf{a}$
$\mathbf{F}_{12} = - \mathbf{F}_{21}$
$\mathbf{F}(G) = m\mathbf{g}$
$\mathbf{F}(f)_k = \mu_k \mathbf{F}_N$
$\mathbf{F}(f)_s \leq \mu_s \mathbf{F}_N$
$I = \frac{1}{2} mr^2$ *(solid cylinder)*
$I = (2/5)mr^2$ *(sphere)*

$\theta = \theta + \omega_0 t + \frac{1}{2} \alpha t^2$
$\bar{\omega} = \omega_0 + \alpha t$
$\bar{\omega}^2 = \omega_0^2 + 2\alpha(\Delta\theta)$
ave $\omega = (\omega + \omega_0)/2$
$\omega = \Delta\theta / \Delta t$
$\alpha = \Delta\omega / \Delta t$

$\mathbf{p} = m\mathbf{v}$
$\mathbf{F} = \Delta\mathbf{p} / \Delta t$
Impulse = $\mathbf{F}\Delta t = \Delta\mathbf{p}$
$m\mathbf{v}_1 + m\mathbf{v}_2 = m\mathbf{v}_1' + m\mathbf{v}_2'$
$I = mr^2$ *(point mass)*
$I = mr^2$ *(thin hoop)*

$d = r\theta$
$v = r\omega$
$a_t = r\alpha$
$v_x = v \cdot \cos(\theta)$
$v_y = v \cdot \sin(\theta)$
$v^2 = v_x^2 + v_y^2$
$\tan(\theta) = v_y / v_x$
$W = Fd \cdot \cos(\theta)$
$KE_t = \frac{1}{2} mv^2$
$KE_r = \frac{1}{2} I\omega^2$
$GPE = mgy$
$KE_0 + PE_0 + W = KE_f + PE_f$
$SPE = \frac{1}{2} kx^2$

1. Define the following quanties:
   a) Work

   b) Impulse

   c) Potential Energy

   d) Angular velocity

2) A bicycle odometer (which measures distance traveled) is attached near the wheel hub and is designed for 27-inch wheels. What happens if you use it on a bicycle with 24-inch wheels?

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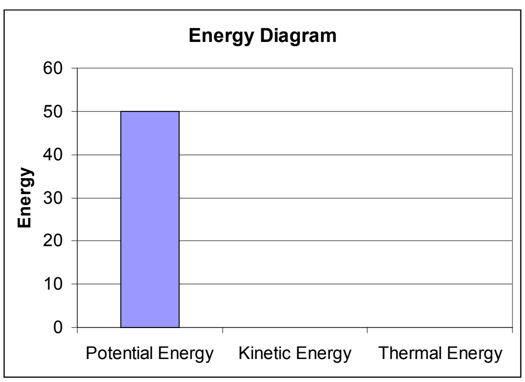
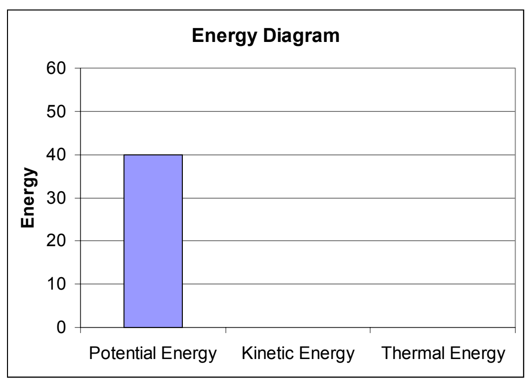
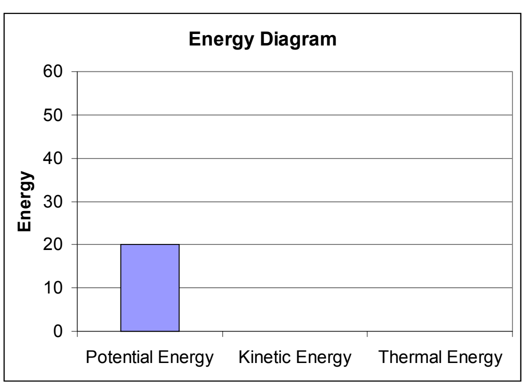
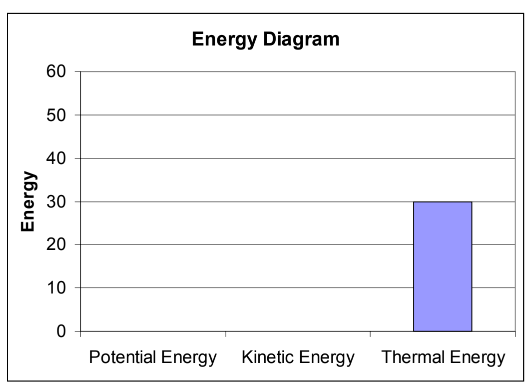
3) A glass ball collides head-on with a steel ball (about the same size, but heavier) initially not moving. In the space below, draw the momentum diagrams for the system before and after the collision.

4) A soapbox car has an initial energy distribution as seen in the first chart. In the remaining charts, draw the amount of kinetic energy there must be in the car and the raceway. (Thermal Energy = Internal energy.)









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5) The planet Mercury orbits the sun once in every 88 (earth) days. What is its angular speed around the sun (in radians per second)? Its average orbital velocity is 47.9 km/s. What is the mean radius of its orbit?

6) Tarzan (mass of 75 kg) rescues Jane by swing in at 4.5 m/s and grabbing her so that they then swing off at 2.7 m/s. What must be Jane's mass?

7) You are working for a firm exploring possible alternatives to gasoline engines. One proposal is to use energy stored in a fly wheel. You boss wonders how fast a solid 250 kg fly wheel of diameter 1.8 meters would have to rotate to store enough energy for a car to travel 300 km. You have been assigned to calculate this, and decide to assume a car of 1600 kg (including fly wheel) and an average retarding force (friction and air resistance) of 500 N while traveling.

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8) Real world problem. Fill in ONLY the indicated steps of the FOCUS and DESCRIBE steps. DO NOT SOLVE THE PROBLEM

As a concerned citizen, you have volunteered to serve on a committee investigating injuries to Middle School students participating in sports programs. Currently your committee is investigating the high incidence of ankle injuries on the basketball team. You are watching the team practice, looking for activities which can result in large horizontal forces on the ankle. Observing the team practice jump shots gives you an idea, so you try a small calculation. A 40-kg student jumps 1.0 m straight up and shoots the 0.80 kg basketball at his highest point. From the rajectory of the basketball, you deduce that the ball left his hand at 30 from the horizontal at 20 m/s. What is his horizontal velocity when he hits the ground?

EVERYDAY LANGUAGE
Sketch with Given Information

What are you trying to find?

What are the physics principle(s)?

Physics Description
Diagram

Define Variables

Quantitative Relationships (*Write down ONLY the equations needed to solve this problem.*)