## Review Worksheet <br> Energy Circular Motion and Stuff

Name
Mods $\qquad$

1. How much elastic potential energy would be stored if a spring has a spring constant of $400 \mathrm{~N} / \mathrm{m}$ and was stretched from 0 to 0.40 meters?
2. How much additional energy would the same spring store if stretched from 0.40 to 0.80 m ?
3. A hill is $\mathbf{1 5 0} \mathbf{. m}$ long and makes an angle of $\mathbf{2 0 . 0}^{\mathbf{0}}$ with the horizontal. As a $\mathbf{7 5 . 0} \mathbf{- k g}$ jogger runs up the hill, how much work does gravity do on the jogger?
4. An $\mathbf{1 2 0 . 0} \mathbf{- N}$ box of clothes is pulled $\mathbf{1 5 . 0} \mathbf{m}$ up a $\mathbf{3 5 . 0 ^ { 0 }}$ ramp by a force of $\mathbf{1 2 5} \mathbf{N}$ that points along the ramp. If the coefficient of kinetic friction between the box and ramp is $\mathbf{0 . 3 0}$, calculate the change in the box's kinetic energy.
5. A $\mathbf{3 . 5 0} \times 10^{\mathbf{3}} \mathbf{- k g}$ car starts from rest at the top of a driveway $\mathbf{8 . 0} \mathbf{~ m}$ long that is sloped at $\mathbf{3 0 . 0}{ }^{\mathbf{0}}$ with the horizontal. If an average friction force of $5.0 \times 10^{\mathbf{3}} \mathrm{N}$ impedes the motion, what is the speed of the car at the bottom of the driveway?
6. A 1500 kg car is traveling at a constant speed of $40 \mathrm{~m} / \mathrm{s}$.
a. How much energy is transferred to internal energy as the car comes to rest?
b. If the car stops in 200 meters, what is the average force applied to the car?
7. A 1.9 kg kitten jumps down from a 1.5 meter high fence.
a. What is the kitten's $\Delta \mathrm{Eg}$ ?
b. What will be the kitten's speed when it reaches the ground?
8. A 105.g dart rests up against a spring that has been compressed 0.075 meters.
a. If 2.25 J of work were required to compress the spring, what is its spring constant?
b. What is the maximum velocity of the dart after the spring has transferred its energy to it?
c. If the dart were fired vertically, what height would it reach?
9. Tarzan swings on a $\mathbf{4 0 . 0} \mathbf{- m}$ long vine initially inclined at an angle of $\mathbf{3 0 . 0}{ }^{\mathbf{0}}$ with the vertical. What is his speed at the bottom of the swing if he does the following?
a) Starts from rest.

Formula Set-Up with Units


#### Abstract

Answer $\qquad$ b) Pushes off with a speed of $6.00 \mathrm{~m} / \mathrm{s}$.

Formula Set-Up with Units


Answer
8. A child sits on a carousel at a distance of 3.5 m from the center and rotates through an arc length of 6.5 m . What is the angular displacement of the child?
9. A test car moves at a constant speed of $21.5 \mathrm{~m} / \mathrm{s}$ around a circular track. If the distance from the car to the center of the track is $\mathbf{5 0 . 0} \mathbf{~ m}$, what is the centripetal acceleration of the car?
10. An $\mathbf{8 8 . 4} \mathbf{- k g}$ bicyclist is riding at a linear speed of $\mathbf{1 4 . 5} \mathbf{~ m} / \mathrm{s}$ around a circular track with a radius of 42.5 m .
a. Find the magnitude of the frictional force that maintains the bike's circular motion.
b. What is the coefficient of friction between the tire and the road?
11. Deimos, a satellite of Mars, has an average radius of 6.3 km and a mass of $5.0 \times 10^{\mathbf{1 5}} \mathbf{~ k g}$. Calculate the gravitational force applied to a rock with a mass of $\mathbf{3 . 0} \mathbf{~ k g}$ that lies on the surface of Deimos.
12. Data confirming Kepler's Law of Periods comes from measurements of the motion of the planets.

| Planet | Radius of rotation <br> $\left(10^{10} \mathrm{~m}\right)$ | Period <br> $\mathrm{T}(\mathrm{y})$ | $\mathrm{T}^{2} / \mathrm{a}^{3}$ <br> $\left(10^{-34} \mathrm{y}^{2} / \mathrm{m}^{3}\right)$ |
| :--- | :--- | :--- | :--- |
| Mercury | 5.79 | 0.241 |  |
| Venus | 10.8 | 0.615 |  |
| Earth | 15.0 | 1 |  |
| Mars | 22.8 | 1.88 |  |
| Jupiter | 77.8 | 11.9 |  |
| Saturn | 143 | 29.5 |  |
| Uranus | 287 | 84 |  |
| Neptune | 450 | 165 |  |
| Pluto | 590 | 248 |  |

Data from Halliday, Resnick, Walker, Fundamentals of Physics 4th Ed Extended. Table 15-3
From the data above fill in the missing column and then calculate the mass of the Sun using Kepler's $3^{\text {rd }}$ law for 3 of the planets.

