Physics 06-02 Types of Energy *Name:* _____

Energy is the _____ to do _____

Kinetic Energy

Energy due to _____

$$KE = \frac{1}{2}mv^2$$

_____

Unit: Joule

Rotational Kinetic Energy

$$KE = \frac{1}{2}I\omega^2$$

Refer back to previous notes to find the formulas for the moment of inertia, *I*.

Potential Energy

Energy due to _____

Gravitational potential energy

$$PE_g = mgh$$

Since the force of gravity is _____ and the displacement and force must be in same _____, we only worry about the _____ distance

The _____ the object takes doesn't matter, just the _____ _____

Potential Energy is not _____; it is a _____

h is measured from _____ point. Just be _____.

Spring potential energy

$$PE_s = \frac{1}{2}kx^2$$

A 5.2-kg Canada goose is flying towards you at 18 m/s and a height of 3 m. What is its (a) kinetic energy and (b) potential energy?

Let's say a coil suspension spring on a car is compressed 9.0 cm after it is installed in a car. If it has a spring constant of 33000 N/m, what is the potential energy stored in the spring?

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Practice Work

1. What is the difference between kinetic and potential energy?
2. If there is 235 J of energy, how much work can be done? Why? (RW) **235 J**
3. Compare the kinetic energy of a 20,000-kg truck moving at 110 km/h with that of an 80.0-kg astronaut in orbit moving at 27,500 km/h. (OpenStax 7.9) $\mathbf{9.34 \times 10^6}$ **J,** $\mathbf{2.33 \times 10^9}$ **J**
4. (a) How fast must a 3000-kg elephant move to have the same kinetic energy as a 65.0-kg sprinter running at 10.0 m/s? (b) Discuss how the larger energies needed for the movement of larger animals would relate to metabolic rates. (OpenStax 7.10) **1.47 m/s**
5. (a) What is the translational (nonrotational) kinetic energy of a 0.50-kg can of soup (d = 5.0 cm, h = 6.0 cm) with a speed of 2.5 m/s? (b) What is its rotational kinetic energy if it is also rolling across the floor assuming it is a solid cylinder like a condensed soup? (hint: find ω first) (c) How much work is required to stop the can? (RW) **1.56 J; 0.781 J; 2.34 J**
6. (a) What is the translational (nonrotational) kinetic energy of a 165-g billiard ball (d = 57 mm) with a speed of 4.1 m/s? (b) What is its rotational kinetic energy if it is also rolling across the table assuming it is a solid sphere? (hint: find ω first) (c) How much work is required to stop the ball? (RW) **1.39 J; 0.555 J; 1.94 J**
7. Two cars, A and B, are traveling with the same speed of 40.0 m/s, each having started from rest. Car A has a mass of 1200 kg, and car B has a mass of 2000 kg. Compared to the work required to bring car A up to speed, how much additional work is required to bring car B up to speed? (Cutnell 6.17) $\mathbf{6.4 \times 10^5}$ **J**
8. Relative to the ground, what is the gravitational potential energy of a 55.0-kg person who is at the top of the Sears Tower, a height of 443 m above the ground? (Cutnell 6.27) $\mathbf{2.39 \times 10^5}$ **J**
9. A hydroelectric power facility converts the gravitational potential energy of water behind a dam to electric energy. What is the gravitational potential energy relative to the generators of a lake of volume 50.0 km^3 (mass = 5.00×10^{13} kg), given that the lake has an average height of 40.0 m above the generators? (OpenStax 7.16) $\mathbf{1.96 \times 10^{16}}$ **J**
10. A 75.0-kg skier rides a 2830-m-long lift to the top of a mountain. The lift makes an angle of 14.6° with the horizontal. What is the change in the skier's gravitational potential energy? (Cutnell 6.29) $\mathbf{5.24 \times 10^5}$ **J**
11. The spring in a certain Nerf™ toy dart gun has a spring with a spring constant of 318 N/m. How much energy is stored when it is compressed 77 mm when loading a dart? (RW) **0.943 J**
12. What would be the constant of a spring that stores 5.00×10^2 J of energy when compressed 50 cm? (RW) $\mathbf{4.00 \times 10^3}$ **N/m**