1. Potential energy results from an object’s \_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_.

2. Does an unstretched rubber band or uncompressed spring have potential energy?

3. Objects that can be compressed or stretched and return to their original shape have what form of potential energy when compressed or stretched?

4. Where does the elastic potential energy in a stretched rubber band come from?

5. A roofing contractor is standing at the edge of a roof, carrying a package of shingles. Where did his gravitational potential energy come from?

6. What is the formula for calculating gravitational potential energy?

7. Wile E. Coyote carries a 1,000 N anvil to the top of a 100 m cliff, sets it on the edge and waits to push it off when he hears Roadrunner say, “Beep beep!” What is the gravitational potential energy of the anvil as it sets on the edge of the cliff?

8. Wile E. Coyote weighs 300 N. What is his GPE on that same cliff?

9. Ignoring the force of friction from air resistance and cartoon laws of physics, which one will hit the ground first when Wile E. inevitably falls from the cliff at the same time as the anvil?

10. Which one (Wile E. Coyote or the anvil) will hit the ground with more *applied* *force*? Why?

11. ***Challenge:*** Springs, rubber bands, bungee cords, bouncy balls, and other things with elastic properties store and spring back with a only a certain ***percentage*** of the energy used to compress or stretch them. This is why a dropped ball can never bounce higher than the height from which it was dropped. Some things bounce or spring back better than others.

Robert Hooke, an English scientist in the 1600s, discovered this fact while working with springs, and his work became known as *Hooke’s Law of Elasticity.* Hooke called the percentage of kinetic energy a spring can store as elastic potential energy the *Spring Constant* (k). For example, if a spring is compressed with 10 N of force and springs back with 7 N of force, then it stored and returned 70% of the kinetic energy used to compress it. Its spring constant (k) would be 0.7. Hooke’s Law can be applied to almost anything that stores elastic potential energy, such as rubber bands, bungee cords, bouncy balls, etc. Hooke’s formula for calculating the amount of energy a spring can store is: **PE = ½ k x2**

* **PE** is the elastic potential energy (in joules) stored in the compressed/stretched spring
* **k** is the spring constant (in Newtons per meter or N/m), a number between 0 and 1.
* **x** is the distance the spring is compressed or stretched (in meters)

*Problem 1:* You have a spring with a spring constant **k** of 0.9 N/m. You compress it 0.25 m. What is the spring’s **PE** when compressed?

*Problem 2:* You’re making a hornet (for scientific research, of course, not as a weapon!), and you have a choice between two rubber bands. Rubber band 1 has a k of 0.5; rubber band 2 has a k of 0.9. Which would you choose if you want your hornet to fly as far as possible?