

Spring Energy Evaluation

Name: _____ Date: ____ COVID-19 2020 ____

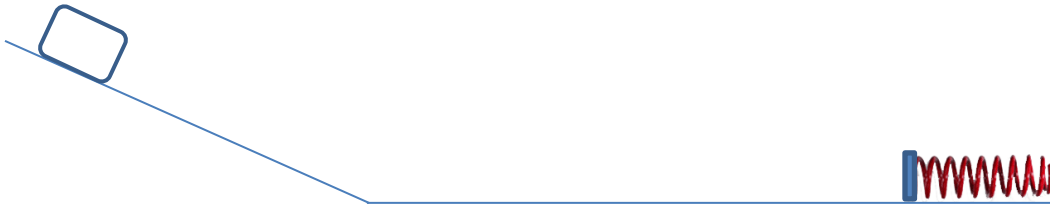
$$F = -k\Delta x$$

$$E_s = \frac{k\Delta x^2}{2}$$

$$E_g = mgh$$

$$E_k = \frac{mv^2}{2}$$

1. [5 marks] A 2.0kg wooden block is released from a 40cm high frictionless ramp and slides down the ramp and across a horizontal surface towards a spring. Upon hitting the spring and starting to compress it; it was found that it was moving at 1.3 m/s at the point when the spring was compressed by 5.0 cm. Calculate the maximum compression the spring.



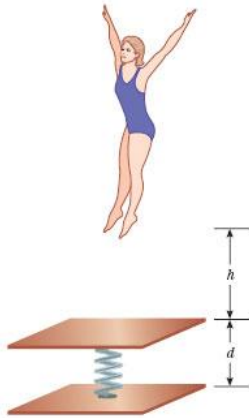
2. [5 marks] A toy dart gun with a spring constant of 150N/m is compressed by 3cm . The dart has a mass of 3g and is fired at a 15g smooth plastic block sitting on a frictionless surface. The dart is fired from the gun and sticks to the plastic block. Calculate the speed of the dart-block after the collision.



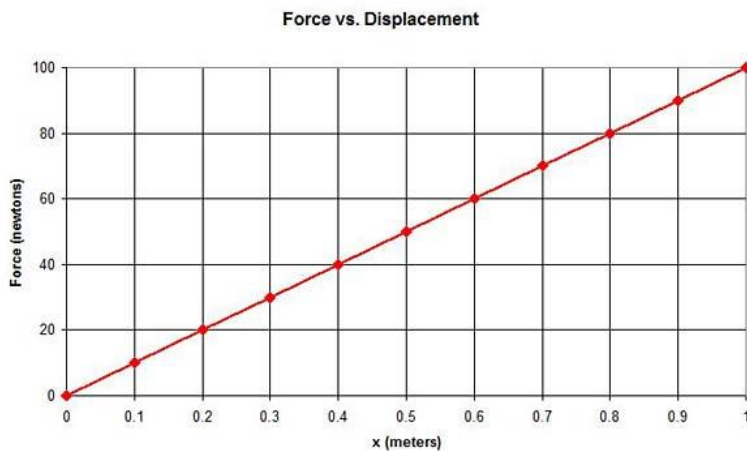
3. [3 marks] During a workout an athlete uses a “rubber band” system to do a chest expander exercise. The system has three rubber bands in parallel (see diagram). The original length of the bands is 80cm and each has a k value of 150N . The athlete stretches them out to 140cm , calculate the force required to perform this stretch and calculate the energy stored in each band.



4. [3 marks] A 72 kg acrobat stands on a spring loaded platform as a part of a stunt. If the spring under the platform has a spring constant of 1.8×10^3 N/m. The spring is compressed by 2.5 m. Calculate the maximum height above the equilibrium position the acrobat flies.



5. [2 marks] The Force vs. Stretch data for a spring is plotted below. Calculate the work required to stretch the spring from 0.2 m to 0.8 m.



6. [2 marks] A 2.0-kg block is dropped from a height of 40 cm onto a spring of spring constant $k=1960 \text{ N/m}$ (see figure). Find the maximum distance the spring is compressed.
[hint: you will need the quadratic formula to finish this problem]

