

Name:

Date:

1.13 Work, Springs

1) The change in Kinetic energy of a system is equal to the _____ plus or minus (don't circle one) the _____ (hint:work), hence the expression _____.

2. Use the work energy theorem to derive an expression for the potential of an object with mass m falling from some height h . (hint: use a relationship between potential energy and kinetic energy. Your final expression will have a V_{final} and a $V_{initial}$ as well as a $h_{initial}$ and h_{final} .)

3. Rank the following in terms of their final speed

4. Does pushing a block up a ramp at a constant speed require any force? Is any work being done? (Hint:Draw a free body diagram)

5. A block is at rest on some block of height h . After some t , the block has obtained a speed of 4 m/s . What is its change in height on the ramp? (Hint:think about potential and kinetic energy, think about how to express the potential energy at different points.)

6. You have a mass m traveling at velocity v , and it will hit three different springs in three different scenarios. Rank the following scenarios by how much work is lost to friction. Scenario 1: $K= 10 \text{ N/M}$, Scenario 2: $K= 34 \text{ N/M}$, Scenario 3: $K= 52 \text{ N/M}$. (Hint:think about how the force of a spring relates to its constant K , and then relate this to a displacement)

7. You've got a spring ($K=188\text{N/M}$) and a ball that weights 2kg . The ramp is 6m high, what is the minimum distance you must push the mass into the spring, so that it reaches the top of the ramp?(Hint: What is the formula for energy of a spring?)

8. A mass m is attached to a spring ($K=140\text{N/M}$), and the spring is displaced 12cm , if the coefficient of kinetic friction between the mass and the ground is $.5$, how many periods (one period is going back and forth) will the spring go through before coming to a stop? (Hint: how much work is lost by friction in a given period?)

9. Given that a graph of force versus displacement, for an oscillatory system like a mass on a spring, has a sinusoidal appearance, looking at the graph below of a system without friction, sketch what the graph would look like if there was friction (this can be a rough estimate).

10. You are making a potato gun for a physics project, one gun has a muzzle velocity of 110 m/s with a 3kg potato, you decide against using explosives, you want to achieve the same velocity but using a spring instead, if the spring you have has a constant of $K = 8083\text{ N/M}$, how long must your barrel at least be? (assume the potato is a point). (Hint: Think about the kinetic energy of a spring, and the kinetic energy of the potato in the first gun)

11. A surface has a coefficient of static friction of $.9$. If a spring has a constant ($K=400\text{ N/M}$), and the object pushed up against the spring is 3.5kg . What is the least distance you must push the spring to achieve any kind of velocity?