Lab 05: Work and Energy Worksheet

Name _____ **Date** _____

Partners _____

_____

PART I – WORK WHEN THE FORCE IS CONSTANT

Mass of "200-g" standard weight = _____ kg

	Time (s)	Position (m)
Start Moving		
Stop Moving		

Average force (N)	
Work done (J)	
Integral during lift (N•m)	
ΔU *gravitational* (J)	

PART II – WORK DONE TO STRETCH A SPRING

Part II		
	Time (s)	Position (m)
Start Pulling		
Stop Pulling		

Spring constant = _____ N/m

	Stretch		
	10 cm	20 cm	Maximum
Integral during pull (N•m)			
ΔU *elastic* (J)			

PART III – WORK DONE TO ACCELERATE A CART

	Time (s)	Position (m)
Start Pushing		
Stop Pushing		

Mass of cart (kg)	
Final velocity (m/s)	
Integral during push (N•m)	
ΔK of cart (J)	

PART IV - ANALYSIS

1. In Part I, calculate the work done as the average force times the distance (height) travelled. The work that you did to lift the mass did not change its kinetic energy. Calculate the change in gravitational potential energy as *mgh* using the measured mass of the standard weight.

   Compute the percent error between

   a. the work done (accepted) and the integral (measured) = _____ %

   b. ΔU gravitational (accepted) and the integral (measured) = _____ %

   Would you say that your values are in agreement? Explain.

2. In Part II you did work to stretch the spring. The graph of force *vs.* position depends on the particular spring you used, but for most springs will be a straight line. This corresponds to Hooke's law, or $F = -kx$, where F is the force applied *by* the spring when it is stretched a distance x. k is the spring constant measured in N/m.

   a. From your graph, does the spring follow Hooke's law? Do you think that it would always follow Hooke's law, no matter how far you stretched it? Explain.

b. Why is the slope of your graph positive while Hooke's law has a minus sign? Explain.

3. In Part II calculate the work you did to stretch the spring to 10 cm, 20 cm, and the maximum stretch as the change in elastic potential energy, $\frac{1}{2}k(x_f^2 - x_i^2)$, using the measured spring constant.

   Compute the percent error between

   a. ΔU elastic (accepted) and the integral (measured) at 10 cm = _____ %

   b. ΔU elastic (accepted) and the integral (measured) at 10 cm = _____ %

   c. ΔU elastic (accepted) and the integral (measured) at max position = _____ %

   Would you say that your values are in agreement? Explain.

4. In Part III calculate the work you did to accelerate the cart as the change in its kinetic energy.

   Compute the % error between ΔK (accepted) and the integral (measured) = _____ %

   Would you say that your values are in agreement? Explain.