**This is a mid-term project and the completed project is due Thursday, April 2, 2015. LATE PROJECTS WILL EARN A MAXIUM GRADE OF 50!**

**Points for each section are listed in ( ) next to the questions. 5 points will be awarded for time management, 5 points for spelling and grammar and 5 points for neatness on the test and project.**

Background Information: Catapults use projectile motion to move objects across distances. A couple of factors can affect the distance an object can be launched, such as the mass of the object, and the amount of force used to move the object. You will be launching marshmallows.

(1 point each) Give an example of each term below and why it is an example.

**Term Example Why is it an example?**

Force

Work

Kinetic energy

Potential Energy

Gravitational Potential Energy

Chemical potential energy

Elastic Potential energy

Electrical energy

Mechanical energy

Nuclear energy

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(This section is worth 10 points)

**I promise that the work on this mid-term project is my own and I have not given nor received help from others.**

**Name: Signature: Date:**

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**This page is due beginning of class on Monday, March 30, 2015.**

Simple machines make our lives easier by allowing us to use less energy & force to do work. Simple machines can be combined to form compound machines, allowing simple machines to be used in greater variety of ways.

(1 point each) There are six simple machines for performing work. List the six simple machines and give an example of each and why it is an example.

Machine Example Why is it an example?

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**Your catapult must be attached to a base no smaller than 10x10 inches no larger than 18x18 inches.**

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(The above section is worth 6 points)

**Your task: design a catapult that can launch a marshmallow that can be launched the highest!**

(1 pt) Write a sentence how a catapult can launch higher than others.

(3 points) Which of the six simple machines do you think would make the best catapult and why?

(5 points) Question: Which type of designs will cause the catapult to launch a marshmallow with the greatest height? Write your hypothesis.

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**This page is due beginning of class Tuesday, March 31, 2015**

(5 points) List the materials you are using:

Construction phase: this is to be done at home OR during Learning Labs.

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(The below section is worth 10 points) Explain your procedure using the guidelines below

a. What did you do? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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b. How did you do it? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Your catapult must be attached to a base no smaller than 10x10 inches no larger than 18x18 inches.**

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c. What happened when you tried various catapults? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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d. What did you change? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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e. What unexpectedly happened? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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This is due at the beginning of class on Wednesday, April 1, 2015.

Make a data chart to record your observations:

Testing phase: this is to be done in class!

(2 points) Mass of marshmallow: \_\_\_\_\_\_\_\_\_\_\_\_\_\_kg (remember to convert g to kg!)

(2 points) Force recorded for pulling back plank \_\_\_\_\_\_\_\_\_\_\_\_\_\_ N

Launch your marshmallow five times and collect the data below.

(3 points) Trial Angle at 15 m height (distance) time

Tan (angle) \* 15m .

1

2

3

4

5

(2 points) Calculate your average height (distance)

**Your catapult must be attached to a base no smaller than 10x10 inches no larger than 18x18 inches.**

(2 points) Calculate your average time

(4 points) Average velocity of marshmallow:

(5 points) Attach a diagram of your catapult and attach to this report. Label the following:

1. the point of greatest kinetic energy

2. the point of greatest potential energy

3. the location where potential energy transforms to kinetic energy

4. name the form of energy used in a catapult

5. How does the catapult demonstrate the laws of motion?

(2 points) How does the catapult demonstrate Newton’s 1st law?

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(2 points) How does the catapult demonstrate Newton’s 2nd law?

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(2 points) How does the catapult demonstrate Newton’s 3rd law?

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**Your catapult must be attached to a base no smaller than 10x10 inches no larger than 18x18 inches.**

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(2 points) How did you increase the accuracy of your catapult?

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(2 points) What kind of changes increased the distance the catapult launched the marshmallow?

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(2 points) WHY did these changes increase the distance?

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**This page is due at end of class Wednesday, April 1, 2015.**

Do a little math - Your catapult is a simple machine. What kind of simple machine is it? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Analysis phase: Use complete sentences!

In moving a marshmallow your catapult is doing work. Identify the class of lever your catapult falls in. Calculate the work being done by your catapult and the mechanical advantage of your machine.

(1 point) My Catapult is a \_\_\_\_\_ Class Lever

MA = Effort arm length / Resistance arm length

(1 point) Length of effort arm \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm.

(1 point) Length of resistance arm \_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm.

(1 point) Mechanical Advantage \_\_\_\_\_\_\_\_\_\_\_\_\_\_

(2 points) Force \_\_\_\_\_\_\_\_ N. Distance \_\_\_\_\_\_\_\_\_ m. Work \_\_\_\_\_\_\_\_\_

Energy:

(2 points) What is the kinetic energy of your marshmallow? (KE= \_\_\_\_\_\_\_ x \_\_\_\_\_\_\_\_\_) =

(2 points) If the KE is that of the marshmallow in flight, what is the potential energy of your marshmallow when the arm is pulled back? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Conclusion:

(5 points) Based upon your research, experimentation, data analysis and observations, was your hypothesis correct? Write in complete sentences.

****(5 points) Write a “what’s next” statement for what you propose should be done based upon your conclusion.

This complete project is due end of class Thursday, April 2, 2015