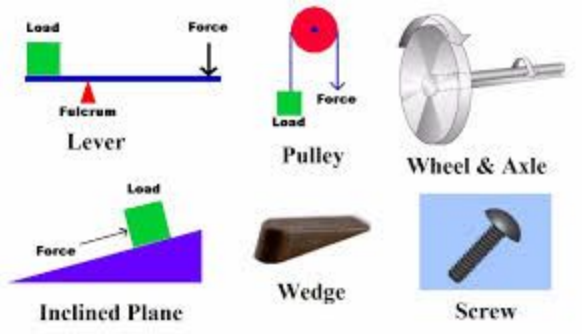
Name: **CY3 YRB NW Power**

Rube Goldberg Project Packet

We will be discovering simple machines, the types of energy, how that energy is converted, and then we will combine these concepts to create a fun, creative, innovative, complex, powerful machine that completes a simple task.

The first step in this process is to learn about simple machines. Your groups will be exploring and experimenting with the simple machines kits to answer the question below.

What are Simple Machines?



After experimenting with and assembling the materials from the Simple Machines Kits your group will present your findings and investigations on <u>Friday, January 17th.</u>

Follow the specific directions for your group. Your group will present either levers, inclined planes, wheels and axles, or pulleys.

Take notes on your classmates' presentations. This information will be helpful for future assessments and for constructing your own complex machine.

Simple Machines - Levers

1. Follow the directions on page 4 in the Simple Machines experiment manual to assemble the spring scale. Notice the information about work and mechanical advantage highlighted in white at the bottom of the page. For mechanical advantage, they call output force - load force and input force- effort force.
2. Your group will experiment with the 3 different levers and finally build the balance scale to share with the class. Follow the directions through experiment 8.
3. After building each lever, calculate the mechanical advantage of each lever. Compare the mechanical advantage of each lever.
4. What type of lever is the balance scale?
5. Investigate levers and how they are useful to humans.
6. Make sure the following information is shared with the class in your presentation.

    - The 3 types of levers and how each makes work easier.
    - Show the balance scale and explain how it uses levers.
    - Show at least 5 images of examples of levers in our everyday world.

Simple Machines - Inclined Planes

1. Follow the directions on page 4 in the Simple Machines experiment manual to assemble the spring scale. Notice the information about work and mechanical advantage highlighted in white at the bottom of the page. For mechanical advantage, they call output force - load force and input force effort force.
2. Your group will experiment with the inclined planes. Complete experiment 9 starting on page 10. What is the advantage of using an inclined plane. What did you discover when you lifted the weight/water straight up vs. using the inclined plane (use the spring scale)?
3. Build experiment 10 - the adjustable inclined plane. Share this build with the class. Calculate the work performed at the highest setting of the plane and the lowest setting.
4. Investigate inclined planes and how they are useful to humans.
5. Investigate wedges and screws and how they are related to inclined planes.
6. Make sure the following information is shared with the class in your presentation.

    - Explain how inclined planes, wedges, and screws makes work easier.
    - Show the adjustable inclined plane you built and share the calculations of work for the adjustable inclined plane.
    - Show at least 5 images of examples of inclined planes in our everyday world. Be sure to include wedges and screws.

Simple Machines - Wheels and Axles

1. Follow the directions on page 4 in the Simple Machines experiment manual to assemble the spring scale. Notice the information about work and mechanical advantage highlighted in white at the bottom of the page. For mechanical advantage, they call output force - load force and input force effort force.
2. Your group will experiment with the wheel and axle tests, experiments 11 and 12, starting on page 16.
3. Calculate the work required to pull the chassis (chas - ee) without wheels, with small wheels on the inclined plane and with large wheels on the inclined plane. Be precise when measuring the distance.
4. What is happening to the work required to pull the load in the various instances?
5. Investigate wheels and axles and how they are useful to humans.
6. Make sure the following information is shared with the class in your presentation.

    - A clear explanation of how wheels and axles make work easier.
    - Show the inclined plane in use with either the large or small set of wheels.
    - Share the calculations of work for your experiments.
    - Show at least 5 images of examples of wheels and axles in our everyday world.

Simple Machines - Pulleys

1. Follow the directions on page 4 in the Simple Machines experiment manual to assemble the spring scale. Notice the information about work and mechanical advantage highlighted in white at the bottom of the page. For mechanical advantage, they call output force - load force and input force effort force.
2. Your group will experiment with experiments 13-15, starting on page 20.
3. After building each pulley, calculate the effort force required for each pulley. Compare advantages of each pulley
4. Build the elevator with pulleys to share with the class.
5. Investigate pulleys and how they are useful to humans.
6. Make sure the following information is shared with the class in your presentation.

    - Show a fixed, movable and compound pulley. They will be provided to you in addition to the building materials. Explain how they work. Share the calculations for effort force discovered when you were lifting with the fixed, moveable and compound pulleys you built with the kit.
    - Show the elevator with pulleys you built and explain how it uses pulleys and many simple machines.
    - Show at least 5 images of examples of pulleys in our everyday world.

Who is Rube Goldberg?

Now that you know more about simple machines, you will apply that knowledge when creating a Rube Goldberg machine.

Investigate the artist, Rube Goldberg, by visiting the site rubegoldberg.com. At the same site go to rube-tube to view various Rube Goldberg machines. Your group will select a video to analyze.

Write the title of the video your group selected here.

_____

Watch the video together and talk together about the simple machines, the energy and its transfer, and how you think the creator(s) made the machine. Use the blank space below for note taking while watching the video.

Show the video to your classmates and explain where the simple machines appear, what energy is present in the machine, and how it is transferred from item to item. Be sure everyone in your group contributes to the presentation.

Present to your classmates on Friday, January 24th

Rube Goldberg Machine Project

Introduction: Every time something in the Universe moves, heats, cools, or explodes, some form of energy is transferred from one piece of matter to another. Since there are many different forms of energy, there are also many different ways to transfer it. Simple machines help move energy from one place to another. Your group will create a Rube Goldberg machine to demonstrate these concepts.

Assignment: Design and construct a Rube Goldberg machine using simple machines and energy transfer to complete 6 (or more) tasks that will result in your machine completing a simple task. You must also use at least 3 different simple machines at least once. A Rube Goldberg machine uses very complex processes to complete a very simple task such as flipping a switch, pouring water, or turning a page.

Materials to create the steps might include

gears, dominoes, marbles, rubber bands, tubing, balls, cups, plates, weights, toy cars, gears, pipe cleaners, clips, balloons, electronics, switches, chemical reactions (vinegar and baking soda), springs, marble runs, magnets, toy sets, blocks, car tracks, paper towel tubes, children's game pieces…….and more.

Items to provide structure might include

cardboard, foam board, masking tape, tape, fasteners, pvc pipe, wire, and more.

Ideas for Simple End Tasks…..

- Pour water into a cup
- Shut something on or off
- Trap Something
- Ring a bell
- Rip a piece of paper
- Blow out a candle
- Pull a kleenex

Machine Requirements:

1. The machine must complete a **simple task** (as reliably as possible).
2. The machine must contain at least **3 different simple machines**. Each step will involve some type of machine (incline, lever, pulley, wheel and axle, screw, wedge, etc.) or maybe even a combination of machines. You can use all types of machines as many times as you need, to complete your task. The requirement is to use 3 DIFFERENT types of machines.

4. Use a **minimum of 6 steps**. There is no maximum number of steps. A step is defined as one complete process. For example, a set of dominoes falling to hit a ball at the end of the line is ONE step, not a step for each domino falling.

5. The boundaries of the machine are your group table.

6. To get full credit, your machine should be successful at least once. You will get 3 attempts. However, you will get more points if it is always reliable.

7. You can not touch the machine once the process has been set in motion.

Steps to completion include.

_____ Bring 2 items to contribute to the group design. **(Due Friday, January 17th)**

_____ Experiment with design. Submit picture of design. **(Due Tuesday, January 21st)**

_____ Create and submit a written plan. **(Due Wednesday, January 22nd)**

_____ Try it out.

_____ Revise.

_____ Adjust written plan. Submit final plan. **(Due Tuesday, January 28th)**

_____ Present machine to class! **(Presentations on Wednesday, January 29th)**

_____ Write individual write up. **(Due Friday, January 31st)** See rubric.

_____ Fill out reflection. **(Due Friday, January 31st)**

Group Member Names:_____

Rube Goldberg Machine Name:_____

Points	**4 Excellent**	**3 Good**	**2 Poor**	**1 Needs Improvement**
Simple Task	Accomplished!	Soooo close		
Machine Process	3 Simple Machines clearly represented	3 Simple Machines represented	Less than 3	
Steps	Group presents 6 or more steps clearly represented.	Group presents 5 steps.	Group presents 4 steps.	Group presents 3 or less steps.
Explanation	Group clearly explained types of energy and transfer, simple machines, and steps.	Group explained types of energy and transfer, simple machines, and steps.	Explanation lacking	No explanation
Creativity	Rube Goldberg Master!	Straightforward representation		
Reliability	Machine was successful on all 3 attempts.	Machine was successful 2 times.	Machine was successful 1 time.	Machine was not successful.
Written Plan	Steps are clearly explained	Steps are present but unclear	Steps are lacking information	

Your group will fill out this rubric together.

_____/ 30

Name: **Rube Goldberg WRITE UP** NW Power CY3 YRB

Use this rubric to understand expectations. Paper clip or staple the rubric to your final draft.

	4	3	2	1
Introduction Paragraph	Includes opening line, statement of purpose, and preview of paragraphs.	Missing one element	Missing more than one element	Introduction paragraph not attempted
Steps Paragraph	Paragraph completely describes machine step by step including the simple end task.	One step missing	More than one step missing	Steps paragraph not attempted
Simple Machines Paragraph	Paragraph explains all simple machines present in the machine.	Missing one simple machine	Missing more than one machine	Simple machines paragraph not attempted
Types of Energy/Energy Transformations Paragraph	Paragraph thoroughly explains the types of energy utilized in the machine and its transformations.	Missing a type of energy or a transformation	Missing more than one type of energy or transformation	Types of Energy/Energy Transformation paragraph not attempted
Conventions (spelling, punctuation, capitalization, grammar)	No errors are noticeably evident.	A few errors are present.	There are many errors.	The writing is confusing because of errors.
Procedural Language (first, second, next, to begin, after, as soon as, finally…..and many more)	Writer expertly utilizes procedural language with variety to clearly explain procedures.	Writer utilizes procedural language but relies heavily on only a few words.	Writer attempts to utilize procedural language but does not understand how to apply it.	Writer did not use procedural language.
Concluding Line	Writer uses a concluding line or paragraph to end their writing.			Writer does not use a concluding line or paragraph

Total Points

_____ + 2 _____/30

Group Interaction Reflection

A group has some similarity when compared to groups of people. Each person represents a different part of the whole working together in a complex manner. Just like the success of the Rube Goldberg machine is dependent on its individual working parts it is the same for your group dynamics. Each group member is vital to the success of the group's outcome.

1. What role or roles did you take on for your group during the project?

2. What strategies did you or your other group members use to stay on task?

3. What did you contribute? What actual components did you complete?

4. What worked well in your group?

5. What challenges did your group have to overcome and how did your overcome them?

6. How does working in a group make the individuals in the group more powerful students?

7. What other comments or ideas would you like to share about the process you and your group members have just completed?