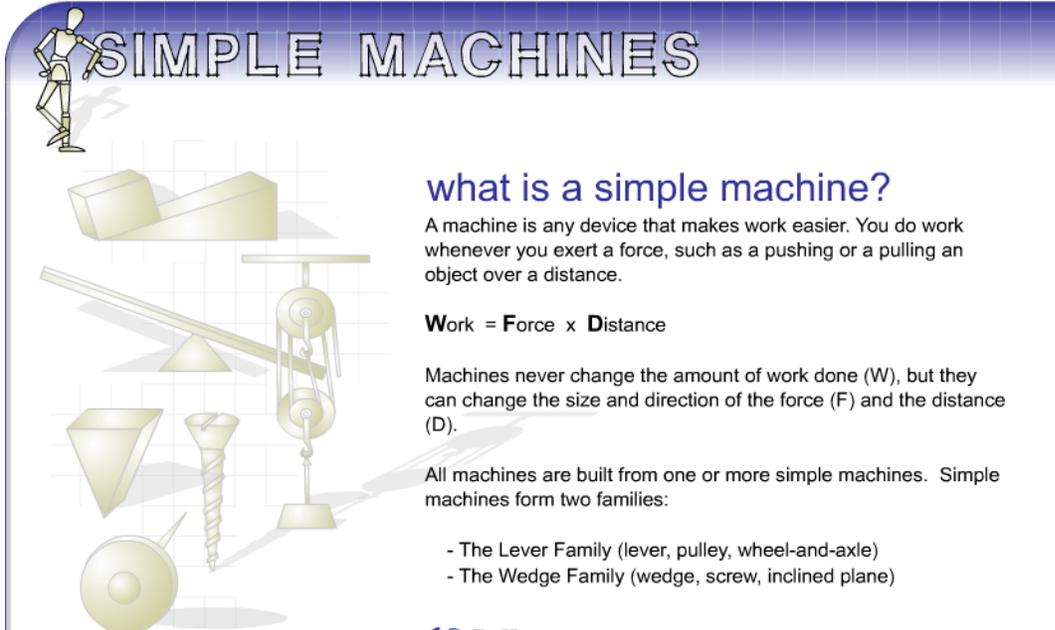


Simple Machines Module Part 1:



what is a simple machine?

A machine is any device that makes work easier. You do work whenever you exert a force, such as a pushing or a pulling an object over a distance.

Work = Force x Distance

Machines never change the amount of work done (W), but they can change the size and direction of the force (F) and the distance (D).

All machines are built from one or more simple machines. Simple machines form two families:

- The Lever Family (lever, pulley, wheel-and-axle)
- The Wedge Family (wedge, screw, inclined plane)

Step 1. Research the meaning and use of “simple Machines”

Check out the following websites and answer the questions below the web addresses.

Look around in the website for the answers, but do not feel you have to find the answers at this one website alone. If the description at this site does not help you to understand the concept, then go to another website. There are some other helpful websites listed below (on page 3).

Please record in your journals any resources you use which are not listed:

Go to this website and explore all the resources found here...

<http://cosi.org/downloads/activities/simplemachines/sm1.html>

From this page click on the drawings of the simple machines to discover how they work, and answer the following questions on your activity sheet. Choose the best possible answer and record the letter which corresponds to your answer on your activity sheet.

1. What is mechanical Advantage (MA):

- A. A mathematical way to explain how much effort is needed to move objects.
- B. The factor by which a machine multiplies the force put into it.
- C. The distance or effort required to move an object with the use of a machine.
- D. The factor required to move an object with a machine.

2. What is the mechanical advantage (MA) of a pulley?

- A. 4
- B. 25
- C. It is equal to the number of ropes attached to the pulley.

D. It is weight of the load divided by the length of the rope attached to the pulley.

3. What is a fulcrum

- A. The pivotal point where the lever rotates.
- B. Half the distance between the weight and the force.
- C. The Egyptian town where levers were invented.
- D. The pivotal argument needed to calculate Mechanical Advantage.

4. What is the mechanical advantage (MA) of a lever?

- A. The weight divided by the length of the arm it sits on. (resistance arm)
- B. The weight divided by the length of the arm the force is applied to. (effort arm)
- C. The length of the effort arm divided by the length of the resistance arm.
- D. The length of the resistance arm divided by the length of the effort arm.

5. What is the mechanical advantage (MA) of a ramp or inclined plane?

- A. 5
- B. The height divided by the slope.
- C. The slope divided by the height.
- D. There is none because you have to move the object further than the height.

6. Is the Mechanical advantage of a screw different from that of an inclined plane?

- A. A screw is an inclined plane who's MA is dependant upon the machine used to drive it.
- B. A screw is an inclined plane and therefore has the same MA as an inclined plane.

7. What is the Mechanical Advantage of a wheel and axle?

- A. MA is expressed as a ratio between the radius of the axle and the radius of the wheel.
- B. MA is expressed as a ratio between the radius of the wheel and the radius of the axle.
- C. MA of a wheel and axle is 6, meaning the wheel spins 6 times faster than the axle.
- D. There is none because the wheel has to move six times faster or farther than the axle.

8. If the mechanical advantage of a simple machine is 4, then the

- A. Output force is 4 times the effort
- B. Effort is 4 times the output force
- C. Efficiency is 4%
- D. The work output is 4 times the input

Look at the picture and go to the following website to answer the last 2 questions:

<http://www.cosi.org/files/Flash/simpMach/sm3.html>

Solve the problem:

We have a wheelbarrow with 100 pounds in it.

(Remember that a wheelbarrow is a type of lever)

The distance from the fulcrum to the effort is 5 ft.

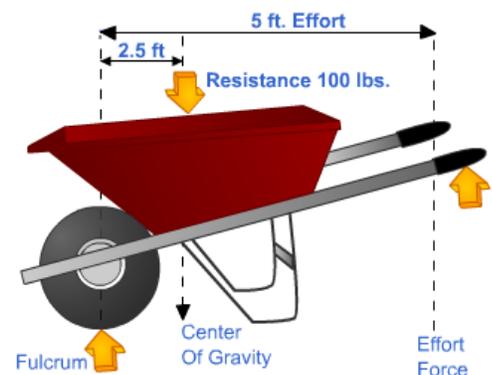
The distance from the fulcrum to the resistance is 2.5 ft.

9. How much effort is needed to lift the handles?

- A. 25lbs
- B. 50 Lbs
- C. 75 Lbs
- D. 100 Lbs

10. What is the mechanical Advantage of this Wheelbarrow?

- A. 2
- B. 2.5
- C. 5
- D. 50



Mechanical Advantage Defined:

http://en.wikipedia.org/wiki/Mechanical_advantage

Here is an interactive website on Mechanical Advantage:

http://www.wisc-online.com/objects/index_tj.asp?objID=ENG20504

Here is a video on Mechanical advantage:

<http://video.google.com/videoplay?docid=8517358537561483069>

Here are some more simple machine websites to check out:

<http://staff.harrisonburg.k12.va.us/~mwampole/1-resources/simple-machines/index.html>

<http://www.edheads.org/activities/simple-machines/glossary.htm>

<http://www.mikids.com/Smachines.htm>

http://www.coe.uh.edu/archive/science/science_lessons/scienceles1/finalhome.htm

http://en.wikipedia.org/wiki/Simple_machine

<http://www.mos.org/sln/Leonardo/InventorsToolbox.html>

<http://library.thinkquest.org/CR0210120/Mechanical%20Advantage.html>

http://www.edinformatics.com/math_science/simple_machines/mechanical_advantage.htm

http://www.edinformatics.com/math_science/simple_machines/lever.htm

Pivot Stickfigure Animator Instructions For use with Version 2.2.5

Please read all instructions before you begin the assignment.

Overview: Pivot Stickfigure Animator is free downloadable software that lets you create stickfigure animations. It is easy to use, user-friendly, and saves animations as a “.piv” file. The only down side is if you would like to send someone an animation, they must also download Pivot Stickfigure Animator. Animations are publishable to the Web.

Making an Animation

- Click and hold on the red pivots on a selected stickfigure (pivots will be red if stickfigure is selected) to move segments. The gold dot on the stickfigure moves the figure. All you have to do is click, hold, and drag the figure wherever you would like the stickfigure to be moved.
- Pivot Stickfigure Animator is similar to making a clay animation. You will have to move the figure very slowly to make it seem like the figure is moving.
- Click the “NEXT FRAME” button to advance to a new frame. The adjustments you made in the previous frame are maintained in the new frame. After you click “NEW FRAME” for the first

time onwards in any animation, the movements will be recorded. Each time you move a stickfigure after the first frame, the position and place the stickfigure was before you moved it is left in gray.

Playback

- To play back an animation, click on the “PLAY” button on the left menu bar, which is on the left-middle side of the animation software. The animation will play itself back. There is an option to have the animation repeat itself after it has played itself back. This option can be toggled by clicking in the white box next to “Repeat.” The preset is to repeat, so the animation will repeat itself automatically. To toggle “Repeat” on or off, click the white box. If the check mark disappears, the repeat option is cancelled.

Stickfigure Options

- You may customize a selected stickfigure by changing its color, size, and thickness. To change its color, select “COLOR” on the menu bar. When you select “COLOR,” a menu will pop up that lets you select a color for your stickfigure. It will have 48 custom colors preset. You may choose one color. If you have Custom Colors, they will be displayed on the pop up, too.
- You may define a Custom Color by selecting the “DEFINE CUSTOM COLORS” button. Pressing on this tag brings up an addition to the “COLORS” box already displayed. You may click and hold on the crosshairs in a field of color to design a Custom Color. Once you have decided what color you would like, you may adjust the brightness of the color by clicking and holding on the arrow next to a bar next to the field of color. Once you are done, click “ADD TO CUSTOM COLORS” at the bottom right of the box. This tag is underneath the field of color and the brightness bar. The color you have created is displayed under the “CUSTOM COLORS” tag. Click the color you would like, and click “OK.” The stickfigure will be colored the color you have selected.
- To increase the size of a selected stickfigure, click the arrows next to the box containing the number 100 in it. Clicking on the arrow pointing up will increase the size of the selected stickfigure; clicking on the arrow pointing down will decrease the size of the selected stickfigure. You may also click, hold, and drag and highlight the 100. You may type a number over it and hit “ENTER” to change the size of the selected stickfigure.
- To change the thickness of a stickfigure, click the “EDIT” button on the menu bar. A box will pop up that contains a stickfigure with the body segment highlighted in blue and a menu bar. A blue segment means that the segment is selected. To select a segment, click on a red pivot. The segment will become blue. The segment’s specifications (thickness, length) are listed down at the bottom of the box. Change the thickness of the stickfigure by clicking the up and down arrows on the menu bar. The thickness of the stickfigure will change according to your commands.

Editing and Drawing a Stickfigure

- To edit a stickfigure, click the “EDIT” button on the menu bar. A box will pop up with a stickfigure with the body segment highlighted. You may change the thickness of the stickfigure by clicking on the up and down arrows. Clicking on the top button that looks like a segment will allow you to create a segment on the selected stickfigure. Your pointer will change to crosshairs. Click and drag to where you would like your segment to end. Click again. The segment will be placed and the pointer will return to normal. Note: You must start on a pivot to make a new line

segment. When you are done, you may want to save the figure you have edited. Bring down the “FILE” menu and click on “SAVE AS.” (You will need to create a new folder for Pivot. Click the “NEW FOLDER” icon at the top right of the “SAVE AS” box. The “NEW FOLDER” icon looks like a portfolio folder with a flash on it. Name the folder as MyPivot in your user drive (U). Click “OPEN” at the bottom of the screen. Type a name for your new figure. Click “SAVE” at the bottom right-hand corner.

- To draw a new figure, select a stick figure. Click on “EDIT.” Move up to the “FILE” tag and click on it. Select “NEW.” You will notice that the stickfigure will disappear and a single segment will be left on the editor. You can draw more than just stickfigures. The icons on the menu bar are tools you may use to create your new figure.
- To add a figure to an animation, bring down the “FILE” menu. Click on “ADD TO ANIMATION.” If you have not previously saved your new figure, Pivot will prompt you to. Pivot will bring up a pop up that tells you that you must name the figure. Pivot will not save your figure, though.
- To add a figure, move your pointer to the menu bar on the left of your screen. If you have added figures to the animation, they will be listed in the dropdown menu under “ADD FIGURE.” Select one of the figure names, then click “ADD FIGURE.”

Tips & Warnings

- Remember that this is animation. Even the smallest movement can take several frames. Take it slow and don't despair too much if it doesn't look perfect the first go around.

Using the Stickfigure Builder

- When creating a new figure, first you must select a stickfigure. Click on “EDIT.” Once the Stickfigure Builder program is up, bring down the “FILE” menu. Click on “NEW.” The stickfigure will disappear. The icons that appear on the menu bar on the left side of the screen are listed below.
 1. Add Line Segment button (line segment with two red dots on the ends) – creates line segment. Must start from a pivot on a segment.
 2. Add Circle Segment button (Circle with two red dots on the ends) – creates circle segment. Must start from a pivot on a segment.
 3. Toggle Segment Kind button (Circle with line in the middle with two red dots on the ends) – toggles selected segment from circle to line and vice versa.
 4. Thickness Changer button (up and down arrows) – toggles thickness of selected segment.
 5. Segment Duplicator button (two parallel lines with red dots on the ends) – duplicates selected segment. Must start from a pivot on a segment.
 6. Static/Dynamic Toggle button (line with an X on the end and a red dot on the other) – toggles selected segment static/dynamic.
 7. Delete Segment button (red X) – deletes selected segment when clicked on.

Backgrounds

- To load a background, bring down the “FILE” tag on the menu on the top of the screen. Select “LOAD BACKGROUND.” Pivot will automatically take you to the “OPEN” box. Bring down the dropdown menu at the top of the box. Double-click “MY DOCUMENTS.” Double click on

“MY PICTURES.” If you have any previously saved backgrounds, you will find them here. Double-click on the background you would like. The background of your animation will change.

- To create a background, open up the “PAINT” program on your computer. To access “PAINT,” click the “START” button. Click “ALL PROGRAMS.” Click “ACCESSORIES.” Click “PAINT.” “PAINT” will open up. Draw a background. When you’re finished, save your background under “MY PICTURES.” Now, to access your background on Pivot, click on “FILE.” Click “LOAD BACKGROUND.” Click the dropdown menu at the top. Select “MY PICTURES.” Select your background, and click “OK.”

These Steps will help with Pivot extras

1. Learn how animation works. Animations work by frames, hundreds, perhaps thousands of pictures put together. Each picture is shown quickly; several pictures are shown to you each second, making it look like the images are moving. This happens in movies also, except the pictures aren't drawn, but taken.
2. Create any figure in Pivot, and move it into the location you want it to start out. Click "Next Frame".
3. Move a joint a little closer to the location you want the scene to end out. You'll notice there is a gray mark where the figure last was, it's supposed to help you out if you get lost, and if you accidentally delete the figure, you can easily put it back in place.
4. Create an animation. Make sure it's long...300-400 frames maybe. Save it as a .piv, then a .GIF.
5. Add some basic sounds! Open up Windows Movie Maker (to find it, search your computer). Click "Import Pictures", import your .gif animation. Drag it into the video section. Now import some music, and drag it into the audio/music section. Click "Save to my computer" and there you have it! You can also do this with a microphone: click the microphone icon in the movie maker. Click "Start Narration" and talk into your microphone along with the animation. Click done and the sound will be added!
6. Practice scenes. Start with 1 frame, have a circle on one side of the animation... click "Next Frame", then move the circle to the other side. Click "Next Frame" and save it on repeat. Now watch it. You'll notice that the animation never ends. Import it into Windows Movie Maker, drag it into the "Video" Section, keep dragging it in. That way you can control how many times it repeats itself. This gets harder the more frames you have it on... you need to drag the figure (frame by frame) to the location it started out. It takes some practice... but you'll eventually get it.

Tips

- When you save your animation as a .gif, resize it to a smaller size. This will shorten the probability of the animation leaving messed up marks and stuff like that! Take note that you can't save animations as .jpg or .jpeg! It won't work as .jpg!
- Move as many joints as you can each frame (But don't move them too much/far)
- Move joints slowly at first, and speed it up... when it's stopping slow it down. (Don't do this if you want a jerky motion)
- PRACTICE
- Have the screen shake when a major blow is created. to do this, you'll need to move all the figures up then down, and back to where they started out (You can have more than just up or down.)
- Make the FPS (Frames Per a Second) higher, so it will make the animation more realistic
- PRACTICE
- Try Practicing with figures... hands, arms, heads, etc.
- you can get very much stick figures like cars,explosions,swords etc.... from droidz.org

Warnings

- Sometimes the program you're using will close itself... so save frequently.

PIVOT Module Activity:

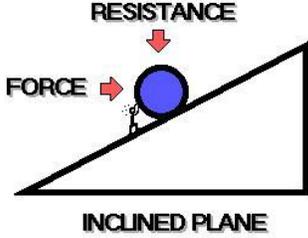
Name(s): _____ and _____

Rotation # _____ Date: _____

Directions: Provide an explanation that describes how the definitions are used as simple machines. Add a picture for each definition. The first one is done for you.

*****When you do a search, include the phrase “simple machine” in order to get the correct definition.

Note: Don't forget to provide a URL (web address) for each definition and each picture.

Simple Machine Definition:	Picture
<p><u>Inclined Plane:</u> The <i>inclined plane</i> is a surface set at an angle, other than a right angle, against a horizontal surface. The <i>inclined plane</i> permits one to overcome a <i>large resistance</i> by applying a relatively <i>small force</i> through a longer distance than the load is to be raised.</p> <p>URL: http://weirdrichard.com/inclined.htm</p>	 <p>URL: http://weirdrichard.com/inclined.htm</p>
<p><u>Wheel and Axle:</u></p> <p>URL:</p>	<p>URL:</p>
<p><u>Screw:</u></p> <p>URL:</p>	<p>URL:</p>
<p><u>Wedge:</u></p> <p>URL:</p>	<p>URL:</p>
<p><u>Lever:</u></p> <p>URL:</p>	<p>URL:</p>

	URL:
Pulley:	
URL:	
	URL:

*****Please make sure you have working URL links and that the file is neat and tidy. Save it to your user drive in a folder named "Pivot" and let your teacher know when you are finished.

Guidelines:

Each animation will include:

- a minimum of 25 frames (excellent ones will have many more than this)
- backgrounds (made in paint, not downloaded)
- characters
- a demonstration of the simple machine.
- save with appropriate names (plane, wheel, etc.)

Here is a tutorial for Pivot Animator:

<http://www.youtube.com/watch?v=16qGQDnWCE0>

Here is another one:

http://www.teachertube.com/view_video.php?viewkey=a7b75c60a6261f74fea5