**Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pd:\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Simple Machines/Mechanical Advantage/Efficiency**

Essential Questions**:** \_\_\_\_\_\_\_\_\_ **how simple machines, such as inclined planes, pulleys, levers and wheel and axles, *are used to create mechanical advantage and increase efficiency*.**

Work is done when a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and moves it a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Work = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The unit for work is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (N· m)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is done if the object \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ travel a distance

Definitions:

Energy:

Work:

Force:

**WORK PROBLEMS:**

How much work is being done by a weightlifter below that applies 1000 Newtons of force but does not move the mass?

How much work is being done by a weightlifter below that applies 500 Newtons of force lifting a mass 2.0 meters?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is done if the object \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ travel a distance

**According *to the scientific definition*, what is work and what is not?**

* + a teacher lecturing to her class WORK NOT WORK
  + a mouse pushing a piece of cheese with its nose across the floor WORK NOT WORK
  + A scientist delivers a speech to an audience of his peers. WORK NOT WORK
* A body builder lifts 350 pounds above his head. WORK NOT WORK
* A mother carries her baby from room to room. WORK NOT WORK
* A father pushes a baby in a carriage. WORK NOT WORK
* A woman carries a 20 kg grocery bag to her car?

**When using a machine to do work, two forces are involved.**

* Input Force (\_\_\_\_\_\_\_\_)
  + The force *\_\_\_\_\_\_\_\_\_\_\_\_\_\_*apply to the machine in doing work (\_\_\_\_\_\_\_\_)

* Output Force (\_\_\_\_\_\_\_)
  + The force that the *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* applies in doing work (\_\_\_\_\_\_\_)

**Two types of work are involved**

Work \_\_\_\_\_\_\_\_\_\_ is the amount of work done \_\_\_\_\_\_\_\_ a machine.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ X \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Work \_\_\_\_\_\_\_\_\_\_ is the amount of work done \_\_\_\_\_\_ a machine.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ X \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Ideally, without friction

W(\_\_\_) = W (\_\_\_)

(F\_\_\_)(d\_\_\_) = (F\_\_\_)(d\_\_\_)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = how many \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ force you get out of a simple machine

**Mechanical Advantage**

**MA = (Fout)/(Fin)**

Simple machines\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ themechanical advantage

Machine

w/

6 M.A.

**EXAMPLE:** A mechanical advantage of 6 means the machine outputs 6 times more force

10 N in

\_\_\_\_\_\_\_\_\_ out

**Calculating Mechanical Advantage**

You apply 2000 N to a machine and the machine applies 200 N to an object. What is the mechanical advantage?

What is the mechanical advantage of a machine that applies 200N to an object when you apply 50N to the machine?

You apply 10 N to a machine and the machine applies 10 N to another object. What is the mechanical advantage?

**Mechanical Advantage: What does it mean?**

Mechanical Advantage = \_\_\_\_\_

* ***There is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to using the machine***

Mechanical Advantage \_\_\_\_\_\_\_\_

* **The machine makes work \_\_\_\_\_\_\_\_\_\_\_\_\_**

Mechanical Advantage \_\_\_\_\_\_\_

* ***The machine makes work \_\_\_\_\_\_\_\_\_\_\_\_***

**Efficiency**

We said that the \_\_\_\_\_\_\_\_\_\_\_\_\_\_equals the \_\_\_\_\_\_\_\_\_\_\_\_\_\_, or: **Win = Wout**

*Some output work is lost due to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

* The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of work input to work output is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* What would improve the efficiency of a machine?(Hint: What reduces friction?)

**Calculating Efficiency**

You do 250,000 J of work to cut a lawn with a hand mower. If the work done by the mower is 200,000 J, what is the efficiency of the lawn mower?

How efficient is a machine that takes 40 J of work and produces 30 J of work?

**Simple Machines**

A device that helps make \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to perform by accomplishing one or more of the following functions:

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_from one place to another,
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a force,
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a force, or
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or speed of a force.

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**6 Simple Machines**

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| **LEVERS**   * A rigid bar that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ around a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. * The bar may be either \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. * In use, a lever has both an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) force and a \_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ force). * The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ force moves; NOT the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ force | Lever1stclass |
| **EXAMPLES OF LEVERS (INCLUDE NAME & DRAWING)** | |

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| **WHEEL & AXLE**  Has a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ secured to a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, called an axle.   * When \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the wheel or axle \_\_\_\_\_\_\_\_\_\_\_\_\_\_, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. One full \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of either part \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_one full revolution of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_part. |
| **EXAMPLES OF WHEEL & AXLE (INCLUDE NAME & DRAWING)** |

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| **PULLEY**  Consists of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.   * A pulley can be used to simply \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a force or to gain a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, depending on how the pulley is arranged. * A pulley is said to be a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_pulley if it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rise or fall with the load being moved.   + A fixed pulley \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a force; however, it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ create a mechanical advantage. * A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_pulley \_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_ with the load that is being moved. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ moveable pulley \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a mechanical advantage; however, it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ change the direction of a force. |
| **EXAMPLES OF PULLEYS (INCLUDE NAME & DRAWING)** |

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| **INCLINED PLANE**  is an even \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_surface (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_).   * The inclined plane makes it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a weight from a lower to higher elevation. |
| **EXAMPLES OF INCLINED PLANES (INCLUDE NAME & DRAWING)** |

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| **WEDGE**  is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ plane.  Wedges are used as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ devices. |
| **EXAMPLES OF WEDGES (INCLUDE NAME & DRAWING)** |

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| **SCREW**  Also a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ plane.   * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the screw are like a type of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (or \_\_\_\_\_\_\_\_\_\_\_\_\_ plane) |
| **EXAMPLES OF SCREWS (NAMES & DRAWINGS)** |