Simple Machines Practice Test

1. Which of the following is NOT one of the 6 basic types of simple machines?
   a. Gears
   b. Pulleys
   c. Lever
   d. Wheel and Axle

2. Fill in the blanks on the following statement:
   Machines can multiply ____**force**__, but according to Conservation of Energy, they cannot ever multiply _____**work**__.

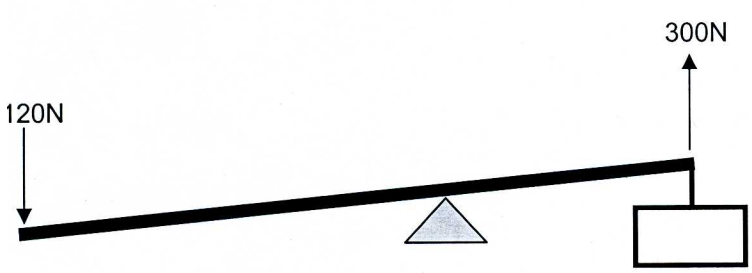
3. A 100 Newton force applied to a grouping of pulleys lifts a 400N object. What is the actual mechanical advantage of this grouping of pulleys?

$$AMA = \frac{Fr}{Fe} = \frac{400N}{100N} = 4\ AMA$$

4. A certain ramp has an actual mechanical advantage of 3. A 200N effort force is required to push a certain box up the ramp. What is the weight of the box?

$$AMA = \frac{Fr}{Fe}\quad 3 = \frac{Fr}{200N} = Fr = 600N$$

5. Calculate the AMA of the lever in the given diagram.



$$AMA = \frac{Fr}{Fe} = \frac{300N}{120N} = 2.5$$

6. Fill in the blank in the following statement:
   Anytime a machine is used and force is gained, __**distance**__ is sacrificed.

7. An ideal lever is used to lift a 500N object a distance of 40cm above its initial position. A 350N effort force is required to accomplish this.
   A. Calculate the work output by the lever.

$W_{out} = (500N \times 0.40m) = 200J$

B. Calculate the effort distance, through which 350N effort force was exerted.

Wout = Wi = 200 J = (350N) (d) **d = 200J / 350N = .57 m**

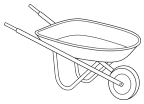
(F x D) = (F) (D)

8. An effort force of 8 Newtons is applied to an ideal pulley system to lift up a 1.5 Newton object. If the effort force is exerted through a distance of 6 meters, calculate the distance that the object is raised about its initial position.

$W_{out} = W_i$ $\quad (1.5N \times d) = (8N)(6M)$

$(F \times D) = (F)(D)$ $\quad d = 32M$

9. Label the following levers: 1st, 2nd, 3rd for the class that is represents



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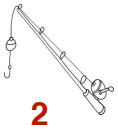
3



2

2

3

3

2

1

10. Brooke applied a force of 50 N for 10 m to lift a 40 N weight 10 m high. How efficient is the pulley?

80%

11. Jacob pushes a class 1 lever so that the end he pushes down on is .5 m from the fulcrum. The object he is trying to lift is .1 m from the fulcrum. What is the IMA of the lever as he has it set up?

5

12. Fill in this blank: **inclined plane** is a flat surface, a sloped surface, or a ramp.

13. Which of the following is true about a single, fixed pulley?
    1. It has a mechanical advantage less than 1
    2. ***It has a mechanical advantage equal to 1***
    3. It has a mechanical advantage greater than 1
    4. It has no friction.

14. Which of the following would most likely make a machine more efficient?
    1. Increasing the Mechanical Advantage
    2. Increasing the effort distance by decreasing the effort force
    3. Increasing the effort force by decreasing the effort distance
    4. ***Decreasing the friction by using wheels or lubricant***

15. If a simple machine has an efficiency of 80% and you input 400J of work, how much work will the machine output?

320 J

Extra challenge question #1:
A woman uses a lever to pry a rock from her yard. She exerts a 200N force through a distance of 50cm, and the lever outputs a force of 500N through 10cm. Is the lever an example of an ideal machine? How do you know, using calculations in your explanation?

$W_{in} = W_{out}$

$(200N)(0.50M) = (500N)(0.10M)$

$100Nm \neq 50NM$

So NO it's not ideal, because $W_{in} \neq W_{out}$. (some energy must have been lost due to friction.)

Extra challenge question #2:
A 250N effort force is exerted on an ideal machine with an actual mechanical advantage of 4. If the effort distance is 3 meters, calculate the resistance distance. (hint: you'll have trouble solving this in one step. But think about what measurement you could solve for in one step, and if that measurement would help answer the question.)

$4 = \frac{R_f}{E_f} = \frac{R_f}{250} = R_f = 1000\,N$

$W_{out} = W_i = (1000N \times R_d) = (250N \times 3M)$

$(F \times D) = (F)(D)$

$R_d = 0.75M$