

Simple Machines Study Guide

Define the following

1. input force – A force you apply to a simple machine.
2. efficiency – Ability of a machine to convert work input into work output.
3. mechanical advantage – Ratio of output force to input force.
4. output force – Force you overcome when using a simple machine, also called the resistance force.

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5. compound machine – Device made of more than one simple machine.

6. Fulcrum – The pivot point of a lever.

Describe the following simple machines and give an example of each:

7. Inclined plane – A slanted surface used to raise an object. ex: wheelchair ramp

8. Wedge – A movable inclined plane with one or two sloping sides. ex: knife

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9. Lever – A bar that is free to pivot about a fixed point. ex: a rake
10. Wheel and axle – Simple machine that consists of two circular objects. ex: potter's wheel
11. Screw – An inclined plane wrapped around a cylinder post. ex: threaded bolt
12. Pulley – A grooved wheel with a rope or chain wrapped around it. ex: flagpole

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13. What is work? Work is when a force causes an object to move in the same direction that the force is applied.
14. Give 3 examples of work being done.
1. Pushing a box from the bottom of a hill to the top of the hill.
 2. Pulling a sled across a field covered with snow.
 3. Lifting a book bag off the floor.

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15. Give 3 examples of work not being done.
1. The Moon orbiting Earth.
 2. Standing still.
 3. Pushing on a refrigerator that doesn't move.
16. Is it possible to get more work out of a machine than you put into it? Why or Why not? No, some energy is always used by the friction force; therefore not all energy put into the machine is used on the load.
17. The unit for power is a _____. Watt

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18. Describe the relationship between distance and work in reference to simple machines.
The amount of force needed decreases as the distance between the fulcrum and the force you apply increases.
19. The thread that wraps around a screw can be classified as what type of simple machine?
Inclined plane

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20. Describe how a fixed pulley makes doing work easier. A fixed pulley makes work easier by changing the direction of the input force.
21. Describe how a screw makes doing work easier. A screw makes work easier by changing the size or direction of a force with one movement.
22. The rate at which work is done is called _____.
Power

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23. Explain mechanical advantage. Mechanical advantage occurs when a machine allows you to exert less force to complete a job.

Next to each situation write work or no work. Then explain your answer. Work is done on an object when an object moves in the same direction as the force being applied.

- A. Studying for this test. N, no movement required
- B. Lifting a bag of groceries W, force is in the same direction the object moves
- C. Walking a dog on a leash N, no force needs to be applied to move the dog forward, unless he is stubborn.
- D. Sleeping N, no force is being applied on you.
- E. Pressing a stamp onto an envelope N, stamp doesn't move
- F. Holding an umbrella N, umbrella doesn't move

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24. What is the purpose of a machine? **The purpose of a machine is to make work easier.**
25. A winding mountain road would be an example of what type of simple machine. **Inclined plane= winding road, whole mountain = a screw**
26. What type of simple machine is a door knob? **Wheel and Axle**

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27. All forms of energy can do _____. Work

28. The unit for work is _____. Joules

29. What is the formula for work?

$$\text{Work} = \text{Force} \times \text{Distance}$$

30. What is the formula for power?

$$\text{Power} = \text{Work} / \text{Time}$$

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31. What is the formula for mechanical advantage?

$\text{Mechanical Advantage} = \text{Output Force} / \text{Input force}$

32. A rock weighing 2 newtons was lifted 3 meters.
How much work was done?

$2\text{N} \times 3 \text{ Watts} = 6 \text{ Joules}$

33. How much power was used in question 28 if it took 2 seconds to lift the rock?

$6\text{J} / 2 \text{ S} = 3 \text{ Watts}$

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34. To pry the lid off a paint can, you apply a force of 50 newtons to the handle of a screwdriver, what is the mechanical advantage of the screwdriver if it applies a force of 500 newtons to the lid?

$$500\text{N} / 50\text{N} = 10$$

35. Define and give an example of each type of lever.

1st class lever - the fulcrum is in the middle, ex: seesaw

2nd class lever - the load (output force, or resistance force) is in the middle, ex. nutcracker

3rd class lever - the effort force (input force) is in the middle
ex: catapult, your arm

36. How can you increase the mechanical advantage of a lever? By increasing the length of the effort arm

lever	wedge	100% efficiency	bicycle	Output force	Pulley
Change the amount of force or distance of force	Picking up a book	Broom	Friction	No mechanical advantage	Wheel and Axle
Fulcrum	Inclined plane is movable	Joints	Simple Machines	Force must be in the direction of movement	Watts
Input force	Effort Force	Joules	Screw	See-saw	Resistance Force
Inclined plane	Compound Machine	Stairs	Changing the direction of force	Multiplies the distance	Distance