

Test - Work, Power & Simple Machines

Name: _____

Multiple Choice (1 pt ea)

Identify the choice that best completes the statement or answers the question.

- _____ 1. The **actual** mechanical advantage of a machine _____.
- cannot be less than 1
 - decreases as the input (effort) distance increases
 - increases with greater friction
 - is less than the ideal mechanical advantage of the machine
- _____ 2. Which of the following statements indicates the *best* way to increase power?
- increase the amount of work done in a given amount of time, or do a given amount of work in less time
 - increase the amount of work done in a given amount of time, or do a given amount of work in more time
 - decrease the amount of work done in a given amount of time, or do a given amount of work in less time
 - decrease the amount of work done in a given amount of time, or do a given amount of work in more time
- _____ 3. Liz throws a softball with a force of 63 N a distance of 25 m. Jamie throws the softball with the same amount of force, but the ball only goes 17 m. Which girl does **less** work?
- They do the same amount of work.
 - Liz
 - Jamie
 - Neither girl does any work.
- _____ 4. When a machine does work, a trade-off occurs. Which of the following best exemplifies that trade-off?
- A ramp allows you to decrease force, but requires a greater input force.
 - A pulley changes the direction of your force, but requires a greater input force.
 - A lever increases output force and the distance the load moves.
 - A wheel and axle decreases output force and the distance the load moves.
- _____ 5. Work input is greater than output on a shotgun used by a hunter. Which might explain where some of the input went?
- heat
 - sound
 - friction
 - all of the above
- _____ 6. Some simple machines are closely related to one another because of their shape or function. A variation of an inclined plane is a _____.
- wedge
 - wheel & axle
 - lever
 - pulley
- _____ 7. A machine is classified as a compound machine if it _____.
- is very efficient
 - has an IMA greater than 1
 - has moving parts
 - is made up of two or more simple machines that operate together
- _____ 8. A mechanical device requires 420 J of work to do 230 J of work in lifting a crate. What is the efficiency of the device?
- 55%
 - 183%
 - 190%
 - 0.5%
- _____ 9. An inclined plane reduces effort force by _____.
- reducing the effort distance
 - increasing the distance through which the force is applied
 - reducing the work
 - increasing the work

- _____ 10. If you know the input distance and output distance of a machine, which of the following can you calculate?
- ideal mechanical advantage
 - actual mechanical advantage
 - efficiency
 - work
- _____ 11. The power of a machine measures _____.
- the work it does
 - the force it produces
 - its rate of doing work
 - its strength
- _____ 12. The efficiency of a machine is always **less** than 100 percent because _____.
- the work input is too small
 - the work output is too great
 - some work input is lost to friction
 - a machine cannot have an IMA greater than 1
- _____ 13. The Law of Conservation of Energy explains that while work input is greater than work output for all machines, the “missing” energy must have been _____.
- miscalculated
 - converted into something like friction
 - converted back into input energy
 - lost
- _____ 14. In which of the following scenarios is work being done, according to the scientific definition?
- Jose solves a “work” calculation in his head.
 - Shasta lifts her chair onto the desk after the afternoon announcements.
 - Garrett holds a barbell still over his head in weightlifting class.
 - Paige carries a reference table across the classroom.
- _____ 15. A force acting on an object does **no** work if _____.
- the force is greater than the force of friction
 - the force is not in the direction of the object’s motion
 - a machine is used to move the object
 - the object accelerates
- _____ 16. A wheelbarrow is an example of a(an) _____.
- wedge
 - inclined plane
 - wheel and axle
 - lever
- _____ 17. A 120-m long ski lift carries skiers from a station at the foot of a slope to a second station 40 m above. What is the IMA of the lift?
- 40
 - 160
 - 3
 - 0.3
- _____ 18. A machine applies a horizontal force to push packed boxes onto a conveyor belt, which carries them across a factory for shipping. Which of the following best describes a direct energy transfer that takes place?
- from machine to conveyor belt
 - from conveyor belt to shipping truck
 - from machine to box
 - from machine to shipping truck
- _____ 19. Alex helps his teacher lift a 200-N box of books 1.2 m from the floor to the desktop. In which of the following situations will he do **more** work?
- He lifts a 98-N box to the same height.
 - He lifts a box of the same weight 1.7 m.
 - He lifts a box of the same weight 0.9 m.
 - He lifts a 175-N box to the same height.
- _____ 20. If Antonia exerts a force of 700 N to walk 6 m up a flight of stairs in 6 s, how much power does she use?
- 25,200 W
 - 700 W
 - 19 W
 - 4200 W

Completion (1 pt ea)

Complete each statement with the correct choice from the word bank.

Word Bank:	wedge	increase	Watt	input	screw
output	decrease	mechanical advantage	Joule	efficiency	

21. A(An) _____ can be described as an inclined plane wrapped around a cylinder.
22. Besides a reduction in friction, the only way to increase the amount of work output of a machine is to _____ the work input.
23. The _____ of a machine is the number of times that the machine increases the input force.
24. The force that is exerted on a machine is called the _____ force.
25. The SI unit of work is the _____.

Short Answer

Answer each question using complete sentences.

26. **(2 pts)** How will a lubricant affect the efficiency of a simple machine such as a pulley?
27. **(2 pts)** If two swimmers compete in race, does the faster swimmer automatically develop more power?
28. **(4 pts)** Describe and explain a situation in which work is done, and one in which work is *not* done.

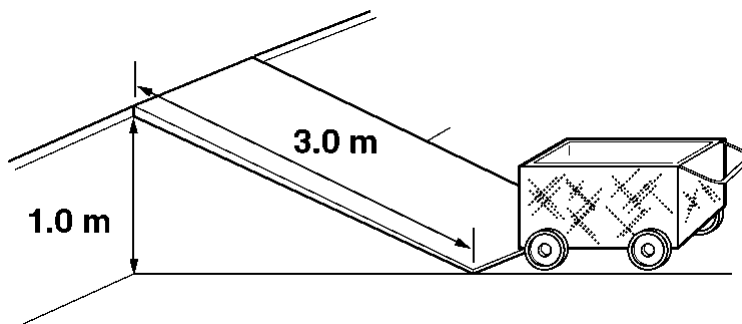
Calculation (5 pts ea)

Calculate each answer. Show your work by identifying the formula, plugging in your values, and giving the final answer with correct units.

29. A force of 11 N is applied to the handle of a screwdriver being used to pry off the lid of a paint can. As the input force moves through a distance 0.3 m, the screwdriver does 3 J of work on the lid. What is the efficiency of the screwdriver?
30. A girl lifts a 160-N load a height of 1 m in a time of 0.5 s. What power does the girl produce?
31. A 20-N force applied to the handle of a door produces a 44-N output force. What is the AMA of the handle?

32. A worker uses a cart to move a load of bricks weighing 69 kg a distance of 10 m across a parking lot. If he pushes the cart with a constant force of 209 N, what amount of work does he do?

33. What is the IMA of the ramp in the figure below?

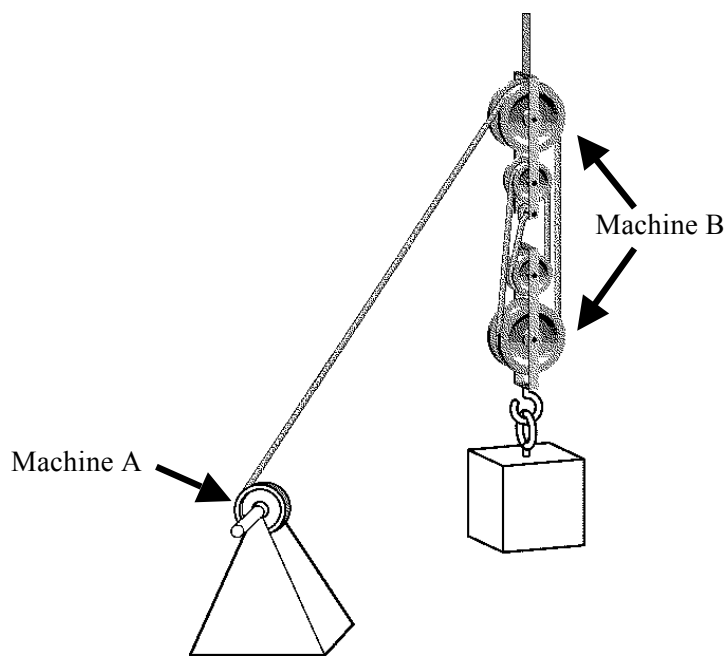


Miscellaneous (1 pt ea)

34. Identify the two simple machines used in the figure below:

Machine A: _____

Machine B: _____



Test - Work, Power, Machines

Name: KEY

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23. The mechanical advantage of a machine is the number of times that the machine increases the input force.
24. The force that is exerted on a machine is called the input force.
25. The SI unit of work is the Joule.

Short Answer

Answer each question using complete sentences.

26. (2 pts) How will a lubricant affect the efficiency of a simple machine such as a pulley?

A lubricant will increase a simple machine's efficiency by decreasing friction, which increases work output.

27. (2 pts) If two swimmers compete in race, does the faster swimmer automatically develop more power? Power depends on work and time, from which you can extrapolate that it depends on force and velocity. If the slower swimmer exerts more force (e.g. she is larger and has to use more force to propel herself), then she might develop more power.
28. (4 pts) Describe and explain a situation in which work is done, and one in which work is *not* done.
- Work is done when a person kicks a soccer ball (force is applied in the same direction that the ball travels).
 - Work is not done when a person holds something in his/her hand (force is being applied to hold the object up, but it is not moving).

Calculation (5 pts ea)

Calculate each answer. Show your work by identifying the formula, plugging in your values, and giving the final answer with correct units.

29. A force of 11 N is applied to the handle of a screwdriver being used to pry off the lid of a paint can. As the input force moves through a distance 0.3 m, the screwdriver does 3 J of work on the lid. What is the efficiency of the screwdriver?

$$\text{Efficiency} = \frac{\text{Work output}}{\text{Work input}} \times 100\% = \frac{\text{Work output}}{\text{Input force} \times \text{Input distance}} \times 100\%$$

$$\text{Efficiency} = \frac{3 \text{ J}}{11 \text{ N} \times 0.3 \text{ m}} \times 100\% = \frac{3 \text{ J}}{3.3 \text{ N}\cdot\text{m}} \times 100\% = \frac{3 \text{ J}}{3.3 \text{ J}} \times 100\% = 91\%$$

$$\text{Efficiency} = 91\%$$

30. A girl lifts a 160-N load a height of 1 m in a time of 0.5 s. What power does the girl produce?

$$\text{Power} = \frac{\text{Work}}{\text{Time}} = \frac{\text{Force} \times \text{Distance}}{\text{Time}} = \frac{160 \text{ N} \times 1 \text{ m}}{0.5 \text{ s}} = 320 \text{ N}\cdot\text{m/s} = 320 \text{ J/s}$$

$$\text{Power} = 320 \text{ J/s} = 320 \text{ W}$$

31. A 20-N force applied to the handle of a door produces a 44-N output force. What is the AMA of the handle?

$$\text{Work} = \text{Force} \times \text{Distance} = 209 \text{ N} \times 10 \text{ m} = 2090 \text{ N}\cdot\text{m} = 2090 \text{ J}$$

$$\text{Work} = 2090 \text{ J}$$

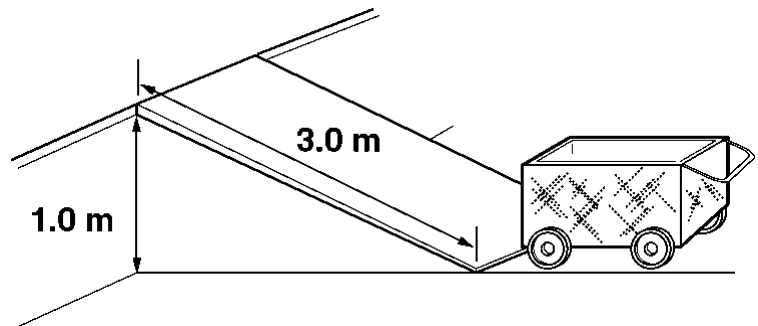
32. A worker uses a cart to move a load of bricks weighing 69 kg a distance of 10 m across a parking lot. If he pushes the cart with a constant force of 209 N, what amount of work does he do?

$$\text{AMA} = \frac{\text{Output force}}{\text{Input force}} = \frac{44 \text{ N}}{20 \text{ N}} = 2.2$$

$$\text{AMA} = 2.2$$

33. What is the IMA of the ramp in the figure below?

$$\text{Ideal mechanical advantage} = \frac{\text{Input distance}}{\text{Output distance}} = \frac{3 \text{ m}}{1 \text{ m}} = 3$$



Miscellaneous (1 pt ea)

34. Identify the two simple machines used in the figure below:

Machine A: wheel & axle

Machine B: pulley

