Chapter 14 Worksheet Do not write on this paper. Put all work on a separate sheet of paper.

1. For work to be done on the object, the object has to __.
2. Any part of a force that does not act in the direction of an object's motion does no ___ on an object.
3. The SI unit of work is the __.
4. The rate at which work is done is called ___.
5. The SI unit of power is the __.
6. The watt and the horsepower are both units of __.
7. A device that changes the size or direction of force used to do work is called a(an) __.
8. The force that is exerted on a machine is called the __ force.
9. Besides a reduction in friction, the only way to increase the amount of work output of a machine is to __ the work input.
10. The __ of a machine is the number of times that the machine increases the input force.
11. The mechanical efficiency of any machine is always __ than 100 percent.
12. The fulcrum is always between the effort force and the resistance force in a(an) __-class lever.

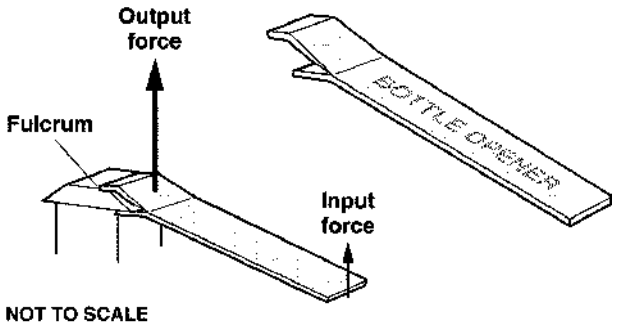
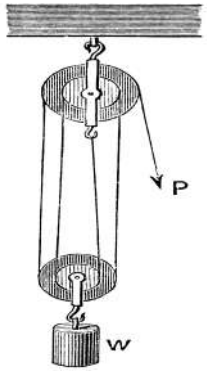


Figure 14-1

13. The bottle opener shown in Figure 14-1 is a(an) __-class lever.
14. Using Figure 14-1, if the input distance is 14 cm (0.14 m) and the output distance is 2 cm (0.02 m) what is the ideal mechanical advantage of the bottle opener?
15. The ideal mechanical advantage of a third-class lever is always __ than 1.
16. Two or more simple machines working together make up a(an) __ machine.
17. Explain how work is done when you lift a book? (use the terms force, distance, direction and move)
18. Why don't you do work as you hold a book motionless over your head?
19. Why is the work output of a machine never equal to the work input?
20. If you grease a ramp to make a box slide more easily, what happens to the ramp's mechanical advantage? Explain your answer.
21. If a simple machine could be frictionless, how would its IMA and AMA compare?
22. What is the equation for calculating a machine's efficiency?
23. Explain why the mechanical efficiency of any machine is alwasy less than 100%.
24. Why is a machines actual mechanical advantage always less than it's ideal mechanical advantage?
25. A tractor exerts a force of 20,000 newtons to move a trailer 8 meters. How much work was done on the trailer?
26. A car exerts a force of 500 newtons to pull a boat 100 meters in 10 seconds. How much power does the car use?
27. If a machine uses 500 J of work to accomplish 300 J of work, what is the efficiency of the machine?
28. A 3-meter-long ramp is used to lift a piano to a moving truck, which is 1 meter off the ground. What is the ideal mechanical advantage of the ramp?
29. Calculate the mechanical advantage of a ramp that is 6.0 m long and 1.5 m high.



pulley system 1

30. What is the mechanical advantage of pulley system 1?
31. While rowing in a race, John does 3960 J of work on the oars in 60.0s. What is his power output in watts?
32. It takes 100 kJ of work to lift an elevator 18m. If this is done in 20 s, what is the average power of the elevator during the process? (because the work is in kJ the answer should be in kW)
33. Suppose you are moving a box of books. Calculate your power output if you exert a force of 60.0 N to push the box 12.0 m in 20.0 s.
34. A crane uses an average force of 5200 N to lift a girder 25 m. How much work does the crane do ont he girder?
35. An apple weighing 1 N falls through a distance of of 1 m. How much work is done on the apple by the force of gravity?
36. The brakes on a bicycle apply 125 N of frictional force to the wheels as the bicycle travels 14.0 m. How much work have the brakes done on the bycycle?
37. While rowing in a race, John uses his arms to exert a force of 165 N per stroke while pulling the oar 0.800 m. How much work does he do in 30 strokes?

A B

38. What is the mechanical advantage of pulley A?
39. What is the mechanical advantage of pulley B?

ch 14 worksheet Answer Section

1. ANS: move
   STA: SPS8.d
2. ANS: work
   STA: SPS8.d
3. ANS: joule
   STA: SPS8.
4. ANS: power
   STA: SPS8. | SCSh5.
5. ANS: watt
   STA: SPS8. | SCSh5.
6. ANS: power
   STA: SPS8.
7. ANS: machine
   STA: SPS8.
8. ANS: input
9. ANS: increase
10. ANS: mechanical advantage
11. ANS: less
    STA: SPS8.e | SCSh5.
12. ANS: first
    STA: SPS8.e | SCSh5.
13. ANS: second
    STA: SPS8.e | SCSh5.
14. ANS:
    7
    $\frac{\text{input distance}}{\text{output distance}} = \frac{0.14\text{ m}}{0.02\text{ m}} = 7$
15. ANS: less
16. ANS: compound
17. ANS:
    Work is done because a force is applied in the direction in which the book moves.
    STA: SPS8.d
18. ANS:
    There is no movement, so no work is done.
    STA: SPS8.d
19. ANS:
    Some of work input is used to overcome friction.
20. ANS:
    It increases; friction has been reduced.
21. ANS:
    They would be equal.
22. ANS:
    $\text{Efficiency} = \frac{\text{Work output}}{\text{Work input}} \times 100\%$
23. ANS:
    Becuase you always loose some of the work input to friction.
24. ANS:
    because the ideal mechanical advantage includes what is lost to friction and the ideal mechanical advantage does not
25. ANS:
    160,000 J
    w = F x d w = 20,000 x 8
26. ANS:
    5000 W
    P = w / t P = F x d / t
    P = 500 x 100 / 10
27. ANS:
    60%
    efficience = $\frac{\text{work out}}{\text{work in}}$ x 100% or $\frac{300\text{ J}}{500\text{ J}}$ x 100%
28. ANS:
    3
    IMA = $\frac{\text{input distance}}{\text{output distance}}$ or $\frac{3\text{m}}{1\text{m}}$
29. ANS:
    4
30. ANS:
    5

31. ANS:
P = 66 W
3960 J = W P = W / t
60 s = t P = 3960 / 60
? = P

32. ANS:
P = 5 kW
W = 100 kJ P = W/t
t = 20 s P = 100 kJ / 20s
P = ?

33. ANS:
P = 36 W
60 N = F P = W / t or F x d / t
12. m = d P = 720 / 20
20 s = t
? = P

34. ANS:
W = 1.3 x 10^5 J or 130000 J
5200 N = F W = F x d
25 m = d W = 5200 x 25
? = W

35. ANS:
W = 1 J
1 N = F W = F x d
1 m = d W = 1 x 1
? = W

36. ANS:
W = 1750 J
125 N = F W = F x d
14.0 m = d W = 125 x 14.0
? = W

37. ANS:
W = 3960 J
165 N = F W = F x d
.800 m = d per stroke W = 165 x .800 = 132 J x 30
Work in 30 strokes = ?

38. ANS:
1

39. ANS:
2