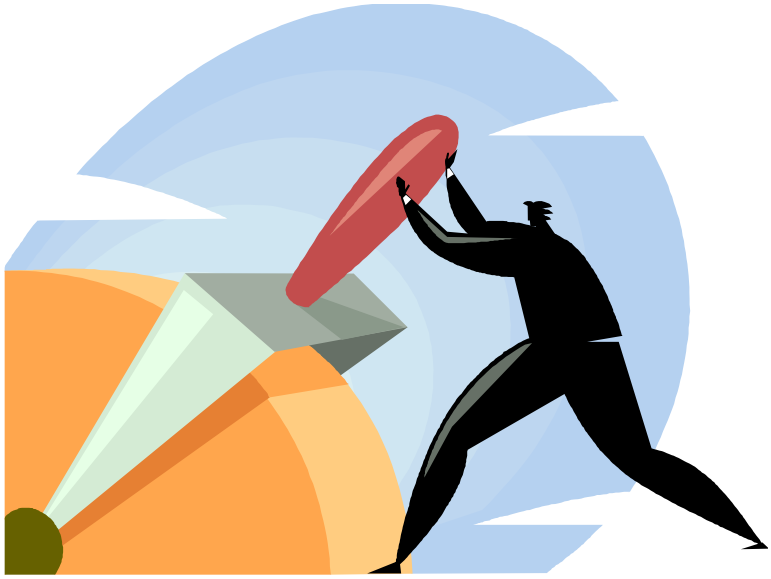
Name:_____

Date Due:_____

Simple Machines

Physical Science

Chapter 4



Work & Power

1. Define the following terms:
   a. work=
   b. joule=
   c. power=
   d. watt=
   e. horsepower=

2. When does a force do work?

3. If there is no movement, has work been done?

4. Describe the conditions of force and motion that results in the maximum work done.

5. What is the equation for work?

6. What is the amount of work done when a 1 N force moves an object 1 meter?

7. How much work is done when a 10.0 N force moves an object 2.5 meters?

8. What is the equation for power?

9. How are work and power related?

10. How much work does a 100 watt light bulb do when it is lit for 30 seconds?_____

11. How much power is used when 100 J of work is done in 10 seconds?_____

12. You lift a book from the floor to a bookshelf 1.0 m above the ground. How much power is used if the upward force is 15.0 N and you do the work in 2.0 s?_____

13. How did James Watt define the horsepower?_____

14. You carry two heavy bags of groceries upstairs to your kitchen. Will you do more work on the bags if you carry them up one at a time? Explain._____

15. A desk exerts an upward force to support a computer resting on it. Does this force do work? Explain._____

16. Two cars have the same weight, but one of the cars has an engine that provides twice the power of the other. Which car can make it to the top of the mountain pass first? Which car does more work to reach the pass?_____

Machines

17. Define the following terms:
    a. machine=
    b. output distance=
    c. input distance =
    d. output force=
    e. input force=
    f. work output=
    g. work input=
    h. actual mechanical advantage=
    i. ideal mechanical advantage=
    j. efficiency=

18. How can using a machine make a task easier to perform?

19. How is a machine able to increase a force?

20. Consider the equation: Work = Force x Distance. Is the force required to do a given amount of work increased or decreased if a machine increases the distance over which a force is exerted?

21. Besides changing the amount of force and the distance, what else does a machine do?_____

_____

22. Why is the work done by a machine always less than the work done on a machine?_____

_____

_____

23. What is the equation for work input?_____

24. What is the equation for work output?_____

25. How is work input and work output related for a machine?_____

_____

26. How can you increase the work output of a machine?_____

_____

27. A machine produces a larger force than you exert to operate the machine. How does the input distance of the machine compare to its output distance?_____

_____

28. You do 200 J of work pulling the oars of a rowboat. What can you say about the amount of work the oars do to move the boat? Explain._____

_____

29. How does the output distance the end of a baseball bat move when it is swung compare with the input distance you move your hands through? _____

_____

_____

30. How does the actual mechanical advantage of a machine compare to its ideal mechanical advantage?_____

_____

Simple Machines

31. Define the following terms:
    a. lever=_____
    b. fulcrum=_____
    c. input arm=_____
    d. output arm=_____
    e. first class lever=_____
    f. second class lever=_____
    g. third class lever=_____
    h. wheel and axle=_____
    i. incline plane=_____
    j. wedge=_____
    k. screw=_____
    l. pulley=_____
    m. fixed pulley=_____
    n. moveable pulley=_____
    o. pulley system=_____

32. List the six types of simple machines.

    a. _____
    b. _____
    c. _____
    d. _____
    e. _____
    f. _____

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33. Draw an example of each of the six simple machines.

34. What defines a first-class lever?_____

_____

35. What defines a second-class lever?_____

_____

36. What defines a third-class lever?_____

_____

37. How are the lever and the wheel and axle related to each other?_____

_____

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38. What is the ideal mechanical advantage of a ramp if its length is 4.0 m and its higher end is 0.5 m above its lower end?_____

39. If you want to pry the lid off a paint can, will it require less force to use a long screwdriver or a short screwdriver? Explain._____

40. What is the equation for efficiency?_____

41. What happens to the efficiency of a machine if you reduce the friction?_____

42. A construction worker moves a crowbar through a distance of 0.50 m to lift a load 0.05 m off of the ground. What is the IMA of the crowbar?_____

43. The IMA of a simple machine is 2.5. If the output distance of the machine is 1.0 m, what is the input distance?_____

44. Why is the actual mechanical advantage of a machine always less than its ideal mechanical advantage?_____

45. Why can no machine be 100% efficient?_____

46. What is the efficiency of a machine with a work output of 120 J and a work input of 500 J?_____

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47. You test a machine and find that it exerts a force of 5 N for each 1 N of force you exert operating the machine. What is the actual mechanical advantage of the machine?_____

_____

48. How can two machines appear identical and yet not have the same actual mechanical advantage?_____

_____

49. Suppose you are an inventor in 1900. You are constructing a bicycle of your own design. What could you do to ensure your bicycle efficiently changes the work input into forward motion?____

_____

_____

50. When is the ideal mechanical advantage of a machine greater than 1?_____

_____

51. You have just designed a machine that uses 1000 J of work from a motor for every 800 J of useful work the machine supplies. What is the efficiency of your machine?_____

_____

52. If a machine has an efficiency of 40%, and you do 1000 J of work on the machine, what will be the work output of the machine?_____

_____

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53. You are going to calculate the ideal mechanical advantage for the following examples using the equations below.

Incline Plane = Distance along Incline/Change in Height

Wedge = Length of Wedge / Width of Wedge

Screw = More threads has greater IMA

Lever = Input Arm/Output Arm

Wheel & Axel = Diameter of the Wheel / Diameter of the Axel

Pulley = Number of Supporting Load Ropes

a) You have a lever with an input arm of 12cm and an output arm of 2cm. What is the IMA?

b) You have a 1m wheel with an axel of10cm. What is the IMA?

c) The ramp at school is 250cm long with a height of 25cm. What is the IMA?

d) A fixed pulley has one supporting arm. What is the IMA?

e) A block and tackle pulley system has five supporting ropes. What is the IMA?

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f) You are trying to pry a lip of a can with a screw driver. The input arm is 9cm and the output arm is 1cm. What is the IMA?

g) You are cutting some food with a knife with a thickness of 1mm and height of 5cm. What is the IMA?

h) You have to choose between a screw with 50 threads and a screw with 25 threads. Which one has greater IMA?

i) The tire on your car has a radius of 50cm and an axel radius of 5cm. What is the IMA?

j) The stairs in the hall are 10m high and 100m long. What is the IMA?

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Compound Machines

54. Define the following terms:
    a. compound machine=_____

55. How do compound machines make work easier than simple machines?_____

56. How is the work done by a machine compare to the work put into it?_____

57. Give an example of a compound machine and describe the simple machine in it? _____

58. Explain why the efficiency of compound machines is generally less than the efficiency of simple machines._____