REVISION QUESTIONS ON WORK AND MACHINES

Multiple Choice

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

_____ 1. For work to be done on an object,
   a. some force need only be exerted on the object.
   b. the object must move some distance as a result of a force.
   c. the object must move, whether or not a force is exerted on it.
   d. the object must not move.

_____ 2. Which of these is an example of work being done on an object?
   a. holding a heavy piece of wood at a construction site
   b. trying to push a car that doesn't move out of deep snow
   c. pushing a child on a swing
   d. holding a door shut on a windy day so it doesn't blow open

_____ 3. If you exert a force of 20 newtons to push a desk 10 meters, how much work do you do on the desk?
   a. 200 joules
   b. 30 joules
   c. 10 joules
   d. 100 joules

_____ 4. Work is measured in
   a. meters.
   b. pounds.
   c. joules.
   d. newtons.

_____ 5. What do machines do?
   a. change the amount of force you exert or the distance over which you exert the force
   b. increase the amount of work that is done
   c. decrease the amount of work that is done
   d. eliminate friction

_____ 6. Pulling down on a rope to hoist a sail on a sailboat is an example of a machine
   a. multiplying the force you exert.
   b. multiplying the distance over which a force is exerted.
   c. changing the direction over which a force is exerted.
   d. reducing friction.

_____ 7. The mechanical advantage of a machine is the number of times a machine increases
   a. the distance an object is moved.
   b. the amount of friction.
   c. the change in direction.
   d. the force exerted on the machine.

_____ 8. Without friction there would be
   a. less machine efficiency.
   b. greater output work than input work.
   c. greater input work than output work.
   d. equal input and output work.

_____ 9. An ideal machine would have an efficiency of
   a. 1 percent.
   b. 10 percent.
   c. 50 percent.
   d. 100 percent.

_____ 10. A ramp is an example of a simple machine called a(n)
   a. inclined plane.
   b. wedge.
   c. lever.
   d. pulley.

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____ 11. The ideal mechanical advantage for an inclined plane is equal to the length of the incline divided by the
    a. mass of the incline.
    b. slope of the incline.
    c. height of the incline.
    d. angle of the incline.

____ 12. Which of these is an example of a third-class lever?
    a. Scissors
    b. Pliers
    c. fishing pole
    d. Nutcracker

____ 13. The ideal mechanical advantage of a wheel and axle is equal to the
    a. radius of the wheel divided by the radius of the axle.
    b. radius of the axle divided by the radius of the wheel.
    c. radius of the wheel divided by the length of the axle.
    d. length of the axle divided by the radius of the wheel.

____ 14. A machine that utilizes two or more simple machines is called a
    a. combination machine.
    b. compound machine.
    c. mechanical machine.
    d. mixed machine.

____ 15. One example of a compound machine is a
    a. door.
    b. pliers.
    c. bicycle.
    d. shovel.

____ 16. Which body parts act as the fulcrums of levers?
    a. Muscles
    b. Bones
    c. Joints
    d. Tendons

____ 17. Which body parts are shaped like wedges?
    a. Muscles
    b. Tendons
    c. Incisors
    d. bones in your legs

____ 18. A simple machine that might be thought of as an inclined plane that moves is a
    a. lever.
    b. wheel and axle.
    c. wedge.
    d. pulley.

____ 19. Which of these could be considered an inclined plane wrapped around a cylinder?
    a. Lever
    b. Screw
    c. wheel and axle
    d. Pulley

____ 20. The fixed point that a lever pivots around is called the
    a. axle.
    b. pulley.
    c. gear.
    d. fulcrum.

____ 21. In order to do work on an object, the force you exert must be
    a. the maximum amount of force you are able to exert.
    b. in the same direction as the object's motion.
    c. in a direction opposite to Earth's gravitational force.
    d. quick and deliberate.

_____ 22. Work equals force times
     a. energy.
     b. velocity.
     c. distance.
     d. mass.

_____ 23. When you raise or lower a flag on a flagpole, you are using a(n)
     a. wheel and axle.
     b. pulley.
     c. wedge.
     d. inclined plane.

_____ 24. How can a hockey stick be considered a machine?
     a. It multiplies force.
     b. It multiplies distance.
     c. It changes direction.
     d. It reduces friction.

_____ 25. The mechanical advantage of a machine that changes only the direction of force is
     a. 1.
     b. less than 1.
     c. greater than 1.
     d. 0.

_____ 26. Most of the machines in your body consist of bones and muscles and are called
     a. wedges.
     b. levers.
     c. pulleys.
     d. compound machines.

_____ 27. If tight scissors have an efficiency of 50 percent, half of your work is wasted due to
     a. the output force.
     b. the input force.
     c. friction.
     d. changes in direction.

_____ 28. The power of a light bulb that converts electrical energy at a rate of 100 joules per second is
     a. 50 watts.
     b. 200 watts.
     c. 100 watts.
     d. 40 watts.

_____ 29. Power is measured in units called
     a. joules.
     b. pounds.
     c. watts.
     d. newtons.

_____ 30. The wedge, screw, and lever are all
     a. simple machines.
     b. compound machines.
     c. found in the human body.
     d. 100 percent efficient.

Modified True/False
Indicate whether the sentence or statement is true or false. If false, change the identified word or phrase to make the sentence or statement true.

_____ 31. Holding a 25-N bag of sugar 1 meter above the floor requires <u>25 joules</u> of work. _____

_____ 32. The force exerted by a machine is called the <u>output</u> force. _____

____ 33. The mechanical advantage of a machine that changes only the <u>direction</u> of a force is 1. _____

____ 34. Efficiency compares the output work to the <u>output force</u>. _____

____ 35. A wheel and axle is a <u>compound</u> machine. _____

____ 36. A second-class lever always multiplies <u>distance</u>. _____

____ 37. The ideal mechanical advantage of a wheel and axle is the radius of the wheel <u>times</u> the radius of the axle. _____

____ 38. When you raise your leg, the <u>knee</u> acts as a fulcrum for the upper leg. _____

____ 39. You do <u>work</u> on an object when you lift it from the floor to a shelf. _____

____ 40. <u>Energy</u> is the rate at which work is done. _____

Completion
Complete each sentence or statement.

41. A gardener pushes on the angled handle of a lawn mower, causing it to move forward across a lawn. The only portion of the gardener's force that does work on the lawn mower is the force in the _____ direction.

42. A newton-meter is a measure of work also known as the _____.

43. The amount of work done in lifting a 25-N bag of sugar 2 meters is the same as lifting two 25-N bags of sugar _____ meter(s).

44. The force applied to a machine is called the _____ force.

45. A machine makes work easier by multiplying force or _____, or by changing direction.

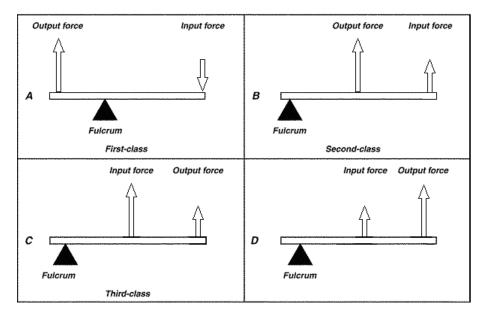46. All machines have a(n)_____ of less than 100%.

47. The ideal mechanical advantage would equal the actual mechanical advantage if there were no losses due to _____.

48. The efficiency of an actual machine is always less than _____ %.

49. The output work of a certain machine is 12,600 J. If the input work is 18,000 J, the efficiency is _____.

50. When you use a paint can opener to open a can of paint, you use the paint can opener as a simple machine called a(n) _____.

51. A jar lid is an example of a simple machine called a(n) _____.

52. A screwdriver is a simple machine called a(n) _____.

53. A ramp in a parking garage is an example of a simple machine called a(n) _____.

54. The ideal mechanical advantage of a compound machine is the _____ of the ideal mechanical advantages of the simple machines that make it up.

55. Lengthening a ramp will _____ its ideal mechanical advantage.

56. A chef sometimes holds the tip of a knife stationary when chopping food. Held this way, the knife is a compound machine made up of a wedge and a _____.

57. As you wave your hand at the wrist, your hand is acting as a simple machine called a(n) _____.

58. As you bite into a peach, your front teeth act as a simple machine called a(n) _____.

59. Power is equal to _____ divided by time.

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60. A device that is twice as powerful as another can do _____ the amount of work in the same amount of time.
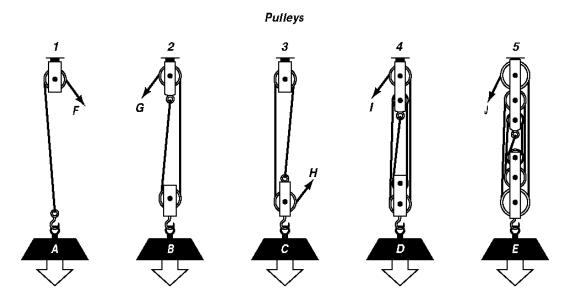
Short Answer Questions

Use the diagram to answer each question.

Levers

61. In what class of lever is the direction of the input force opposite to the direction of the output force?

62. What class of lever is a pair of scissors? Explain your answer.

63. Which class of lever does not multiply the input force? What is its advantage?

64. To which class of lever does each of the following belong: (a) fishing pole; (b) wheelbarrow; (c) bottle opener; (d) pliers?

65. What would happen to the ideal mechanical advantage of the lever in diagram B if the output force were moved farther from the fulcrum?

66. Why would it be impossible to build machine D?

Use the diagram to answer each question.

Pulleys

67. Is machine 1 classified as a simple or a compound machine?

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68. What is machine 1 used for?

69. In machine 2, which letter represents the input force?

70. Which machines multiply the input force?

71. Which machine has the greatest ideal mechanical advantage?

72. Compare the distances and directions of the input force and output force in machine 4.

Essay

73. A bricklayer lifts a stack of bricks onto his shoulder, carries it across a room, and then lifts the bricks onto a ledge above his head. Explain if work is being done in each of these three situations.

74. Explain how the ideal mechanical advantage and efficiency of a machine determine the machine's actual mechanical advantage.

75. A constant push of 250 N is necessary to slide a crate weighing 400 N along a 2.0-meter-long ramp. If the ramp raises the crate 1.0 m, what is the efficiency of the ramp?

76. Why is it more difficult to steer a bike when your hands are close together on the handlebars than when they are far apart?

77. The output force of a lever with an ideal mechanical advantage of 3 is used as the input force of a pulley system with an ideal mechanical advantage of 2. What is the ideal mechanical advantage of the compound machine? Explain.

78. When you bite with your front teeth, your jaw acts as a third-class lever. As you chew with your back teeth, your jaw acts as a second-class lever. Explain how your jaw can act as two different classes of levers and how the ideal mechanical advantage of each helps you bite and chew food.

79. Explain why wedges and screws are actually types of inclined planes.

80. You push a food tray 1.5 m along a cafeteria table with a constant force of 18 N. How much work do you do?