Date _____ Period _____ Name _____

CHAPTER 10

Study Guide

Energy, Work, and Simple Machines

Vocabulary Review

Write the term that correctly completes the statement. Use each term once.

compound machine	**joule**	**resistance force**
efficiency	**kinetic energy**	**watt**
effort force	**machine**	**work**
energy	**mechanical advantage**	**work-energy theorem**
ideal mechanical advantage	**power**	

1. _____ _____ can be calculated by comparing a machine's output work to its input work.

2. _____ A(n) _____ is a device that changes the magnitude or the direction of a force.

3. _____ A(n) _____ consists of two or more simple machines linked so that the resistance force of one machine becomes the effort force of the second machine.

4. _____ The _____ is the force exerted by a machine.

5. _____ A _____ is a unit of power defined as 1 joule per second.

6. _____ The _____ is the force exerted by a person on a machine.

7. _____ The _____ states that the work done on an object equals the change in kinetic energy of the object.

8. _____ The ability of an object to produce a change in itself or its surroundings is called _____.

9. _____ The energy that results from the motion of an object is called _____.

10. _____ The rate of doing work is called _____.

11. _____ The ratio of the resistance force of a machine to its effort force is its _____.

12. _____ The _____ is the SI unit used for work.

13. _____ To calculate a machine's _____, compare the effort distance to the resistance distance.

14. _____ When an applied force is multiplied by the distance through which the force is applied, _____ is calculated.

Section 10.1 Energy and Work

In your textbook, read about work and energy on pages 258–259.
For each phrase on the left, write the letter of the matching item.

_____ **1.** calculation of kinetic energy

_____ **2.** calculation of work

_____ **3.** equivalent to $kg \cdot m^2/s^2$

_____ **4.** statement that the work done on an object is equal to the object's change in kinetic energy

_____ **5.** symbol for kinetic energy

_____ **6.** symbol for work

a. W
b. Fd
c. $\frac{mv^2}{2}$
d. $W = \Delta KE$
e. J
f. KE

In your textbook, read about work and energy change and calculating work on pages 259–263.
For each statement below, write* true *or rewrite the italicized part to make the statement true.

7. _____ Through the process of doing work, energy can move between the external world and the system as the result of *forces*.

8. _____ If the external world does work on the system, the quantity of work is *negative*.

9. _____ If the external world does work on the system, the energy of the system *increases*.

10. _____ If the system does work on the external world, the energy of the system *remains the same*.

11. _____ In the equation $W = Fd$, it is assumed that the force *varies* and is exerted in the direction of displacement.

12. _____ In the equation $W = Fd \cos \theta$, angle θ is the angle between the direction of the force and *the direction of the displacement*.

For questions 13–15, draw an arrow in the shaded box that shows the direction of the force.

13. $W > 0$

d→

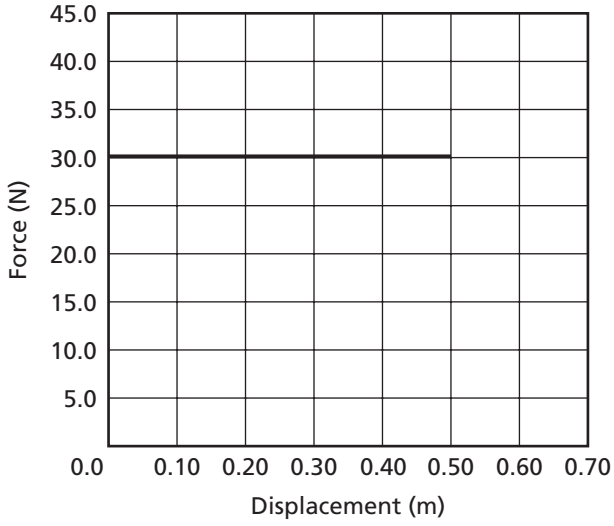
14. $W = 0$

d→

15. $W < 0$

d→

The force-displacement graph of a crate that was pushed horizontally is shown at right. Refer to the graph to answer questions 16–21.



16. How far did the crate move horizontally?

_____

17. What was the magnitude of the force that acted on the crate?

_____

18. What does the area under the graph represent?

_____

_____

19. How much work was done in moving the crate 0.10 m?

20. Suppose you wanted to know the amount of work done in moving the crate 0.40 m. First, find the amount of work done using the graph. Then use the equation for calculating work to find the amount of work. How do your answers compare?

_____

_____

_____

21. On the force-displacement graph above, draw a line that shows that the force uniformly increases from 30.0 N to 40.0 N as the crate is pushed from 0.50 m to 0.70 m. What is the total amount of work done on the crate as it moves from 0.0 m to 0.70 m?

In your textbook, read about power on pages 263–265.
For each term on the left, write the letter of the matching item.

_____ **22.** calculation of power
_____ **23.** rate of doing work
_____ **24.** symbol for power
_____ **25.** unit of power
_____ **26.** 1000 W

a. kW
b. power
c. P
d. $\frac{W}{t}$
e. watt

Section 10.2 Machines

In your textbook, read about the benefits of machines on pages 266–268.
For each statement below, write* true *or rewrite the italicized part to make the statement true.

1. _____ The term machine refers to *complex* tools.

2. _____ A machine eases the load by changing *only the direction* of a force.

3. _____ Work is the use of mechanical means to transfer *energy*.

4. _____ A machine *can* create energy.

5. _____ A force that is exerted by a machine is the *effort* force.

6. _____ The mechanical advantage of a machine is the *product* of its resistance force and its effort force.

7. _____ If the mechanical advantage of a certain machine is 1.5, the machine *increases* the effort force.

8. _____ A real machine *cannot* have a mechanical advantage less than 1.

9. _____ The *ideal mechanical advantage* of a pulley can be used to calculate the distance the effort force moves compared to the distance the resistance force moves.

10. _____ If a machine transfers all of the energy applied to it, the output work is *greater than* the input work.

11. _____ In *a real machine*, the input work is equal to the output work.

12. _____ The efficiency of a machine is the *ratio* of work output to work input, expressed as a percentage.

13. _____ The efficiency of an ideal machine is *greater than* 100 percent.

14. _____ A machine with an efficiency of 1.2 requires a *smaller* effort force than a machine that has an efficiency of 2.2.

In your textbook, read about compound machines on pages 269–272.
Circle the letter of the choice that best completes the statement or answers the question.

15. Which of the following items is *not* an example of a simple machine?

a. a crowbar
c. a bicycle
b. a knife
d. a wheelchair ramp

16. The gears used in many machines are a combination of more than one _____.

a. lever
c. screw
b. pulley
d. wheel and axle

17. The *IMA* of any simple machine equals the _____.

a. amount of output force
c. product of distances moved
b. amount of work done
d. ratio of distances moved

18. When two or more simple machines are combined in such a way that _____, the result is a compound machine.

a. all of the parts move at the same time
b. the resistance force of one machine becomes the effort force of the other machine
c. the simple machines all touch each other
d. the teeth of one simple machine fit in the teeth of another simple machine

19. The *MA* of a compound machine is the _____ of the *MA*s of the simple machines it contains.

a. difference
c. quotient
b. product
d. sum

20. How can the rider change the *MA* of a multigear bicycle?

a. by choosing the path of the bicycle
c. by oiling the chain
b. by choosing the size of the gears
d. by pedaling faster

21. A person can ride a bicycle up a hill more easily if the _____.

a. gears are the same size
b. rear gear is larger than the front gear
c. rear gear is smaller than the front gear
d. rider rotates the pedals through fewer turns for each revolution of the wheel

22. Which of the following items is *not* a part of a lever system in the human body?

a. bone
c. muscle contraction
b. moveable joint
d. nerve fibers

23. A lever system in the human body has _____ efficiency and _____ mechanical advantage.

a. high, high
c. low, high
b. high, low
d. low, low

24. A tall person has levers with less mechanical advantage than a short person because _____ force is needed to move _____ levers.

a. greater, longer
c. greater, shorter
b. less, longer
d. less, shorter

25. A pulley is used to lift a car engine. The engine is lifted 35.6 cm for every 1.07 m the rope is pulled. What is the *IMA* of the pulley?

a. 0.0300
c. 3.00
b. 0.333
d. 33.3

Answer the following questions. Show your calculations.

26. A student is removing rocks from a garden. She exerts a force of 218 N on a lever to raise one rock a distance of 11.0 cm.

a. If the rock weighs 1050 N, how far does the girl move her end of the lever if the lever is an ideal machine?

b. If the lever actually has an efficiency of 78.3 percent, how far does the girl move her end of the lever?