

Chapter 14 Study Guide

Multiple Choice

- In which of the following is no work done?
 - climbing stairs
 - lifting a book
 - pushing a shopping cart
 - doing a handstand
- A force acting on an object does no work if
 - a machine is used to move the object.
 - the force is not in the direction of the object's motion.
 - the force is greater than the force of friction.
 - the object accelerates.
- What is the unit of work?
 - joule
 - newton/meter
 - watt
 - all of the above
- If you exert a force of 10.0 N to lift a box a distance of 1.0 m, how much work do you do?
 - 10.0 J
 - 100.0 J
 - 0.1 J
 - 11.0 J
- If you perform 20 joules of work lifting a 10-N box from the floor to a shelf, how high is the shelf?
 - 2.0 m
 - 10 m
 - 0.5 m
 - 200 m
- The SI unit of power is the
 - joule.
 - newton.
 - newton-meter.
 - watt.
- The power of a machine measures
 - its rate of doing work.
 - its strength.
 - the force it produces.
 - the work it does.
- 2984 watts equals about how many horsepower?
 - 16
 - 4
 - 24
 - 8
- A machine is a device that can multiply
 - force.
 - power.
 - work.
 - all of the above
- When a machine does work, it cannot do which of the following?
 - change the direction of a force.
 - increase a force and change the distance a force moves.
 - increase the distance a force moves and change the direction of a force.
 - increase a force and increase the distance a force moves an object.
- How can a machine make work easier for you?
 - by decreasing the amount of work you do
 - by changing the direction of your force
 - by increasing the work done by the machine
 - none of the above

12. How can you make the work output of a machine greater than the work input?
 - a. by decreasing friction
 - b. by increasing the input force
 - c. by increasing the output distance
 - d. this is impossible
13. The actual mechanical advantage of a machine
 - a. cannot be less than 1.
 - b. decreases as the input distance increases.
 - c. increases with greater friction.
 - d. is less than the ideal mechanical advantage of the machine.
14. If you have to apply 40 N of force on a crowbar to lift a rock that weights 400 N, what is the actual mechanical advantage of the crowbar?
 - a. 0.1
 - b. 10
 - c. 360
 - d. 16,000
15. 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?
 - a. 0.3
 - b. 3
 - c. 40
 - d. 160
16. The efficiency of a machine is always less than 100 percent because
 - a. a machine cannot have an IMA greater than 1.
 - b. some work input is lost to friction.
 - c. the work input is too small.
 - d. the work output is too great.
17. 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?
 - a. 0.5%
 - b. 190%
 - c. 55%
 - d. 183%
18. A motor with an efficiency of 75 percent must supply 240 J of useful work. What amount of work must be supplied to the motor?
 - a. 75 J
 - b. 180 J
 - c. 320 J
 - d. 420 J
19. An inclined plane reduces the effort force by
 - a. increasing the distance through which the force is applied.
 - b. increasing the work.
 - c. reducing the effort distance.
 - d. reducing the work.
20. An ax is an example of a(an)
 - a. inclined plane.
 - b. lever.
 - c. wedge.
 - d. wheel and axle.
21. Which of the following is an example of a wheel and axle?
 - a. hammer
 - b. an automobile steering wheel
 - c. a jar lid
 - d. a pencil

22. The ideal mechanical advantage of a pulley system is equal to the
- distance the load has to move.
 - length of the rope.
 - number of rope segments supporting the load.
 - weight of the object being lifted.
23. The ideal mechanical advantage of a wheel and axle is found by
- multiplying the circumference of the wheel by the radius of the axle.
 - dividing the radius of the wheel by the radius of the axle.
 - dividing the radius of the axle by the radius of the wheel.
 - multiplying the radius of the wheel by the radius of the axle.
24. An example of a compound machine is a
- | | |
|-------------|------------|
| a. crowbar. | c. ramp. |
| b. bicycle. | d. seesaw. |
25. A machine is classified as a compound machine if it
- has moving parts.
 - has an IMA greater than 1.
 - is made up of two or more simple machines that operate together.
 - is very efficient.

Completion

Complete each statement.

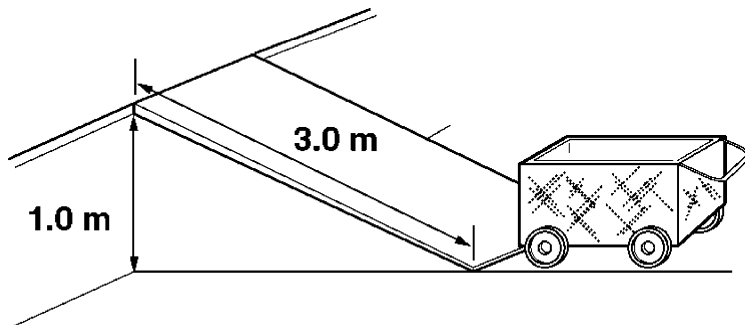
26. The rate at which work is done is called _____.
27. The SI unit of power is the _____.
28. A device that changes the size or direction of force used to do work is called a(an) _____.
29. The force that is exerted on a machine is called the _____ force.
30. The _____ of a machine is the number of times that the machine increases the input force.
31. The mechanical efficiency of any machine is always _____ than 100 percent.
32. A(An) _____ can be described as an inclined plane wrapped around a cylinder.
33. As the thickness of a wedge of given length increases, its IMA _____.

Short Answer

34. If a simple machine provides an increased output force, what happens to the output distance?
35. Why is the work output of a machine never equal to the work input?
36. If a simple machine could be frictionless, how would its IMA and AMA compare?
37. Which has the greater IMA—a screw with closely spaced threads or a screw with threads spaced farther apart?
38. You do 400 J of work with a pulley. If the pulley does 380 J of work, what is the efficiency of the pulley?

Problem

39. A worker uses a cart to move a load of bricks weighing 680 N 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? Show your work.
40. 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? Show your work.
41. To pull a tree out of a yard, you can apply a force of 50 N to the shovel. The shovel applies a force of 900 N to the tree. What is the AMA advantage of the shovel?
42. The input force of a pulley system must move 8.0 m to lift a 3000-N engine a distance of 2.0 m. What is the IMA of the system? Show your work.
43. A 20-N force applied to the handle of a door produces a 44-N output force. What is the AMA of the handle? Show your work.

Other**USING SCIENCE SKILLS****Figure 14-2**

44. **Calculating** What is the IMA of the ramp in Figure 14-2? Show your work.

Chapter 14 Study Guide

Answer Section

MULTIPLE CHOICE

1. ANS: D PTS: 1 DIF: L1 OBJ: 14.1.1
BLM: knowledge
2. ANS: B PTS: 1 DIF: L2 OBJ: 14.1.1
BLM: comprehension
3. ANS: A PTS: 1 DIF: L1 OBJ: 14.1.2
BLM: knowledge
4. ANS: A PTS: 1 DIF: L2 OBJ: 14.1.2
BLM: application
5. ANS: A PTS: 1 DIF: L2 OBJ: 14.1.2
BLM: application
6. ANS: D PTS: 1 DIF: L1 OBJ: 14.1.3
BLM: knowledge
7. ANS: A PTS: 1 DIF: L1 OBJ: 14.1.3
BLM: knowledge
8. ANS: B PTS: 1 DIF: L2 OBJ: 14.1.4
BLM: application
9. ANS: A PTS: 1 DIF: L1 OBJ: 14.2.1
BLM: knowledge
10. ANS: D PTS: 1 DIF: L2 OBJ: 14.2.1
BLM: comprehension
11. ANS: B PTS: 1 DIF: L1 OBJ: 14.2.2
BLM: knowledge
12. ANS: D PTS: 1 DIF: L2 OBJ: 14.2.2
BLM: comprehension
13. ANS: D PTS: 1 DIF: L1 OBJ: 14.3.1
BLM: knowledge
14. ANS: B PTS: 1 DIF: L1 OBJ: 14.3.2
BLM: application
15. ANS: B PTS: 1 DIF: L2 OBJ: 14.3.2
BLM: application
16. ANS: B PTS: 1 DIF: L1 OBJ: 14.3.3
BLM: knowledge
17. ANS: C PTS: 1 DIF: L2 OBJ: 14.3.4
BLM: application
18. ANS: C PTS: 1 DIF: L2 OBJ: 14.3.4
BLM: application
19. ANS: A PTS: 1 DIF: L1 OBJ: 14.4.1
BLM: knowledge
20. ANS: C PTS: 1 DIF: L1 OBJ: 14.4.1
BLM: knowledge

21. ANS: B PTS: 1 DIF: L1 OBJ: 14.4.1
BLM: knowledge
22. ANS: C PTS: 1 DIF: L1 OBJ: 14.4.2
BLM: knowledge
23. ANS: B PTS: 1 DIF: L1 OBJ: 14.4.2
BLM: knowledge
24. ANS: B PTS: 1 DIF: L1 OBJ: 14.4.3
BLM: knowledge
25. ANS: C PTS: 1 DIF: L1 OBJ: 14.4.3
BLM: knowledge

COMPLETION

26. ANS: power
PTS: 1 DIF: L1 OBJ: 14.1.3 BLM: knowledge
27. ANS: watt
PTS: 1 DIF: L1 OBJ: 14.1.3 BLM: knowledge
28. ANS: machine
PTS: 1 DIF: L1 OBJ: 14.2.1 BLM: knowledge
29. ANS: input
PTS: 1 DIF: L1 OBJ: 14.2.2 BLM: knowledge
30. ANS: mechanical advantage
PTS: 1 DIF: L1 OBJ: 14.3.1 BLM: knowledge
31. ANS: less
PTS: 1 DIF: L1 OBJ: 14.3.3 BLM: knowledge
32. ANS: screw
PTS: 1 DIF: L1 OBJ: 14.4.1 BLM: knowledge
33. ANS: decreases
PTS: 1 DIF: L1 OBJ: 14.4.2 BLM: knowledge

SHORT ANSWER

34. ANS:
The simple machine reduces the output distance.
PTS: 1 DIF: L1 OBJ: 14.2.1 BLM: knowledge

35. ANS:
Some of work input is used to overcome friction.
- PTS: 1 DIF: L1 OBJ: 14.2.2 BLM: knowledge
36. ANS:
They would be equal.
- PTS: 1 DIF: L2 OBJ: 14.3.1 BLM: analysis
37. ANS:
the screw with closely spaced threads
- PTS: 1 DIF: L2 OBJ: 14.4.2 BLM: comprehension
38. ANS:
95%
- PTS: 1

PROBLEM

39. ANS:
Work = Force \times Distance = 209 N \times 10 m = 2090 N·m = 2090 J
Work = 2090 J
- PTS: 1 DIF: L2 OBJ: 14.1.2 BLM: application
40. ANS:
Power = $\frac{\text{Work}}{\text{Time}} = \frac{\text{Force} \times \text{Distance}}{\text{Time}} = \frac{160 \text{ N} \times 1 \text{ m}}{0.5 \text{ s}} = 320 \text{ N}\cdot\text{m}/\text{s} = 320 \text{ J}/\text{s}$
Power = 320 J/s = 320 W
- PTS: 1 DIF: L2 OBJ: 14.1.3 BLM: application
41. ANS:
18
- PTS: 1 DIF: L2 OBJ: 14.3.2 BLM: application
42. ANS:
IMA = $\frac{\text{Input distance}}{\text{Output distance}} = \frac{8.0 \text{ m}}{2.0 \text{ m}} = 4.0$
IMA = 4.0
- PTS: 1 DIF: L2 OBJ: 14.3.2 BLM: application

43. ANS:

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

$$\text{AMA} = 2.2$$

PTS: 1

DIF: L2

OBJ: 14.3.2

BLM: application

OTHER

44. ANS:

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

PTS: 1

DIF: L2

OBJ: 14.3.2

BLM: application