

Multiple Choice

Read each question and choose the best answer by putting the corresponding letter in the blank to the left.

- _____ 1. Which of the following is a unit of work?
- A. slug
 - B. dyne
 - C. newton
 - D. joule
- _____ 2. An ideal spring
- A. always returns an object to its equilibrium position.
 - B. has a small mass.
 - C. has a variable spring constant, k .
 - D. has small internal friction.
- _____ 3. The slope of a force-distance graph for the force exerted by an ideal spring is equal to
- A. work.
 - B. the acceleration of the spring.
 - C. the equilibrium position of the spring.
 - D. the spring constant, k .
- _____ 4. The SI unit of power is the
- A. watt.
 - B. joule.
 - C. newton.
 - D. kilowatt-hour.
- _____ 5. Which statement is true about the work-energy theorem?
- A. It states that the work done on an object is equal to the change in the object's gravitational potential.
 - B. It states that the work done on an object is equal to the change in the object's kinetic energy.
 - C. It refers to the absolute value of the energies.
 - D. It is not valid if the force applied is variable.
- _____ 6. By what factor is the kinetic energy increased when the speed of a car is increased from 30.0 m/s to 50.0 m/s?
- A. 2.78
 - B. 0.36
 - C. 1.67
 - D. 0.60

- _____ 7. How much will the kinetic energy of a school bus increase if its velocity is tripled?
- A. It will double.
 - B. It will triple.
 - C. It will be six times greater.
 - D. It will be nine times greater.
- _____ 8. A book is lifted up from the floor and put on a shelf with a height, h . Which of the following statements is true, if only conservative forces act on the book?
- A. $\Delta U = -|mg|h$
 - B. $\Delta K = \frac{1}{2}|mv^2|$
 - C. $\Delta K = -|mg|h$
 - D. $\Delta U = 0 \text{ J}$
- _____ 9. Which one of the following is *not* an example of a nonconservative force?
- A. air resistance
 - B. friction
 - C. the force a spring exerts on an object
 - D. internal friction
- _____ 10. In which case is work nonzero?
- A. The force applied is constant.
 - B. Only balanced forces are applied to an object at rest.
 - C. The force applied is perpendicular to the distance the object is moved.
 - D. Potential energy is constant.
- _____ 11. When potential energy of an object is zero and its total mechanical energy is nonzero, then
- A. the object is at its maximum height.
 - B. the object is in motion.
 - C. the object is doing no work.
 - D. kinetic energy is also zero.

Short Answer

After reading each sentence, write a response in the blank provided.

12. The product of a distance and the component of force that acts over that distance is defined as _____.
13. In a force-distance graph, the area under the curve represents _____, whether the force is constant or not.
14. Hooke's law says that the distance a spring is stretched or compressed is _____ proportional to force.
15. The reference position for a spring's motion is called its _____.
16. The rate of doing work is _____.
17. An example of a conservative force is _____.

18. The equation $\Delta U_g = mg \Delta h$ can be used to find gravitational potential energy only when _____.
19. A compressed spring will have more _____ than any other kind of energy.
20. In the equation, $U_g = -G \frac{m_1 m_2}{r}$, for an object relatively close to the earth's surface, r is _____.
21. The tendency of a spring to return to its equilibrium position is caused by _____ energy.
22. If total mechanical energy is conserved, then we assume only _____ forces are at work.

True/False

Read the following statements. Identify each as true or false by putting *T* or *F* in the blank to the left.

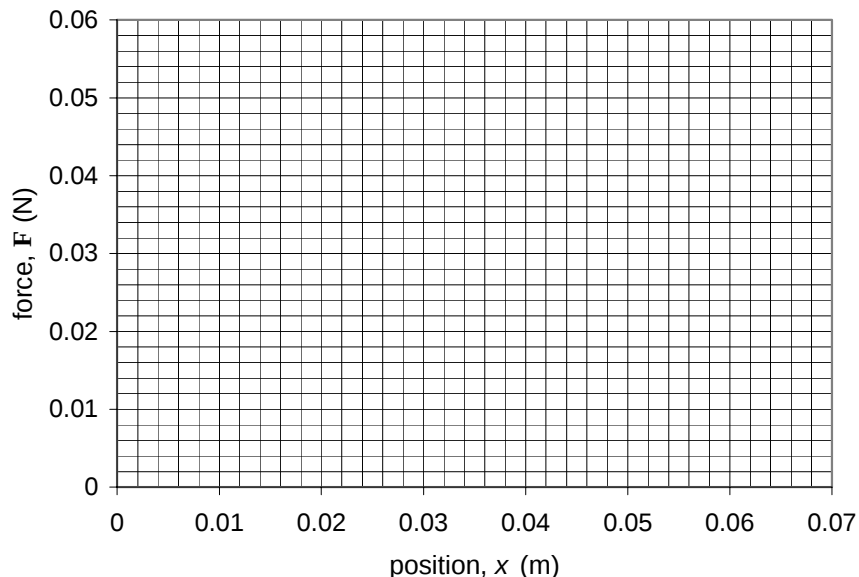
- ____ 23. Work is a vector quantity since it involves force, which is a vector.
- ____ 24. It is possible to exert a large force and do no work.
- ____ 25. Work and energy have the same units.
- ____ 26. The spring constant, k , is a dimensionless constant.
- ____ 27. In an oscillating spring, the force is variable, so the spring does no work.
- ____ 28. Power is a scalar quantity.
- ____ 29. Lifting a box of twenty books and lifting each of the twenty books one at a time requires the same amount of power.
- ____ 30. The same amount of power is needed to work quickly as to work slowly.
- ____ 31. Kinetic energy is a vector quantity since it involves velocity, which is a vector.
- ____ 32. A falling object possesses only kinetic energy since it is in motion.

Application Problems

Complete the problems below. Be sure to show your work, consider significant figures, and put your answer with the correct units in the blank provided.

33. Jon pushes a lawnmower with a force of 50.0 N directed at 50° from the horizontal. The lawnmower moves 90.0 m.
- ____ a. How much work did Jon do with the lawnmower?

- _____ b. If Jon took 1 hour to mow 90.0 m of grass, what was his power in SI units?
- _____ 34. When the brakes of a car traveling 100. km/h are locked, how many times farther will the car skid than it would if the brakes were locked at 25 km/h?
- _____ 35. Chuck weighs 5.0×10^2 N on a bathroom scale containing a heavy spring. The spring is compressed 2.0 cm under his weight. Find the total work done on the spring during the compression.
36. Chris is playing pinball. He pulls out the piston (which has a spring mechanism) to release the ball and to begin his game. His force varies with how far he pulls the piston out. When he pulls the piston out 0.01 m, he exerts a force of 0.0075 N. When he pulls the piston out 0.015 m, he exerts a force of 0.011 25 N. When he is ready to start the game, he has pulled the piston out 0.07 m and exerted a force of 0.0525 N.
- a. Make a force-distance graph of the piston's movement.



_____ b. Calculate work done using the graph that you made in part a.

_____ c. What quantity does the slope of the graph tell us?

_____ 37. A 0.35 kg ball falls from a resting place to the floor 3.0 m below. What is its speed when it hits the ground, assuming no air resistance?