Physics Chapter 5--Work and Energy Study Guide

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. In which of the following sentences is *work* used in the everyday sense of the word?
a. Lifting a heavy bucket involves doing work on the bucket.
b. The force of friction usually does negative work.
c. Sam and Rachel worked hard pushing the car.
d. Work is a physical quantity.

____ 2. A force does work on an object if a component of the force
a. is perpendicular to the displacement of the object.
b. is parallel to the displacement of the object.
c. perpendicular to the displacement of the object moves the object along a path that returns the object to its starting position.
d. parallel to the displacement of the object moves the object along a path that returns the object to its starting position.

____ 3. Work is done when
a. the displacement is not zero.
b. the displacement is zero.
c. the force is zero.
d. the force and displacement are perpendicular.

____ 4. If the sign of work is negative,
a. the displacement is perpendicular to the force.
b. the displacement is in the direction opposite the force.
c. the displacement is in the same direction as the force.
d. no work is done.

____ 5. In which of the following scenarios is work done?
a. A weightlifter holds a barbell overhead for 2.5 s.
b. A construction worker carries a heavy beam while walking at constant speed along a flat surface.
c. A car decelerates while traveling on a flat stretch of road.
d. A student holds a spring in a compressed position.

____ 6. A child moving at constant velocity carries a 2 N ice-cream cone 1 m across a level surface. What is the net work done on the ice-cream cone?
a. 0 J
b. 0.5 J
c. 2 J
d. 20 J

____ 7. A child pulls a balloon for 12 m with a force of 1.0 N at an angle 60° below horizontal. How much work does the child do on the balloon?
a. –10 J
b. –6.0 J
c. 6.0 J
d. 12 J

____ 8. Which of the following energy forms is associated with an object due to its position?
a. potential energy
b. positional energy
c. total energy
d. kinetic energy

____ 9. Which of the following formulas would be used to directly calculate the kinetic energy of an object with mass *m* bouncing up and down on a spring with spring constant *k*?

a. $KE = \frac{1}{2}kx^2$
c. $KE = \frac{1}{2}mv^2$
b. $KE = -\frac{1}{2}kx^2$
d. $KE = -\frac{1}{2}mv^2$

____ 10. Ball A has triple the mass and speed of ball B. What is the ratio of the kinetic energy of ball A to ball B.

a. 3
c. 9
b. 6
d. 27

____ 11. What is the kinetic energy of a 0.135 kg baseball thrown at 40.0 m/s?

a. 54.0 J
c. 108 J
b. 87.0 J
d. 216 J

____ 12. Which of the following equations expresses the work-kinetic energy theorem?

a. $ME_i = ME_f$
c. $\Delta W = \Delta KE$
b. $W_{net} = \Delta PE$
d. $W_{net} = \Delta KE$

____ 13. If friction is the only force acting on an object during a given physical process, which of the following assumptions can be made in regard to the object's kinetic energy?

a. The kinetic energy decreases.
b. The kinetic energy increases.
c. The kinetic energy remains constant.
d. The kinetic energy decreases and then increases.

____ 14. The main difference between kinetic energy and potential energy is that

a. kinetic energy involves position, and potential energy involves motion.
b. kinetic energy involves motion, and potential energy involves position.
c. although both energies involve motion, only kinetic energy involves position.
d. although both energies involve position, only potential energy involves motion.

____ 15. Gravitational potential energy is always measured in relation to

a. kinetic energy.
c. total potential energy.
b. mechanical energy.
d. a zero level.

____ 16. The equation for determining gravitational potential energy is $PE_g = mgh$. Which factor(s) in this equation is (are) *not* intrinsic to an object?

a. *m*
c. *h*
b. *g*
d. both *g* and *h*

____ 17. Which of the following parameters does *not* depend on how resistant a spring is to being compressed or stretched?

a. compression distance
c. spring constant
b. relaxed length
d. stretching distance

____ 18. What are the units for a spring constant?

a. N
c. N•m
b. m
d. N/m

____ 19. In the presence of frictional force,

a. nonmechanical energy is negligible and mechanical energy is no longer conserved.
b. nonmechanical energy is negligible and mechanical energy is conserved.

c. nonmechanical energy is no longer negligible and mechanical energy is conserved.
d. nonmechanical energy is no longer negligible and mechanical energy is no longer conserved.

____ 20. Why doesn't the principle of mechanical energy conservation hold in situations when frictional forces are present?
a. Kinetic energy is not completely converted to a form of potential energy.
b. Potential energy is completely converted to a form of gravitational energy.
c. Chemical energy is not completely converted to electrical energy.
d. Kinetic energy is completely converted to a form of gravitational energy.

____ 21. For which of the following situations is the conservation of mechanical energy most likely to be a valid assumption?
a. A skateboard rolls across a sewer grate.
b. A parachutist falls from a plane.
c. You rub your hands together to keep warm.
d. A soccer ball flies through the air.

____ 22. Which of the following refers to the sum of kinetic energy and all forms of potential energy?
a. total energy
b. Σ energy
c. nonmechanical energy
d. mechanical energy

____ 23. Which of the following are examples of conservable quantities?
a. potential energy and length
b. mechanical energy and length
c. mechanical energy and mass
d. kinetic energy and mass

____ 24. Which of the following is a form of mechanical energy?
a. internal energy
b. chemical potential energy
c. gravitational potential energy
d. electrical energy

____ 25. Friction converts kinetic energy to
a. mechanical energy.
b. potential energy.
c. nonmechanical energy.
d. total energy.

____ 26. Which of the following is the rate at which work is done?
a. potential energy
b. kinetic energy
c. mechanical energy
d. power

____ 27. Which of the following equations is *not* an equation for power, *P*, in terms of work, *W*, displacement, *d*, time interval, Δt, force, *F*, and/or velocity, *v*?
a. $P = F\dfrac{d}{\Delta t}$
b. $P = \dfrac{W}{\Delta t}$
c. $P = Fv$
d. $P = \dfrac{Fv}{\Delta t}$

____ 28. Which of the following are *not* units of power?
a. hp
b. J
c. W
d. J/s

____ 29. How much power is required to lift a 2.0 kg mass at a speed of 2.0 m/s?
a. 2.0 J
b. 4.0 J
c. 9.8 J
d. 39 J

____ 30. A more powerful motor can do
   a. more work in a longer time interval.
   b. the same work in a shorter time interval.
   c. less work in a longer time interval.
   d. the same work in a longer time interval.

Short Answer

31. Explain the scientific meaning of *work*.

32. In the following sentence, is the everyday meaning or the scientific meaning of work intended?
A bulldozer does work lifting a load.

33. What formula can be used to calculate work if the force acts at an angle to the displacement?

34. Name the two SI units for work.

35. A child pulls a toy across the floor. Is the work done on the toy positive, negative, or zero?

A car travels at a speed of 25 m/s on a flat stretch of road. The driver must maintain pressure on the accelerator to keep the car moving at this speed.

36. What is the net work done on the car over a distance of 250 m?

37. The car's engine is doing work on the car, yet the kinetic energy of the car is not changing. What is happening to the energy supplied by the engine?

38. An object is lowered into a deep hole in the ground. How does the potential energy of the object change?

39. A ski jumper has 1.2×10^4 J of potential energy at the top of the ski jump. The friction on the jump slope is small, but not negligible. What can you conclude about the ski jumper's kinetic energy at the bottom of the jump? Explain your answer.

40. In terms of energy, what occurs when a machine does work on an object?

Problem

41. A flight attendant pulls a 50.0 N flight bag a distance of 250.0 m along a level airport floor at a constant speed. A 30.0 N force is exerted on the bag at an angle of 50.0° above the horizontal. How much work is done on the flight bag?

42. A hill is 100 m long and makes an angle of 12° with the horizontal. As a 50 kg jogger runs up the hill, how much work does the jogger do against gravity?

43. A 15.0 kg crate, initially at rest, slides down a ramp 2.0 m long and inclined at an angle of 20.0° with the horizontal. Using the work-kinetic energy theorem and disregarding friction, find the velocity of the crate at the bottom of the ramp. (g = 9.81 m/s^2)

44. A skier with a mass of 88 kg hits a ramp of snow at 16 m/s and becomes airborne. At the highest point of flight, the skier is 3.7 m above the ground. What is the skier's gravitational potential energy at this point?

45. A 2.00 g coin, which has zero potential energy at the surface, is dropped into a 10.0 m well. After the coin comes to a stop in the mud, what is its potential energy with respect to the surface?

46. A 40.0 N crate is pulled up a 5.0 m inclined plane at a constant velocity. If the plane is inclined at an angle of 37° to the horizontal and there is a constant force of friction of 10.0 N between the crate and the surface, what is the net gain in potential energy by the crate?

47. Old Faithful geyser in Yellowstone National Park shoots water every hour to a height of 40.0 m. With what velocity does the water leave the ground? (Assume no air resistance and that $g = 9.81$ m/s^2.)

48. A pendulum with a mass of 1 kg is released from a height of 1.5 cm above the height of its resting position. How fast will the pendulum be moving when it passes through the lowest point of its swing?

49. What is the average power output of a weightlifter who can lift 250 kg a height of 2.0 m in 2.0 s?

50. A jet engine develops 1.0×10^{5} N of thrust to move an airplane forward at a speed of 9.0×10^{2} km/h. What is the power output of the engine?