Identify the letter of the choice that best completes the statement or answers the question. In the space next to the question, indicate how much confidence you have in your answer (C = Confident; S = So-so; G = Guessed).

1. What two conditions are necessary for mechanical work to be done?
   a. Motion and some component of force that is parallel to the motion.
   b. Motion and some component of force that is perpendicular to the motion.
   c. Constant velocity motion and a net force that is not zero.
   d. Constant velocity motion and a net force of zero.

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

3. 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.

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. It is impossible for work to be negative.

5. How much work is done on a 20 kg file cabinet if it is pushed 3 m by a force of 45 N?
   a. 60 J  b. 590 J  c. 135 J  d. 65 J

6. A worker does 25 J of work lifting a bucket, then sets the bucket back down in the same place. What is the total net work done on the bucket?
   a. −25 J  b. 0 J  c. 25 J  d. 50 J

7. What is the sign on work done by kinetic friction?
   a. Positive
   b. Negative
   c. Friction does zero work
   d. Cannot be determined

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

9. 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

10. Gravitational potential energy is always measured in relation to
    a. total potential energy  b. mechanical energy  c. a reference level  d. kinetic energy.
11. 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.

12. Which of the following energy forms is not involved in hitting a tennis ball?
a. kinetic energy
b. chemical potential energy
c. gravitational potential energy
d. elastic potential energy

13. 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 \( k \)?
\[
\begin{align*}
(a) \ K E &= \frac{1}{2} k x^2 \\
(b) \ K E &= -\frac{1}{2} k x^2 \\
(c) \ K E &= \frac{1}{2} m v^2 \\
(d) \ K E &= -\frac{1}{2} m v^2
\end{align*}
\]

14. If a 1 kg mass has a speed of 25 m/s, what is its kinetic energy?
\[
\begin{align*}
(a) \ 25 \text{ J} & \quad (b) \ 625 \text{ J} \\
(c) \ 313 \text{ J} & \quad (d) \ 245 \text{ J}
\end{align*}
\]

15. Which of the following is not a factor in determining elastic potential energy?
\[
\begin{align*}
(a) \ \text{compression distance} & \quad (b) \ \text{mass} \\
(c) \ \text{spring constant} & \quad (d) \ \text{stretching distance}
\end{align*}
\]

16. If the mass of a moving object was doubled, but its speed remained the same, the kinetic energy of the object would change by a factor of
\[
\begin{align*}
(a) \ 1/4 & \quad (b) \ 1/2 \\
(c) \ 2 & \quad (d) \ 4
\end{align*}
\]

17. If the speed of a moving object was doubled, but its mass remained the same, the kinetic energy of the object would change by a factor of
\[
\begin{align*}
(a) \ 1/4 & \quad (b) \ 1/2 \\
(c) \ 2 & \quad (d) \ 4
\end{align*}
\]

18. If the mass of a moving object was doubled and its speed was cut in half, the kinetic energy of the object would change by a factor of
\[
\begin{align*}
(a) \ 1/4 & \quad (b) \ 1/2 \\
(c) \ 2 & \quad (d) \ 4
\end{align*}
\]

19. If the displacement of a horizontal mass-spring system was doubled, the elastic potential energy in the system would change by a factor of
\[
\begin{align*}
(a) \ 1/4 & \quad (b) \ 1/2 \\
(c) \ 2 & \quad (d) \ 4
\end{align*}
\]

20. In the presence of frictional force,
\[
\begin{align*}
(a) \ \text{nonmechanical energy is negligible and mechanical energy is no longer conserved.} \\
(b) \ \text{nonmechanical energy is negligible and mechanical energy is conserved.} \\
(c) \ \text{nonmechanical energy is no longer negligible and mechanical energy is conserved.} \\
(d) \ \text{nonmechanical energy is no longer negligible and mechanical energy is no longer conserved.}
\end{align*}
\]

21. What is true of the mechanical energy of an object assuming there is no friction?
\[
\begin{align*}
(a) \ \text{The kinetic energy always increases.} \\
(b) \ \text{The potential energy always increases.} \\
(c) \ \text{The total mechanical energy is constant.} \\
(d) \ \text{The potential energy always decreases.}
\end{align*}
\]
22. 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.

23. Which of the following equations expresses the work-kinetic energy theorem?
   a. \( ME_i = ME_f \)
   b. \( W_{\text{net}} = \Delta PE \)
   c. \( \Delta W = \Delta KE \)
   d. \( W_{\text{net}} = \Delta KE \)

24. If the net work done on an object is negative, what will happen 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.

25. If a 5 kg object at rest experiences a net force of 25 N for a distance of 15 meters, what is its increase in kinetic energy?
   a. 75 J  
   b. 125 J  
   c. 375 J  
   d. None of the above

26. A car is going twice as fast as another. Both cars skid to a rest. The faster car will skid _____ as the slower car.
   a. twice as far  
   b. four times as far  
   c. the same distance  
   d. half as far

27. One car has twice the Kinetic Energy as another. Both cars skid to a rest. The car with more KE will skid _____ as the other car.
   a. twice as far  
   b. four times as far  
   c. the same distance  
   d. half as far

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

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

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.

31. What happens to power produced if more work is done in the same amount of time?
   a. Power increases  
   b. Power decreases  
   c. Power remains constant  
   d. Not enough information

32. What will happen to the time in which work is done if power increases while work remains constant?
   a. The time will increase  
   b. The time will decrease  
   c. The time will remain constant  
   d. Not enough information

33. Which of the following is NOT an SI unit directly related to power?
34. Which of the following is a valid equation for mechanical advantage?
   a. \( AMA = \frac{F_{out}}{F_{in}} \)  
   b. \( IMA = \frac{d_{out}}{d_{in}} \)  
   c. \( AMA = \frac{W_{out}}{W_{in}} \)  
   d. \( IMA = \frac{F_{out}}{d_{in}} \) 

35. An iron bar is used to lift a slab of cement. The force applied to lift the slab is \(4.0 \times 10^2\) N. If the slab weighs 6400 N, what is the mechanical advantage of the bar?
   a. 1.6  
   b. 16  
   c. 6000  
   d. 6.3% 

36. What is the efficiency of a machine that requires \(1.00 \times 10^2\) J of input energy to do 35 J of work?
   a. 2.9 %  
   b. 29%  
   c. 35%  
   d. 65% 

37. What simple machine would you use to split a lot into two pieces?
   a. Pulley  
   b. Wedge  
   c. Lever  
   d. Screw 

38. What quantity measures the output force of a machine relative to the input force?
   a. mechanical advantage  
   b. leverage  
   c. torque  
   d. efficiency 

39. What quantity measures the work done by a machine relative to the work done on a machine?
   a. mechanical advantage  
   b. leverage  
   c. torque  
   d. efficiency 

40. Which pulley system requires the least input force?
   a. One support strand lifting a 1 kg mass  
   b. Two support strands lifting a 1 kg mass  
   c. Three support strands lifting a 1 kg mass  
   d. Four support strands lifting a 1 kg mass 

41. Which incline requires the least input force?
   a. A long incline less than 45°  
   b. A short incline greater than 45°  
   c. A 45° incline  
   d. No incline, just picking the object up 

42. Which lever arrangement requires the least input force?
   a. Placing a fulcrum far away from the load  
   b. Placing a fulcrum at the midpoint of the lever  
   c. Placing a fulcrum as close as possible to the load  
   d. The placement of the fulcrum does not affect the force required to lift an object