Physics 130: Questions to study for midterm #1 from Chapter 7

1. Kinetic energy is defined to be one-half the
   a. mass times the speed.
   b. mass times the speed squared.
   c. mass times the acceleration.
   d. weight times the speed squared.

2. Which has the greater kinetic energy, a heavy truck at rest or a moving roller skate?
   a. the heavy truck
   b. the roller skate
   c. The kinetic energies are equal.

3. If a sports car with a mass of 1000 kg travels down the road with a speed of 20 m/s, its kinetic energy is 200,000
   a. kg/(m/s)^2
   b. kg·s^2/m^2
   c. kg·m/s
   d. kg·m^2/s^2

4. Which of the following objects has the largest kinetic energy? A mass of _____ with a speed of _____.
   a. 6 kg ... 2 m/s
   b. 4 kg ... 3 m/s
   c. 2 kg ... 5 m/s
   d. 6 kg ... 3 m/s

5. Assume that a red car has a mass of 1000 kg and a white car has a mass of 2000 kg. If both cars are traveling at the same velocity,
   a. their kinetic energies are equal.
   b. their momenta are equal.
   c. the red car's kinetic energy is twice as big.
   d. the white car's kinetic energy is twice as big.

6. Assume that a red car has a mass of 1000 kg and a white car has a mass of 2000 kg. If the red car has twice the velocity of the white car,
   a. their kinetic energies are equal.
   b. their momenta are equal.
   c. the red car's momentum is twice as big.
   d. the white car's momentum is twice as big.
7. Assume that two cars have the same mass, but that the red car has twice the speed of the blue car. We then know that the red car has _____ kinetic energy as the blue car.
   a. twice as much
   b. one-half as much
   c. four times as much
   d. one-fourth as much

8. A ball moving at 4 m/s toward the right has a head-on collision with an identical stationary ball. Each of the following possibilities satisfies the law of conservation of linear momentum. Which one also conserves kinetic energy? One ball has a velocity of _____ while the other has a velocity of _____ to the right.
   a. 2 m/s to the right ... 2 m/s
   b. zero ... 4 m/s
   c. 2 m/s to the left ... 6 m/s
   d. 4 m/s to the left ... 8 m/s

9. A 3-kg toy car with a speed of 6 m/s collides head-on with a 2-kg car traveling in the opposite direction with a speed of 4 m/s. If the cars are locked together after the collision with a speed of 2 m/s, how much kinetic energy is lost?
   a. 10 J
   b. 28 J
   c. 60 J
   d. 70 J

10. In physics, work is defined as the product of the
    a. net force and the distance traveled.
    b. net force parallel to the motion and the distance traveled.
    c. net force parallel to the motion and the time it is applied.
    d. applied force and the distance traveled.

11. An object has a velocity toward the south. If a force directed toward the south acts on the object, it will initially cause the kinetic energy of the object to _____.
    a. increase
    b. decrease
    c. remain the same

12. What average power is required to accelerate a 1200-kg car from rest to 20 m/s in 10 s?
    a. 240 W
    b. 24,000 W
    c. 36,000 W
    d. 48,000 W
13. An object has a velocity toward the south. If a force directed toward the north acts on the object, it will initially cause the kinetic energy of the object to _____.
   a. increase
   b. decrease
   c. remain the same

14. Two objects have different masses but the same kinetic energies. If you stop them with the same retarding force, which one will stop in the shorter distance?
   a. the heavier one
   b. the lighter one
   c. Both stop in the same distance.

15. The kinetic energy of an object moving in a circle at a constant speed is
   a. continually changing as the force changes direction.
   b. equal to the force times the time for one revolution.
   c. equal to one-half of the potential energy.
   d. constant.

16. The momentum of an object moving in a circle at a constant speed is
   a. continually changing as the force changes direction.
   b. equal to the force times the time for one revolution.
   c. equal to one-half of the potential energy.
   d. constant.

17. Which of the following forces does the most work? A force of _____ acting through a distance of _____.
   a. 1 N ... 5 m
   b. 2 N ... 4 m
   c. 3 N ... 3 m
   d. 4 N ... 2 m

18. A tennis ball on the end of a string travels in a horizontal circle at a constant speed. The circle has a circumference of 2 m, the ball has a speed of 3 m/s, and the centripetal force is 1.5 N. How much work is done on the ball each time it goes around?
   a. zero
   b. 6 J
   c. 9 J
   d. 12 J

19. How much work is performed by the gravitational force $F$ on a synchronous satellite during one day?
   a. zero, because the satellite does not move.
   b. zero, because the force is perpendicular to the velocity.
   c. $FC$, where $C$ is the circumference of the orbit.
   d. $Fr$, where $r$ is the radius of the orbit.
20. A bowler lifts a bowling ball from the floor and places it on a rack. If you know the weight of the ball, what else must you know in order to calculate the work she does on the ball?
   a. the mass of the ball
   b. the time required
   c. nothing else
   d. the height of the rack

21. What is the gravitational potential energy of a ball with a weight of 50 N when it is sitting on a shelf 2 m above the floor?
   a. 100 J
   b. 200 J
   c. 400 J
   d. We cannot say without knowing the zero level.

22. Which one of the following does not affect the value for the gravitational potential energy of an object?
   a. its height
   b. the location of the zero value
   c. its mass
   d. All of them do.

23. A woman with a mass of 60 kg climbs a set of stairs that are 3 m high. How much gravitational potential energy does she gain?
   a. 60 J
   b. 180 J
   c. 540 J
   d. 1800 J

24. What is the minimum work done by a 60-kg person while walking up a trail that gains 720 m in elevation?
   a. 12 J
   b. 780 J
   c. 43,200 J
   d. 432,000 J

25. What is the gravitational potential energy of a ball with a weight of 50 N when it is sitting on a shelf 2 m above the floor? Assume the potential energy is zero on the floor.
   a. 100 J
   b. 200 J
   c. 400 J
   d. zero
26. A man with a mass of 70 kg falls 10 m. How much gravitational potential energy does he lose?
   a. 10 J
   b. 70 J
   c. 700 J
   d. 7000 J

27. Which of the following properties of a ball is conserved as it falls freely in a vacuum?
   a. kinetic energy
   b. gravitational potential energy
   c. momentum
   d. mechanical energy

28. If we examine a ball in free fall, we find that the kinetic energy of the ball is not constant. This
   is not a violation of the law of conservation of energy because the
   a. force of gravity does work on the ball.
   b. the conserved quantity is mechanical energy.
   c. the gravitational potential energy also changes.
   d. All of the above are correct.

29. A man with a mass of 70 kg falls 10 m. How much kinetic energy does he gain?
   a. 10 J
   b. 70 J
   c. 700 J
   d. 7000 J

30. If a 0.5-kg ball is dropped from a height of 6 m, what is its kinetic energy when it hits the
   ground?
   a. 3 J
   b. 9 J
   c. 30 J
   d. There is not enough information to say.

31. At which point in the swing of an ideal pendulum (ignoring friction) is the kinetic energy a
   maximum?
   a. at either end
   b. at the lowest point
   c. It's always the same.

32. A 1-kg ball falling freely through a distance of one meter loses 10 J of gravitational potential
   energy. How much does the kinetic energy of the ball change if this occurs in a vacuum?
   a. gain of 1 J
   b. gain of 10 J
   c. loss of 1 J
   d. loss of 10 J
33. A 3-kg mass is released at the top of a frictionless angled ramp (3 m long and 2 m high) and slides down the ramp. What is the kinetic energy of the mass when it reaches the bottom?
   a. 90 J
   b. 60 J
   c. 18 J
   d. 9 J
   e. 6 J

34. A block of wood loses 160 J of gravitational potential energy as it slides down a ramp. If it has 90 J of kinetic energy at the bottom of the ramp, we can conclude that
   a. mechanical energy is conserved.
   b. momentum is conserved.
   c. 250 J of energy was lost.
   d. 70 J of energy was transformed to another form.

35. A 0.5-kg air-hockey puck is initially at rest. What will its kinetic energy be after a net force of 0.6 N acts on it for a distance of 2 m?
   a. 0.3 J
   b. 0.6 J
   c. 1.2 J
   d. 2.4 J

36. A toy car has a kinetic energy of 12 J. What is its kinetic energy after a frictional force of 0.6 N opposing the direction of motion has acted on it for 5 m?
   a. 3 J
   b. 4 J
   c. 6 J
   d. 9 J

37. Which of the following is NOT a potential energy?
   a. elastic
   b. friction
   c. chemical
   d. nuclear

38. Which of the following is NOT a unit of energy?
   a. joule
   b. newton-meter
   c. kilowatt-hour
   d. watt

39. Which of the following is an energy unit?
   a. newton
   b. kilowatt
   c. kilogram-meter/second
   d. kilowatt-hour
40. If a 60-kg sprinter can accelerate from a standing start to a speed of 10 m/s in 2 s, what average power is generated?
   a. 600 W
   b. 1200 W
   c. 1500 W
   d. 3000 W