KINEMATICS

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

1. Speed is
   a. a measure of how fast something is moving.
   b. always measured in terms of a unit of distance divided by a unit of time.
   c. the distance covered per unit time.
   d. all of the above.
   e. none of the above.

2. One possible unit of speed is
   a. miles per hour.
   b. light years per century.
   c. kilometers per hour.
   d. all of the above.
   e. none of the above.

3. When you look at the speedometer in a moving car, you can see the car's
   a. average distance traveled.
   b. instantaneous acceleration.
   c. average speed.
   d. instantaneous speed.
   e. average acceleration.

4. Acceleration is defined as the CHANGE in
   a. time it takes to move from one place to another place.
   b. velocity of an object.
   c. distance divided by the time interval.
   d. velocity divided by the time interval.
   e. time it takes to move from one speed to another speed.

5. Suppose you are in a car that is going around a curve. The speedometer reads a constant 30 miles per hour. Which of the following is NOT true?
   a. You and the car are accelerating.
   b. Your acceleration is constantly changing.
   c. Your velocity is constant.
   d. Your direction is constantly changing.
   e. Your speed is constant.

6. A car starts from rest and after 7 seconds it is moving at 42 m/s. What is the car’s average acceleration?
   a. 0.17 m/s²
   b. 1.67 m/s²
   c. 6 m/s²
   d. 7 m/s²
   e. none of the above

7. As an object falls freely in a vacuum, its
   a. velocity increases.
   b. acceleration increases.
   c. both A and B.
   d. none of the above.
8. A ball is thrown upwards and caught when it comes back down. In the absence of air resistance, the speed of the ball when caught would be
   a. less than the speed it had when thrown upwards.
   b. more than the speed it had when thrown upwards.
   c. the same as the speed it had when thrown upwards.

9. Suppose an object is in free fall. Each second the object falls
   a. the same distance as in the second before.
   b. a larger distance than in the second before.
   c. with the same instantaneous speed.
   d. with the same average speed.
   e. none of the above

10. If you drop a feather and a coin at the same time in a tube filled with air, which will reach the bottom of the tube first?
    a. The feather
    b. Neither—they will both reach the bottom at the same time.
    c. The coin

11. A ball tossed vertically upward rises, reaches its highest point, and then falls back to its starting point. During this time the acceleration of the ball is always
    a. in the direction of motion.
    b. opposite its velocity.
    c. directed downward.
    d. directed upward.

12. When a basketball player jumps to make a shot, once the feet are off the floor, the jumper's acceleration
    a. varies with body orientation.
    b. depends on launch speed.
    c. is usually greater for taller players (but not always).
    d. depends on all the above.
    e. is $g$; no more, no less.

13. Suppose you take a trip that covers 180 km and takes 3 hours to make. Your average speed is
    a. 30 km/h.
    b. 60 km/h.
    c. 180 km/h.
    d. 360 km/h.
    e. 540 km/h.

14. A ball is thrown straight up. At the top of its path its instantaneous speed is
    a. 0 m/s.
    b. about 5 m/s.
    c. about 10 m/s.
    d. about 20 m/s.
    e. about 50 m/s.

15. A ball is thrown straight up. At the top of its path its acceleration is
    a. 0 m/s$^2$.
    b. about -5 m/s$^2$.
    c. about -10 m/s$^2$.
    d. about -20 m/s$^2$.
    e. about -50 m/s$^2$. 
16. A car accelerates at 2 m/s². Assuming the car starts from rest, how much time does it need to accelerate to a speed of 20 m/s?
   a. 2 seconds
   b. 10 seconds
   c. 20 seconds
   d. 40 seconds
   e. none of the above

17. A freely falling object starts from rest. After falling for 6 seconds, it will have a speed of about
   a. -6 m/s.
   b. -30 m/s.
   c. -60 m/s.
   d. -300 m/s.
   e. more than -300 m/s.

18. If you drop a feather and a coin at the same time in a vacuum tube, which will reach the bottom of the tube first?
   a. Neither-they will both reach the bottom at the same time.
   b. The coin
   c. The feather

19. If a projectile is fired straight up at a speed of 30 m/s, the total time to return to its starting point is about
   a. 3 seconds.
   b. 6 seconds.
   c. 30 seconds.
   d. 60 seconds.
   e. not enough information to estimate.

20. Suppose a jumper claims a hang time of 2 seconds. Then that jumper must be able to jump a vertical distance of
   a. 1 m.
   b. 2 m.
   c. 3 m.
   d. 4 m.
   e. 5 m.

21. A vector is a quantity that has
   a. magnitude and time.
   b. time and direction.
   c. magnitude and direction.

22. A scalar is a quantity that has
   a. direction.
   b. magnitude.
   c. time.
   d. color.

23. When representing velocity as a vector,
   a. the direction of the arrow shows the direction of motion.
   b. the length of the arrow represents the speed.
   c. the length of the arrow is drawn to a suitable scale.
   d. all of the above
   e. none of the above
24. In order to find the components of a vector, you should
   a. draw the vector with correct magnitude and orientation.
   b. measure the sides of the rectangle.
   c. draw a rectangle so that the vector is the diagonal.
   d. all of the above

25. In the absence of air friction, the vertical component of a projectile's velocity doesn't change as the projectile moves.
   a. Always false
   b. Always true
   c. Sometimes true

26. A ball thrown in the air will never go as far as physics ideally would predict because
   a. one can never throw the ball fast enough.
   b. gravity is acting.
   c. air friction slows the ball.
   d. ideally the ball would never land.
   e. all of the above

27. A ball is thrown straight upward at 10 m/s. Ideally (no air resistance), the ball will return to the thrower's hand with a speed of
   a. 0 m/s.
   b. 5 m/s.
   c. 10 m/s.
   d. 20 m/s.
   e. There is not enough information to say.