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

1. Identify the following quantities as scalar or vector: the speed of a snail, the time it takes to run a mile, the free-fall acceleration.
   A. vector, scalar, scalar
   B. vector, scalar, vector
   C. scalar, scalar, vector
   D. scalar, vector, vector

2. Which of the following is an example of a vector quantity?
   A. velocity        B. volume        C. temperature    D. mass

Use the following diagram to answer questions 3 & 4.

3. In the figure above, which diagram represents the vector addition \( C = A + B \)?
   A. I       B. II       C. III       D. IV

4. In the figure above, which diagram represents the vector addition \( C = A - B \)?
   B. I       B. II       C. III       D. IV

5. Two vectors, of magnitudes 20 and 50 are added. Which one of the following is a possible answer for the magnitude of the resultant?
   A. 10       B. 20       C. 40       D. 80

6. What is the resultant displacement of 1 meter south and 3 meters south?
   A. 4 m south
   B. 4 m north
   C. 2 m north
   D. 2 m south
   E. none of these

7. What is the magnitude of the resultant when adding the displacements 3.0 m east and 4.0 m north?
   A. 7.0 m       B. 5.0 m       C. 3.0 m       D. 1.4 m       E. none of these

8. What is the direction of the resultant when adding the displacements 3.0 m east and 4.0 m north?
   A. 22° N of E   B. 24° E of N  
   C. 53° N of E  
   D. 59° W of S 
   E. none of these
9. In a coordinate system, the magnitude of the \( x \)-component of a vector and \( \theta \), the angle between the vector and \( x \)-axis, are known. The magnitude of the vector equals the \( x \)-component:
   A. divided by the cosine of \( \theta \).
   B. multiplied by the cosine of \( \theta \).
   C. divided by the sine of \( \theta \).
   D. multiplied by the sine of \( \theta \).

10. In a coordinate system, a vector is oriented at angle \( \theta \) with respect to the \( x \)-axis. The \( y \)-component of the vector equals the vector’s magnitude multiplied by which trigonometric function?
   A. \( \cos \theta \)  
   B. \( \cot \theta \)  
   C. \( \sin \theta \)  
   D. \( \tan \theta \)

11. What is the magnitude of the east component of a vector 10.00 m long directed 36.9° north of east?
   A. 3.00 m  
   B. 4.00 m  
   C. 6.00 m  
   D. 8.00 m  
   E. none of these

Use the following diagram to answer questions 12-14.

12. How many displacement vectors shown in the figure above have horizontal components?
   A. 2  
   B. 3  
   C. 4  
   D. 5

13. How many displacement vectors shown in the figure above have components that lie along the \( y \)-axis and are pointed in the \(-y\) direction?
   A. 0  
   B. 2  
   C. 3  
   D. 5

14. Which displacement vectors shown in the figure above have vertical components that are equal?
   A. \( d_1 \) and \( d_2 \)  
   B. \( d_1 \) and \( d_3 \)  
   C. \( d_2 \) and \( d_5 \)  
   D. \( d_4 \) and \( d_5 \)

15. Which of the following is an accurate statement?
   A. A vector cannot have zero magnitude if one of its components is not zero.
   B. The magnitude of a vector can be less than the magnitude of one of its components.
   C. If the magnitude of vector A is less than the magnitude of vector B, then the \( x \)-component of A is less than the \( x \)-component of B.
   D. The magnitude of a vector can be positive or negative.
16. Which of the following is an example of projectile motion?
   A. a jet lifting off a runway
   B. a thrown baseball
   C. an aluminum can dropped straight down into the recycling bin
   D. a space shuttle being launched

**Use the following diagram to answer questions 17-21.**

![Diagram of a projectile motion path with labeled points A, B, C, and D.]

17. At what point of the ball’s path shown in the figure above is the vertical component of the ball’s velocity zero?
   A. A  
   B. B  
   C. C  
   D. D

18. In the figure above, the magnitude of the ball’s velocity is least at location:
   A. A  
   B. B  
   C. C  
   D. D

19. In the figure above, the magnitude of the ball’s velocity is greatest at location:
   A. A  
   B. B  
   C. C  
   D. D

20. In the figure above, the horizontal component of the ball’s velocity at A is:
   A. zero.  
   B. equal to the vertical component of the ball’s velocity at C.  
   C. equal in magnitude but opposite in direction to the horizontal component of the ball’s velocity at D.  
   D. equal to the horizontal component of its initial velocity.

21. In the figure above, at which point is the ball’s speed about equal to the speed at which it was tossed?
   A. A  
   B. B  
   C. C  
   D. D

22. As it flies through the air, what is the vertical acceleration of a ball that was launched 30° above horizontal at an initial velocity of 25 m/s?
   A. 0 m/s²  
   B. -9.81 m/s²  
   C. -12.5 m/s²  
   D. -25 m/s²  
   E. none of these

23. For a projectile launched horizontally at 75 m/s, what is the initial vertical velocity?
   A. 0 m/s  
   B. -9.81 m/s  
   C. 35 m/s  
   D. 75 m/s  
   E. none of these
24. For a projectile launched horizontally at 75 m/s, what is the initial horizontal velocity?
   A. 0 m/s
   B. -9.81 m/s
   C. 35 m/s
   D. 75 m/s
   E. none of these

25. What is the initial vertical velocity of a ball that is launched 30° above horizontal with an initial velocity of 25 m/s?
   A. 0 m/s
   B. 9.81 m/s
   C. 12.5 m/s
   D. 22 m/s
   E. none of these

26. What is the initial horizontal velocity of a ball that is launched 30° above horizontal with an initial velocity of 25 m/s?
   A. 0 m/s
   B. 9.81 m/s
   C. 12.5 m/s
   D. 22 m/s
   E. none of these

27. If a rock is dropped at the same instant that a ball at the same elevation is thrown horizontally, which object will take the longest time to hit the floor?
   A. the ball
   B. the rock
   C. They land at the same time.
   D. not enough information given

28. At what point are the vertical velocity AND the vertical acceleration of a projectile both zero?
   A. just after the launch
   B. at the top of its path
   C. the instant before hitting the ground
   D. none of these

29. Which of the following would increase the range of a projectile?
   A. increase the initial launch velocity
   B. use a launch angle of about 45°
   C. decrease air resistance
   D. raise the launcher higher above the ground
   E. all of the above

30. For a projectile launched at an upward angle, which of the following quantities has a magnitude of zero?
   A. vertical acceleration
   B. initial horizontal velocity
   C. initial vertical velocity
   D. horizontal acceleration
   E. none of these