1. A bullet is fired through a board, 14.0 cm thick, with its line of motion perpendicular to the face of the board. If it enters with a speed of 450 m/s and emerges with a speed of 220 m/s, what is the bullet’s acceleration as it passes through the board, assuming constant acceleration?
   a) -500 km/s²  
   b) -550 km/s²  
   c) -360 km/s²  
   d) -520 km/s²  
   e) -275 km/s²

2. $V_x$ is the velocity of a particle moving along the $x$ axis as shown. If $x = 2.0$ m at $t = 1.0$ s, what is the position of the particle at $t = 6.0$ s?

   a) -2.0 m  
   b) +2.0 m  
   c) +1.0 m  
   d) -1.0 m  
   e) 6.0 m

3. Which of the following is true?
   a) The velocity of a particle must be zero if the acceleration is zero.
   b) The magnitude of the velocity of a particle being accelerated must change.
   c) For a projectile, the acceleration at the top of the trajectory is the same as the acceleration just before the projectile hits the ground. (Assume no air resistance.)
   d) The instantaneous velocity of an airplane during a flight is never equal to its average velocity averaged over that flight.
   e) None of the other statements is true.

4. An empty beer mug slides horizontally off a table 0.86 m high and strikes the floor 1.4 m from the base. With what speed did the mug leave the table?
   a) 3.3 m/s  
   b) 1.9 m/s  
   c) 2.3 m/s  
   d) 5.1 m/s  
   e) 1.6 m/s

5. At time $t = 0$ a car has a velocity of 16 m/s. It slows down with an acceleration given by $-0.50$ m/s². At the end of 4.0 s it has traveled:
   a) 0 m  
   b) 12 m  
   c) 56 m  
   d) 25 m  
   e) 60 m

6. Two forces are applied to a 5.0-kg object, one is 6.0 N to the north and the other is 8.0 N to the west. The magnitude of the acceleration of the object is:
   a) 0.50 m/s²  
   b) 2.0 m/s²  
   c) 2.8 m/s²  
   d) 10 m/s²  
   e) 50 m/s²

7. A commercial jet plane such as the Boeing 747 can cruise at a speed of 575 miles/hour. Express this speed in m/s given that $1$ ft $= 0.3$ m and there are $5280$ ft in a mile.
   a) 30.6 m/s  
   b) 172 m/s  
   c) 253 m/s  
   d) 392 m/s  
   e) 2800 m/s
8. A car starts from rest and accelerates at a constant rate in a straight line. In the first second the car covers a distance of 2.0 meters. How fast will the car be moving at the end of the second second?
   a) 2.0 m/s
   b) 4.0 m/s
   c) 8.0 m/s
   d) 16 m/s
   e) 32 m/s

9. Starting from one oasis, a camel walks 25 km in direction 30° south of west to a second oasis and from there walks 30 km toward the north to a third oasis. What is the direction from the first oasis to the third oasis?
   a) 21° north of west
   b) 39° west of north
   c) 69° north of west
   d) 51° west of north
   e) 42° west of north

10. The three forces shown act on a particle. What is the magnitude of the resultant of these three forces?
    a) 27.0 N
    b) 23.8 N
    c) 33.0 N
    d) 105 N
    e) 36.0 N

11. The position of a particle moving along the x axis is given by \( x = \alpha t^2 - \beta t \), where \( x \) is in meters, \( t \) is in seconds, \( \alpha = 4 \text{ m/s}^2 \), \( \beta = 8 \text{ m/s} \). What is the position of the particle when its velocity is zero?
    a) -4 m
    b) -2 m
    c) 0 m
    d) 2 m
    e) 4 m

12. A vector \( \mathbf{A} = 4\mathbf{j} - 5\mathbf{i} \) is added to \( \mathbf{B} = 6\mathbf{i} - 8\mathbf{j} \). The magnitude of the resultant vector is
    a) 11
    b) 5.1
    c) 7.1
    d) 4.1
    e) 16.4

13. Which answer represents the sum of 7.56E-2 and 1.2E-4 to the best number of significant digits?
    a) 0.08
    b) 0.076
    c) 0.0757
    d) 0.07572
    e) 0.075720

14. The term \( \frac{1}{2} \rho \nu^2 \) occurs in Bernoulli’s equation in Chapter 15, with \( \rho \) being the density of a fluid and \( \nu \) its speed. Density is defined as \( \frac{m}{V} \), where \( m \) is the mass, and \( V \) is the volume of the fluid. The dimensions of this term are (M, L and T stand for mass, length and time)
    a) \( \text{M}^{-1}L^5T^2 \)
    b) \( \text{MLT}^2 \)
    c) \( \text{ML}^{-1}T^{-2} \)
    d) \( \text{M}^{-1}L^9T^{-2} \)
    e) \( \text{M}^{-1}L^3T^{-2} \)
15. An electron, starting from rest and moving with a constant acceleration, travels 2.0 cm in 5.0 ms. What is the magnitude of this acceleration?
   a) 2.5 km/s²
   b) 0.80 km/s²
   c) 1.6 km/s²
   d) 1.3 km/s²
   e) 3.2 km/s²

16. You hold a tennis racket vertically in your hand. On the top edge of the racket you have balanced a ball. Which statement is true?
   a) The force of your hand on the racket and the force of the ball on the racket are equal in magnitude and opposite in direction.
   b) The force of the racket on your hand and the force of the ball on the racket are equal in magnitude and opposite in direction.
   c) The force of your hand on the racket and the force of the racket on the ball are equal in magnitude and opposite in direction.
   d) The force of the racket on your hand and the force of the racket on the ball are equal in magnitude and opposite in direction.
   e) The force of your hand on the racket and the force of the racket on your hand are equal in magnitude and opposite in direction.

17. The pilot of a light airplane with an airspeed of 200 km/h wants to fly due west. There is a strong wind of 120 km/h blowing from the north. If the pilot points the nose of her airplane north of west so that her ground track is due west, what will be her ground speed?
   a) 80 km/h
   b) 120 km/h
   c) 180 km/h
   d) 160 km/h
   e) It would be impossible to fly due west in this situation.