JP's Physics 101 Test Bank 1

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

____ 1. When a ball is tossed straight up, it momentarily comes to a stop at the top of its path. Is it in equilibrium during this brief moment?
A.   No, because it is weightless.
B.   Yes, because there are no net forces acting on it.
C.   No, because its motion is changing.
D.   Yes, because it is not moving.
E.   Yes, because it has no inertia.

____ 2. A hockey puck slides across the ice at a constant speed. Is it in equilibrium?
A.   No, because friction is slowing it down.
B.   No, because it is moving.
C.   No, because it has inertia.
D.   Yes, because there are no net forces acting on it.
E.   Yes, because the ice exerts no forces on it.

____ 3. A book is at rest on top of a table. Which of the following is correct?
A.   There is no force acting on the book.
B.   The book is in equilibrium.
C.   The inertia of the book is equal to the inertia of the table.
D.   There is no force acting on the table.
E.   The book has no inertia.

____ 4. A parachutist falls toward the Earth's surface at a constant speed. How do the weight of the parachutist and the drag force on the parachute compare?
A.   There is no connection between the drag force and the weight of the parachutist.
B.   The drag force must be significantly less than the weight of the parachutist.
C.   The drag force must be significantly greater than the weight of the parachutist.
D.   This problem is impossible -- a parachutist cannot fall at a constant speed.
E.   The drag force must be equal to the weight of the parachutist.

____ 5. Having made a slight miscalculation, Tarzan the ape man hangs motionless on a vertical grapevine suspended from a tall tree in the depths of the jungle. Which of the following is correct?
A.   There is no tension in the grapevine.
B.   Tarzan is in equilibrium.
C.   Tarzan has no inertia.
D.   There are no forces acting on Tarzan.
E.   Tarzan has no weight.

____ 6. A firefighter slides down a pole at a constant speed. How do the weight of the firefighter and the force of friction between the firefighter and the pole compare?
A.   This problem is impossible -- a firefighter cannot slide at a constant speed.
B.   The frictional force must be significantly less than the weight of the firefighter.
C.   There is no connection between the frictional force and the weight of the firefighter.
D.   The frictional force must be equal to the weight of the firefighter.
E.   The frictional force must be significantly greater than the weight of the firefighter.

_____ 7. A painter weighing 750 newtons stands on a single board scaffold that is supported at each end by a vertical rope from above. If one rope has a tension of 500 newtons and the other has a tension of 350 newtons, what is the weight of the board?
A. 500 newtons
B. 250 newtons
C. 600 newtons
D. 850 newtons
E. 100 newtons

_____ 8. A painter weighing 700 newtons stands on a single board scaffold that is supported at each end by a vertical rope from above. If one rope has a tension of 550 newtons and the other has a tension of 400 newtons, what is the weight of the board?
A. 550 newtons
B. 300 newtons
C. 350 newtons
D. 150 newtons
E. 250 newtons

_____ 9. A painter weighing 800 newtons stands on a single board scaffold that is supported at each end by a vertical rope from above. If one rope has a tension of 550 newtons and the other has a tension of 450 newtons, what is the weight of the board?
A. 250 newtons
B. 100 newtons
C. 200 newtons
D. 350 newtons
E. 150 newtons

_____ 10. The property of a moving object to continue moving is what Galileo called
A. acceleration.
B. speed.
C. direction.
D. velocity.
E. inertia.

_____ 11. The tendency of objects to resist changes in their motion is called
A. inertia.
B. velocity.
C. acceleration.
D. speed.
E. direction.

_____ 12. An automobile with relatively little inertia should
A. get fairly good gas mileage.
B. be difficult to brake to a stop.
C. have room for lots of passengers.
D. be painted a light color, such as white.
E. need a big engine.

_____ 13. Which of the following has the least amount of inertia?
A. a helicopter
B. the wings of a hummingbird
C. your little finger
D. a bowling ball
E. the feet of an elephant

____ 14. In the absence of an external net force, an object at rest remains at rest, and a body in motion moves in a straight line at constant speed. This is a statement of
   A. Newton's Fourth Law of Motion.
   B. Newton's Third Law of Motion.
   C. Newton's First Law of Motion.
   D. Newton's Law of Gravity
   E. Newton's Second Law of Motion.

____ 15. A hockey puck sliding across the ice toward the goal is a good illustration of
   A. Newton's Second Law of Motion.
   B. Newton's First Law of Motion.
   C. Newton's Fourth Law of Motion.
   D. Newton's Law of Gravity
   E. Newton's Third Law of Motion.

____ 16. According to Newton's First Law of Motion,
   A. an object in motion moves in a straight line unless acted upon by a net force.
   B. an object at rest eventually begins to move.
   C. an object in motion moves in a parabolic trajectory unless acted upon by a net force.
   D. an object in motion eventually comes to a halt.
   E. an object at rest always remains at rest.

____ 17. According to Newton's First Law of Motion,
   A. an object at rest remains at rest unless acted upon by a net force.
   B. an object in motion moves in a parabolic trajectory unless acted upon by a net force.
   C. an object at rest always remains at rest.
   D. an object at rest eventually begins to move.
   E. an object in motion eventually comes to a halt.

____ 18. ____ is the rate of change of velocity due to a change in ____ .
   A. Direction; acceleration and/or speed
   B. Speed; direction and/or acceleration
   C. Time; the speed of light
   D. Mass; inertia
   E. Acceleration; speed and/or direction

____ 19. Acceleration is the rate of change of ____ due to a change in ____ .
   A. direction; velocity and/or speed
   B. time; the speed of light
   C. speed; direction and/or velocity
   D. velocity; speed and/or direction
   E. mass; inertia

____ 20. Which of the following best expresses the relation between velocity and acceleration?
   A. An object with zero acceleration must have zero velocity.
   B. An object with zero acceleration must have non-zero velocity.
   C. The instantaneous acceleration and velocity of an object are independent of each other.
   D. An object with non-zero acceleration must have zero velocity.
   E. An object with non-zero acceleration must have non-zero velocity.

____ 21. If the acceleration of a car is directed toward the east, the velocity of the car
      A. cannot be directed toward the north or the south.
      B. must be directed toward the east.
      C. may have any direction.
      D. must be zero.
      E. must be directed toward the west.

____ 22. If an object is moving, then the magnitude of its ____ cannot be zero.
      A. speed
      B. velocity
      C. acceleration
      D. A and B
      E. A, B, and C

____ 23. ____ is the rate of change of ____ due to a change in speed and/or direction.
      A. Velocity; inertia
      B. Velocity; acceleration
      C. Mass; inertia
      D. Inertia; mass
      E. Acceleration; velocity

In each case shown, a ball is released from rest and then rolls down the slope.
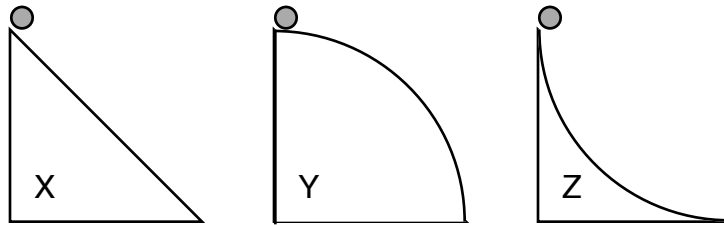
____ 24. In which case(s) does the ball roll with a constant acceleration?
      A. None of these.
      B. X, Y and Z
      C. Z
      D. X
      E. Y

____ 25. In which case(s) does the ball roll with a constant speed?
      A. X, Y and Z
      B. Y
      C. X
      D. Z
      E. None of these.

____ 26. In which case(s) does the downward acceleration of the ball increase with time?
      A. Z
      B. X, Y and Z
      C. None of these.
      D. X
      E. Y

____ 27. In which case(s) does the downward acceleration of the ball decrease with time?
  A. X
  B. X, Y and Z
  C. Z
  D. None of these.
  E. Y

____ 28. In which case(s) does the speed of the ball increase with time?
  A. Y
  B. X, Y and Z
  C. X
  D. None of these.
  E. Z

____ 29. In which case(s) does the speed of the ball decrease with time?
  A. X, Y and Z
  B. X
  C. None of these.
  D. Y
  E. Z

____ 30. In which case does the ball reach the bottom in the shortest time?
  A. Y
  B. X
  C. Z
  D. both Y and Z
  E. all three require the same time

____ 31. In which case does the ball require the longest time to reach the bottom?
  A. Y
  B. all three require the same time
  C. X
  D. both Y and Z
  E. Z

____ 32. A car traveling on a circular track at 50 km/hr
  A. is accelerating but has a constant speed.
  B. has a changing speed but a constant velocity.
  C. has a constant velocity but no acceleration.
  D. is accelerating but has a constant velocity.
  E. has a constant speed but no acceleration.

____ 33. When a car is accelerating, it must be
  A. changing its speed.
  B. changing its color.
  C. changing its speed or its direction.
  D. changing its position.
  E. changing its direction.

____ 34. When a car is accelerating, it must be
   A. changing its direction.
   B. changing its position.
   C. changing its shape.
   D. changing its velocity.
   E. changing its speed.

____ 35. A car on a straight track went from 0 to 60 mi/hr in 10 seconds. Its ____ was 6 mi/hr per second.
   A. acceleration
   B. instantaneous velocity
   C. free fall velocity
   D. velocity
   E. average speed

____ 36. A car travels for 10 seconds on a straight track at a constant speed of 40 m/s. What is its acceleration during this period?
   A. 40 m/s
   B. 10 m/s^2
   C. 0 m/s^2
   D. 40 m/s^2
   E. 4 m/s^2

____ 37. A car on a straight track is traveling at 20 m/s. If the car accelerates for 3 seconds at 5 m/s^2, what will be the car's speed at the end of the acceleration?
   A. 15 m/s
   B. 65 m/s
   C. 35 m/s
   D. 28 m/s
   E. 25 m/s

____ 38. A car on a straight track is traveling at 15 m/s. If the car accelerates for 2 seconds at 5 m/s^2, what will be the car's speed at the end of the acceleration?
   A. 25 m/s
   B. 150 m/s
   C. 40 m/s
   D. 35 m/s
   E. 10 m/s

____ 39. A car on a straight track is traveling at 15 m/s. After the car decelerates for 2 seconds at 5 m/s^2, what will be the car's new speed?
   A. 5 m/s
   B. 10 m/s
   C. 0 m/s
   D. 7 m/s
   E. 8 m/s

____ 40. A car on a straight track is traveling at 25 m/s. If the car accelerates for 3 seconds at 5 m/s^2, what will be the car's speed at the end of the acceleration?
   A. 10 m/s
   B. 5 m/s
   C. 17 m/s
   D. 0 m/s
   E. 15 m/s

____ 41. A car initially at rest accelerates in a straight line at 3 m/s^2. What will be its speed after 4 seconds?
  A.   12 m/s
  B.   3 m/s
  C.   4 m/s
  D.   0 m/s
  E.   7 m/s

____ 42. A car initially at rest accelerates in a straight line at 3 m/s^2. What will be its speed after 2 seconds?
  A.   2 m/s
  B.   6 m/s
  C.   0 m/s
  D.   5 m/s
  E.   3 m/s

____ 43. If a bowling ball is dropped from a height of 10 meters above the ground, it will
  A.   fall downward at a constant speed until it hits the ground.
  B.   rise slowly upwards at a constant speed until it hits the moon.
  C.   fall downward at a constant velocity until it hits the ground.
  D.   fall downward at an ever-decreasing speed until it hits the ground.
  E.   fall downward at an ever-increasing speed until it hits the ground.

____ 44. A body in free fall in a vacuum
  A.   will have the same average speed during each second of its fall.
  B.   will not be accelerated during its fall.
  C.   will have the same acceleration during each second of its fall.
  D.   will drop the same distance during each second of its fall.
  E.   will have a constant velocity during each second of its fall.

____ 45. While experimenting with different bodies in free fall, Galileo found that when air resistance is small enough to be neglected,
  A.   large bodies accelerate more rapidly than small bodies.
  B.   all bodies accelerate at the same rate.
  C.   light bodies accelerate more rapidly than heavy bodies.
  D.   heavy bodies accelerate more rapidly than light bodies.
  E.   small bodies accelerate more rapidly than large bodies.

____ 46. A baseball is thrown straight up with a speed of 30 m/s. What is its acceleration immediately after its release?
  A.   zero
  B.   10 m/s^2 downward
  C.   15 m/s upward
  D.   30 m/s^2 downward
  E.   30 m/s upward

____ 47. A baseball is thrown straight up with a speed of 40 m/s. What is its acceleration one second after its release?
  A.   30 m/s upward
  B.   zero
  C.   20 m/s^2 downward
  D.   10 m/s^2 downward
  E.   20 m/s upward

_____ 48. A baseball is thrown straight up with a speed of 20 m/s. What is its acceleration two seconds after its release?
A. 10 m/s upward
B. 10 m/s^2 downward
C. zero
D. 20 m/s upward
E. 20 m/s^2 downward

_____ 49. A baseball is thrown straight up at a speed of 30 m/s, then caught by the same player when it comes back down. What is the speed of the baseball the instant before it is caught?
A. 60 m/s
B. 0
C. 30 m/s
D. 15 m/s
E. 90 m/s

_____ 50. A bowling ball at a height of 20 meters above the ground is falling vertically at a rate of 10 meters per second. Which of these best describes its fate?
A. It will hit the ground in more than two seconds at a speed less than 10 m/s.
B. It will hit the ground in less than two seconds at a speed greater than 10 m/s.
C. It will hit the ground in exactly two seconds at a speed of 10 m/s.
D. It will hit the ground in more than two seconds at a speed greater than 10 m/s.
E. It will hit the ground in less than two seconds at a speed less than 10 m/s.

_____ 51. A bowling ball at a height of 36 meters above the ground is falling vertically at a rate of 12 meters per second. Which of these best describes its fate?
A. It will hit the ground in more than three seconds at a speed greater than 12 m/s.
B. It will hit the ground in less than three seconds at a speed less than 12 m/s.
C. It will hit the ground in exactly three seconds at a speed of 12 m/s.
D. It will hit the ground in more than three seconds at a speed less than 12 m/s.
E. It will hit the ground in less than three seconds at a speed greater than 12 m/s.

_____ 52. A bowling ball is dropped from rest from a height of 50 meters. One second after its release, the speed of the ball will be _____ (neglecting air resistance).
A. 10 m/s
B. 100 m/s
C. 5 m/s
D. 20 m/s
E. 0 m/s

_____ 53. During the first second after being released from rest, a free-falling ball will drop a distance of
A. 5 meters.
B. 0.5 meter.
C. 15 meters.
D. 10 meters.
E. 1 meter.

____ 54. A person standing at the edge of a cliff 30 m high throws one baseball upwards at 20 m/s and then another baseball downwards at 20 m/s such that both baseballs land at the base of the cliff at exactly the same time. How will the speeds of the two balls compare at the moment of impact (assuming air resistance is negligible)?
A.   Both balls will have essentially the same speed.
B.   The 'upward' ball will be moving faster because it fell from a greater height.
C.   The 'downward' ball will be moving faster because did not have to change directions.
D.   The 'upward' ball will be moving faster because it had a longer time to accelerate.
E.   The 'downward' ball will be moving faster because it traveled a shorter distance.

____ 55. A bowling ball is dropped from rest from a height of 60 meters. Two seconds after its release, the speed of the ball will be ____ (neglecting air resistance).
A.   10 m/s
B.   0 m/s
C.   40 m/s
D.   5 m/s
E.   20 m/s

____ 56. A train traveled a distance of 90 kilometers in 2 hours. It would be most correct to say that its ____ was 45 km/hr.
A.   average speed
B.   acceleration
C.   velocity
D.   free fall velocity
E.   instantaneous speed

____ 57. A car on a straight track accelerated uniformly from 0 to 60 mi/hr in 10 seconds. Its ____ was 30 mi/hr.
A.   instantaneous velocity
B.   velocity
C.   free fall velocity
D.   acceleration
E.   average speed

____ 58. A car on a straight track accelerated uniformly from 0 to 50 mi/hr in 20 seconds. Its ____ was 25 mi/hr.
A.   acceleration
B.   free fall velocity
C.   instantaneous velocity
D.   average speed
E.   velocity

____ 59. The speedometer in your car tells you the ____ of your car.
A.   average speed
B.   inertia
C.   acceleration
D.   velocity
E.   instantaneous speed

____ 60. The cruise control on an automobile is designed to maintain the moving vehicle at a nearly constant
A.   inertia.
B.   acceleration.
C.   direction.
D.   speed.
E.   velocity.

____ 61. A train traveled a distance of 100 kilometers in 2 hours. Its average speed was ____ km/hr.
   A.   200
   B.   75
   C.   100
   D.   2
   E.   50

____ 62. A train traveled a distance of 180 kilometers in 5 hours. Its average speed was ____ km/hr.
   A.   36
   B.   60
   C.   30
   D.   45
   E.   90

____ 63. An airplane flew in a straight line for 2 hours at an average speed of 300 km/hr. It traveled a distance of ____ km.
   A.   300
   B.   600
   C.   150
   D.   500
   E.   400

____ 64. An airplane flew in a straight line for 2 hours and traveled a distance of 500 kilometers; its average speed was ____ km/hr.
   A.   500
   B.   250
   C.   1000
   D.   750
   E.   100

____ 65. To report the velocity of an object, we must specify both its ____ and its ____ .
   A.   mass; length
   B.   direction; mass
   C.   speed; direction
   D.   length; acceleration
   E.   acceleration; speed

____ 66. To report the velocity of an object, we must specify both its speed and its ____ .
   A.   mass
   B.   position
   C.   acceleration
   D.   length
   E.   direction

____ 67. To report the velocity of an object, we must specify both its ____ and its direction.
   A.   acceleration
   B.   length
   C.   mass
   D.   speed
   E.   position

_____ 68. To report the _____ of an object, we must specify both its speed and its direction .
   A. acceleration
   B. position
   C. mass
   D. velocity
   E. length

_____ 69. Assuming level ground and no air resistance, a projectile fired at an angle of 30° will have the same range as another projectile fired with the same speed at an angle of _____ .
   A. 45°
   B. 60°
   C. 90°
   D. 15°
   E. none of these -- each different projection angle produces a different range

_____ 70. Assuming level ground and no air resistance, a projectile fired at an angle of 40° will have the same range as another projectile fired with the same speed at an angle of _____ .
   A. 50°
   B. 20°
   C. 80°
   D. 60°
   E. none of these -- each different projection angle produces a different range

_____ 71. Assuming level ground and no air resistance, a projectile fired at an angle of 55° will have the same range as another projectile fired with the same speed at an angle of _____ .
   A. 45°
   B. 15°
   C. 25°
   D. 35°
   E. none of these -- each different projection angle produces a different range

_____ 72. Assuming level ground and no air resistance, a projectile fired at an angle of 25° will have the same range as another projectile fired with the same speed at an angle of _____ .
   A. 65°
   B. 45°
   C. 55°
   D. 75°
   E. none of these -- each different projection angle produces a different range

_____ 73. Assuming level ground and no air resistance, a projectile fired at an angle of 80° will have the same range as another projectile fired with the same speed at an angle of _____ .
   A. 10°
   B. 60°
   C. 20°
   D. 30°
   E. none of these -- each different projection angle produces a different range

____ 74. Projectile 'A' is fired at an angle of 50° above the horizontal; projectile 'B' is fired with the same speed at an angle of 40° above the horizontal. Assuming level ground and negligible air resistance, which of the following is true?
A.   'A' will reach the same height and have a shorter range than 'B'.
B.   'A' will reach a greater height and have a greater range than 'B'.
C.   'A' will reach a greater height and have a shorter range than 'B'.
D.   'A' will reach a greater height and have the same range as 'B'.
E.   'A' will reach the same height and have the same range as 'B'.

____ 75. Projectile 'A' is fired at an angle of 70° above the horizontal; projectile 'B' is fired with the same speed at an angle of 20° above the horizontal. Assuming level ground and negligible air resistance, which of the following is true?
A.   'A' will reach a greater height and have the same range as 'B'.
B.   'A' will reach the same height and have a shorter range than 'B'.
C.   'A' will reach a greater height and have a greater range than 'B'.
D.   'A' will reach the same height and have the same range as 'B'.
E.   'A' will reach a greater height and have a shorter range than 'B'.

____ 76. Projectile 'A' is fired at an angle of 70° above the horizontal; projectile 'B' is fired with the same speed at an angle of 30° above the horizontal. Assuming level ground and negligible air resistance, which of the following is true?
A.   'A' will reach a greater height and have a greater range than 'B'.
B.   'A' will reach a greater height and have the same range as 'B'.
C.   'A' will reach the same height and have a shorter range than 'B'.
D.   'A' will reach the same height and have the same range as 'B'.
E.   'A' will reach a greater height and have a shorter range than 'B'.

____ 77. Projectile 'A' is fired at an angle of 60° above the horizontal; projectile 'B' is fired with the same speed at an angle of 20° above the horizontal. Assuming level ground and negligible air resistance, which of the following is true?
A.   'A' will reach the same height and have the same range as 'B'.
B.   'A' will reach a greater height and have the same range as 'B'.
C.   'A' will reach a greater height and have a greater range than 'B'.
D.   'A' will reach the same height and have a shorter range than 'B'.
E.   'A' will reach a greater height and have a shorter range than 'B'.

____ 78. Assuming level ground and no air resistance, the maximum range of a projectile will be obtained by firing it at an angle of ____ .
A.   55°
B.   75°
C.   45°
D.   65°
E.   85°

____ 79. In general, the maximum range of a projectile for a given initial speed is obtained with a projection angle of ___ above the horizon (neglecting air resistance).
A.   30°
B.   75°
C.   90°
D.   45°
E.   60°

_____ 80. In the absence of air resistance, the magnitude of the horizontal component of a projectile's velocity
   A. is constant until the projectile hits the ground.
   B. increases with time until the projectile hits the ground.
   C. decreases with time until the projectile hits the ground.
   D. is equal to the magnitude of the vertical component of the projectile's velocity.
   E. is equal to one half of the magnitude of the vertical component of the projectile's
       velocity.

_____ 81. In the absence of air resistance, the magnitude of the vertical component of a projectile's velocity
   A. is constant until the projectile hits the ground.
   B. always increases with time until the projectile hits the ground.
   C. always decreases with time until the projectile hits the ground.
   D. increases and/or decreases with time, due to the acceleration of gravity.
   E. is equal to the magnitude of the horizontal component of the projectile's velocity.

_____ 82. A ball is thrown at 30 m/s at an angle of 60° above the horizontal. Which of the following statements about
       the ball's motion is true (assuming no air resistance)?
   A. The magnitude of the velocity is constant until the ball strikes the ground.
   B. The horizontal component of the velocity is constant until the ball strikes the ground.
   C. The vertical component of the velocity is constant until the ball strikes the ground.
   D. The distance traveled by the ball each second is constant until the ball strikes the
       ground.
   E. Both the horizontal and vertical components of the velocity will constantly change, due
       to gravity.

_____ 83. When air resistance does not affect the motion of a projectile,
   A. the horizontal and vertical components of its velocity will both change at the same rate.
   B. the horizontal and vertical components of its velocity will both change, but at different
       rates.
   C. the vertical component of its velocity will change while the horizontal component
       remains constant.
   D. the horizontal component of its velocity will change while the vertical component
       remains constant.
   E. the horizontal and vertical components of its velocity will remain constant.

_____ 84. In the absence of air resistance, the magnitude of the vertical component of a projectile's acceleration
   A. always decreases with time until the projectile hits the ground.
   B. increases and/or decreases with time, depending on the projectile's velocity.
   C. is equal to the magnitude of the horizontal component of the projectile's acceleration.
   D. always increases with time until the projectile hits the ground.
   E. is constant until the projectile hits the ground.

_____ 85. In the absence of air resistance, the magnitude of the horizontal component of a projectile's acceleration
   A. is equal to the magnitude of the vertical component of the projectile's acceleration.
   B. increases with time until the projectile hits the ground.
   C. is equal to one half of the magnitude of the vertical component of the projectile's
       acceleration.
   D. is constant until the projectile hits the ground.
   E. decreases with time until the projectile hits the ground.

_____ 86. A ball is thrown horizontally off the top of a high cliff. In the absence of air resistance, the vertical distance the ball travels in the first second
A.   depends on the size of the ball – the bigger the ball, the greater the distance.
B.   depends on the speed at which it was thrown – the higher the speed, the greater the distance.
C.   is always the same – about five meters.
D.   depends on the size of the ball – the smaller the ball, the greater the distance.
E.   depends on the speed at which it was thrown – the lower the speed, the greater the distance.

_____ 87. A ball is thrown horizontally off the top of a high cliff. In the absence of air resistance, the horizontal distance the ball travels in the first second
A.   is always the same – about five meters.
B.   depends on the size of the ball – the bigger the ball, the greater the distance.
C.   depends on the speed at which it was thrown – the lower the speed, the greater the distance.
D.   depends on the size of the ball – the smaller the ball, the greater the distance.
E.   depends on the speed at which it was thrown – the higher the speed, the greater the distance.

_____ 88. A ball is thrown horizontally with a speed of 25 m/s from the top of a tower 20 meters high. Assuming level ground below and negligible air resistance, what will be the magnitude of the horizontal velocity component when the ball hits the ground?
A.   5 m/s
B.   35 m/s
C.   15 m/s
D.   50 m/s
E.   25 m/s

_____ 89. A ball is thrown horizontally with a speed of 15 m/s from the top of a tower 20 meters high. Assuming level ground below and negligible air resistance, what will be the magnitude of the horizontal velocity component when the ball hits the ground?
A.   5 m/s
B.   35 m/s
C.   25 m/s
D.   50 m/s
E.   15 m/s

_____ 90. A ball is thrown horizontally with a speed of 35 m/s from the top of a tower 20 meters high. Assuming level ground below and negligible air resistance, what will be the magnitude of the horizontal velocity component when the ball hits the ground?
A.   15 m/s
B.   35 m/s
C.   25 m/s
D.   5 m/s
E.   50 m/s

____ 91. A ball is thrown such that the vertical component of its motion is 30 m/s upwards and the horizontal component of its motion is 20 m/s to the north. How long will it be before the ball reaches its maximum height (neglecting air resistance)?
   A. about 1.5 seconds
   B. about 5 seconds
   C. about 2 seconds
   D. about 3 seconds
   E. about 10 seconds

____ 92. A ball is thrown such that the vertical component of its motion is 30 m/s upwards and the horizontal component of its motion is 20 m/s to the north. How long will it be before the ball hits the ground (assuming a level surface and neglecting air resistance)?
   A. about 6 seconds
   B. about 3 seconds
   C. about 4 seconds
   D. about 8 seconds
   E. about 10 seconds

____ 93. A ball is thrown horizontally with a speed of 25 m/s from the top of a tower 20 meters high. Assuming level ground below and negligible air resistance, how much time will elapse before the ball hits the ground?
   A. about 1 second
   B. about 3 seconds
   C. about 4 seconds
   D. about 5 seconds
   E. about 2 seconds

____ 94. A ball is thrown horizontally with a speed of 25 m/s from the top of a tower 20 meters high. Assuming level ground below and negligible air resistance, how far from the tower will the ball hit the ground?
   A. 20 meters
   B. 40 meters
   C. 30 meters
   D. 25 meters
   E. 50 meters

____ 95. A ball is thrown horizontally with a speed of 25 m/s from the top of a tower 20 meters high. Assuming level ground below and negligible air resistance, what will be the magnitude of the vertical velocity component when the ball hits the ground?
   A. 50 m/s
   B. 25 m/s
   C. 10 m/s
   D. 15 m/s
   E. 20 m/s

____ 96. Which of these is the best description of the trajectory of a projectile shot at an angle of 60° above the horizontal (neglecting air resistance)?
   A. The projectile will gradually arc downward, following the curve of a circle.
   B. The projectile will move upwards at a 60° angle in a straight line at a gradually increasing speed until it stops and then falls straight down.
   C. The projectile will move upwards at a 60° angle in a straight line at a gradually diminishing speed until it stops and then falls straight down.
   D. The projectile will gradually arc downward, following the curve of a parabola.
   E. The projectile will move upwards at a 60° angle in a straight line at a constant speed until it stops and then falls straight down.

____ 97. Which of these is the best description of the trajectory of a projectile shot at an angle of 30° above the horizontal (neglecting air resistance)?
   A. The projectile will move upwards at a 30° angle in a straight line at a gradually diminishing speed until it stops and then falls straight down.
   B. The projectile will gradually arc downward, following the curve of a parabola.
   C. The projectile will gradually arc downward, following the curve of a circle.
   D. The projectile will move upwards at a 30° angle in a straight line at a gradually increasing speed until it stops and then falls straight down.
   E. The projectile will move upwards at a 30° angle in a straight line at a constant speed until it stops and then falls straight down.

____ 98. Which of these is the best description of the trajectory of a projectile shot at an angle of 45° above the horizontal (neglecting air resistance)?
   A. The projectile will gradually arc downward, following the curve of a parabola.
   B. The projectile will gradually arc downward, following the curve of a circle.
   C. The projectile will move upwards at a 45° angle in a straight line at a constant speed until it stops and then falls straight down.
   D. The projectile will move upwards at a 45° angle in a straight line at a gradually increasing speed until it stops and then falls straight down.
   E. The projectile will move upwards at a 45° angle in a straight line at a gradually diminishing speed until it stops and then falls straight down.

____ 99. Which of these is the best description of the trajectory of a projectile shot horizontally off a high cliff (neglecting air resistance)?
   A. The projectile will move outwards in a straight line at a gradually diminishing speed until it stops and then falls straight down.
   B. The projectile will move outwards in a straight line at a gradually increasing speed until it stops and then falls straight down.
   C. The projectile will gradually arc downward, following the curve of a parabola.
   D. The projectile will move outwards in a straight line at a constant speed until it stops and then falls straight down.
   E. The projectile will gradually arc downward, following the curve of a circle.

____ 100. Which of these is the best description of the trajectory of a projectile shot from the top of a high cliff at an angle of 30° below the horizontal (neglecting air resistance)?
   A. The projectile will gradually arc downward, following the curve of a circle.
   B. The projectile will move downwards at a 30° angle in a straight line at a gradually diminishing speed until it hits the ground.
   C. The projectile will move downwards at a 30° angle in a straight line at a constant speed until it hits the ground.
   D. The projectile will move downwards at a 30° angle in a straight line at a gradually increasing speed until it hits the ground.
   E. The projectile will gradually arc downward, following the curve of a parabola.

____101. Which of these is the best description of the trajectory of a projectile shot from the top of a high cliff at an angle of 60° below the horizontal (neglecting air resistance)?
  A. The projectile will gradually arc downward, following the curve of a parabola.
  B. The projectile will gradually arc downward, following the curve of a circle.
  C. The projectile will move downwards at a 60° angle in a straight line at a gradually increasing speed until it hits the ground.
  D. The projectile will move downwards at a 60° angle in a straight line at a constant speed until it hits the ground.
  E. The projectile will move downwards at a 60° angle in a straight line at a gradually diminishing speed until it hits the ground.

____102. Which of these is the best description of the trajectory of a projectile shot from the top of a high cliff at an angle of 10° below the horizontal (neglecting air resistance)?
  A. The projectile will move downwards at a 10° angle in a straight line at a constant speed until it hits the ground.
  B. The projectile will move downwards at a 10° angle in a straight line at a gradually diminishing speed until it hits the ground.
  C. The projectile will gradually arc downward, following the curve of a parabola.
  D. The projectile will move downwards at a 10° angle in a straight line at a gradually increasing speed until it hits the ground.
  E. The projectile will gradually arc downward, following the curve of a circle.

____103. The unit of force is the newton, which is equal to
  A. a $kg\text{-}m^2/s^2$.
  B. a kg/s.
  C. a $kg\text{-}m/s^2$.
  D. a kg-m/s.
  E. a kg-m.

____104. ____ is generally described as a push or a pull.
  A. Inertia
  B. Velocity
  C. Acceleration
  D. Mass
  E. Force

____105. The frictional force acting on a moving body
  A. acts opposite the acceleration of the body.
  B. acts against the motion of the body.
  C. acts at a right angle to the acceleration of the body.
  D. acts in the same direction as the acceleration of the body.
  E. acts at a right angle to the velocity of the body.

____106. A force is required to slide a book across the table at a constant speed because
  A. the natural state of a book is at rest.
  B. all objects require forces to keep them moving.
  C. air resistance opposes the book's motion.
  D. friction opposes the book's motion.
  E. gravity opposes the book's motion.

____107. A firefighter with a mass of 70 kg slides down a vertical pole, accelerating at 3 m/s². The force of friction that acts on the firefighter is
A. 700 N.
B. 0 N.
C. 210 N.
D. 490 N.
E. 70 N.

____108. A firefighter with a mass of 70 kg slides down a vertical pole, accelerating at 3 m/s². The net force that acts on the firefighter is
A. 210 N.
B. 490 N.
C. 70 N.
D. 700 N.
E. 0 N.

____109. A firefighter with a mass of 70 kg slides down a vertical pole, accelerating at 4 m/s². The force of friction that acts on the firefighter is
A. 700 N.
B. 420 N.
C. 0 N.
D. 70 N.
E. 280 N.

____110. A firefighter with a mass of 70 kg slides down a vertical pole, accelerating at 4 m/s². The net force that acts on the firefighter is
A. 700 N.
B. 420 N.
C. 0 N.
D. 70 N.
E. 280 N.

____111. A firefighter with a mass of 70 kg slides down a vertical pole, accelerating at 2 m/s². The force of friction that acts on the firefighter is
A. 70 N.
B. 700 N.
C. 140 N.
D. 0 N.
E. 560 N.

____112. A firefighter with a mass of 70 kg slides down a vertical pole, accelerating at 2 m/s². The net force that acts on the firefighter is
A. 700 N.
B. 140 N.
C. 560 N.
D. 70 N.
E. 0 N.

____113. ____ is a measure of the inertia of a material object.
A. Force
B. Mass
C. Acceleration
D. Velocity
E. Speed

____114. The _____ of an object on the Earth's surface are directly proportional to each other.
  A. force and velocity
  B. mass and weight
  C. speed and velocity
  D. weight and acceleration
  E. acceleration and mass

____115. The ____ of a book resting on a table is equal to the force of gravity acting on the book.
  A. mass
  B. acceleration
  C. inertia
  D. weight
  E. volume

____116. The kilogram is a measure of ____ while the newton is a measure of ____ .
  A. force; mass
  B. weight; mass
  C. mass; volume
  D. volume; force
  E. mass; force

____117. The newton is a measure of ____ while the kilogram is a measure of ____ .
  A. force; mass
  B. mass; force
  C. volume; force
  D. mass; volume
  E. force; weight

____118. The ____ is a measure of mass while the ____ is a measure of force.
  A. meter; newton
  B. kilogram; newton
  C. kilogram; meter
  D. newton; kilogram
  E. newton; meter

____119. The ____ is a measure of force while the ____ is a measure of mass.
  A. newton; kilogram
  B. meter; newton
  C. kilogram; meter
  D. newton; meter
  E. kilogram; newton

____120. Mass and ____ measure essentially the same property of a body, while ____ measures something slightly different.
  A. force; inertia
  B. weight; inertia
  C. velocity; acceleration
  D. inertia; weight
  E. acceleration; velocity

____121. Inertia and ____ measure essentially the same property of a body, while ____ measures something slightly different.
  A.   acceleration; velocity
  B.   mass; weight
  C.   velocity; acceleration
  D.   force; mass
  E.   weight; mass

____122. Weight is best described as a type of ____ .
  A.   velocity
  B.   mass
  C.   inertia
  D.   force
  E.   acceleration

____123. The Moon's gravity is 1/6 of the Earth's gravity. The weight of a bowling ball on the Moon would be ____ its weight on the Earth.
  A.   6 times
  B.   equal to
  C.   1/36 of
  D.   36 times
  E.   1/6 of

____124. The Moon's gravity is 1/6 of the Earth's gravity. The weight of a bowling ball on the Earth would be ____ its weight on the Moon.
  A.   equal to
  B.   6 times
  C.   1/36 of
  D.   36 times
  E.   1/6 of

____125. The Moon's gravity is 1/6 of the Earth's gravity. The mass of a bowling ball on the Earth would be ____ its mass on the Moon.
  A.   1/6 of
  B.   1/36 of
  C.   6 times
  D.   36 times
  E.   equal to

____126. The Moon's gravity is 1/6 of the Earth's gravity. The mass of a bowling ball on the Moon would be ____ its mass on the Earth.
  A.   6 times
  B.   1/6 of
  C.   equal to
  D.   36 times
  E.   1/36 of

____127. If a net force acts on an object, the object will be accelerated in the direction of the force, with the magnitude of the acceleration proportional to the force and inversely proportional to the object's mass. This is a statement of
   A.   Newton's Second Law of Motion.
   B.   Newton's Fourth Law of Motion.
   C.   Newton's Law of Gravity
   D.   Newton's Third Law of Motion.
   E.   Newton's First Law of Motion.

____128. Newton's Second Law of Motion says that the ____ of a body is directly proportional to the ____ and inversely proportional to the ____ of the body.
   A.   mass; acceleration of the body; weight
   B.   acceleration; mass of the body; weight
   C.   acceleration; net force on the body; mass
   D.   net force; acceleration of the body; mass
   E.   net force; mass of the body; acceleration

____129. The acceleration of an object is equal to
   A.   the net force on the object divided by the weight of the object.
   B.   the net force on the object divided by the mass of the object.
   C.   the mass of the object divided by the weight of the object.
   D.   the net force on the object multiplied by the mass of the object.
   E.   the net force on the object multiplied by the weight of the object.

____130. When a certain net force is applied to one brick on a frictionless surface, it accelerates at 6 m/s^2. When the same net force is applied to two bricks that are cemented together,
   A.   they accelerate at 12 m/s^2.
   B.   they accelerate at 6 m/s^2.
   C.   they accelerate at 2 m/s^2.
   D.   they do not accelerate at all.
   E.   they accelerate at 3 m/s^2.

____131. When a certain net force is applied to one brick on a frictionless surface, it accelerates at 6 m/s^2. When the same net force is applied to three bricks that are cemented together,
   A.   they accelerate at 3 m/s^2.
   B.   they accelerate at 2 m/s^2.
   C.   they do not accelerate at all.
   D.   they accelerate at 18 m/s^2.
   E.   they accelerate at 6 m/s^2.

____132. When a certain net force is applied to one brick on a frictionless surface, it accelerates at 6 m/s^2. When twice as much net force is applied to two bricks that are cemented together,
   A.   they do not accelerate at all.
   B.   they accelerate at 12 m/s^2.
   C.   they accelerate at 6 m/s^2.
   D.   they accelerate at 2 m/s^2.
   E.   they accelerate at 3 m/s^2.

____133. When a horizontal net force is applied to one brick on a frictionless surface, it accelerates at 6 m/s^2. When the magnitude of this horizontal net force is doubled, the brick
   A.   accelerates at 6 m/s^2.
   B.   accelerates at 12 m/s^2.
   C.   does not accelerate at all.
   D.   accelerates at 3 m/s^2.
   E.   accelerates at 2 m/s^2.

____134. When a horizontal force is applied to one brick on a frictionless surface, it accelerates at 6 m/s^2. When an additional force – equal in magnitude and opposite in direction to the first – is also applied to this brick, it
   A.   accelerates at 3 m/s^2.
   B.   accelerates at 12 m/s^2.
   C.   does not accelerate at all.
   D.   accelerates at 6 m/s^2.
   E.   accelerates at 2 m/s^2.

____135. A net force of 6 N will accelerate a 2 kg mass at a rate of ___ .
   A.   8 m/s^2
   B.   12 m/s^2
   C.   3 m/s^2
   D.   6 m/s^2
   E.   2 m/s^2

____136. A net force of 6 N will accelerate a 3 kg mass at a rate of ___ .
   A.   2 m/s^2
   B.   9 m/s^2
   C.   18 m/s^2
   D.   3 m/s^2
   E.   6 m/s^2

____137. The same net force that accelerates a 6 kg mass at 2 m/s^2 would accelerate a 3 kg mass at ____ .
   A.   6 m/s^2
   B.   5 m/s^2
   C.   2 m/s^2
   D.   4 m/s^2
   E.   3 m/s^2

____138. The same net force that accelerates a 6 kg mass at 2 m/s^2 would accelerate a 4 kg mass at ____ .
   A.   3 m/s^2
   B.   6 m/s^2
   C.   4 m/s^2
   D.   2 m/s^2
   E.   5 m/s^2

____139. To accelerate a 6 kg mass at 2 m/s^2 requires a net force of ____ .
   A.   6 N
   B.   12 N
   C.   3 N
   D.   8 N
   E.   2 N

____140. To accelerate a 6 kg mass at 3 m/s² requires a net force of ____ .
  A. 3 N
  B. 9 N
  C. 6 N
  D. 18 N
  E. 2 N

____141. A falling object is said to reach terminal speed
  A. when there is no gravitational force acting on it.
  B. when its air resistance equals the force of gravity on it.
  C. when its air resistance equals the force of friction on it.
  D. when it lands on the ground.
  E. when there is no air resistance acting on it.

____142. Two parachutists jump from an airplane together and open their identical parachutes at the same time. Which of the following is true?
  A. Both parachutists will land at the same time.
  B. The two parachutists will fall at the same rate.
  C. The heavier parachutist will encounter less air resistance.
  D. The lighter parachutist will fall more rapidly.
  E. The heavier parachutist will reach a higher terminal speed.

____143. Two parachutists jump from an airplane together and open their identical parachutes at the same time. Which of the following is true?
  A. The two parachutists will fall at the same rate.
  B. The heavier parachutist will encounter less air resistance.
  C. Both parachutists will land at the same time.
  D. The lighter parachutist will reach a higher terminal speed.
  E. The heavier parachutist will fall more rapidly.

____144. Two parachutists jump from an airplane together and open their identical parachutes at the same time. Which of the following is true?
  A. The two parachutists will fall at the same rate.
  B. The heavier parachutist will fall more slowly.
  C. Both parachutists will land at the same time.
  D. The lighter parachutist will reach a higher terminal speed.
  E. The heavier parachutist will encounter greater air resistance.

____145. As a sky diver falls just after jumping from an airplane,
  A. her speed decreases while her acceleration increases.
  B. her speed and acceleration both increase.
  C. her speed is constant while her acceleration increases.
  D. her speed increases while her acceleration decreases.
  E. her speed and acceleration both decrease.

____146. As a sky diver falls just after jumping from an airplane,
  A. her acceleration is constant while her speed increases.
  B. her acceleration and speed both increase.
  C. her acceleration decreases while her speed increases.
  D. her acceleration increases while her speed decreases.
  E. her acceleration and speed both decrease.

____147. When a falling object reaches terminal speed,
    A.   its acceleration is zero, and its speed is constant.
    B.   its acceleration is increasing, and its speed is increasing.
    C.   its acceleration is constant, and its speed is zero.
    D.   its acceleration is constant, and its speed is increasing.
    E.   its acceleration is increasing, and its speed is constant.

____148. When a falling object reaches terminal speed,
    A.   it begins to fall more slowly.
    B.   it begins to fall more rapidly.
    C.   it falls with a constant speed.
    D.   its motion becomes unpredictable.
    E.   it stops falling.

____149. Two tennis balls -- a normal one and one filled with water -- are dropped from the top of a tall building. Which of the following is true?
    A.   The normal ball will experience more air resistance and will hit the ground first.
    B.   Both balls will hit the ground together.
    C.   The normal ball will experience less air resistance and will hit the ground first.
    D.   The water-filled ball will experience more air resistance and will hit the ground first.
    E.   The water-filled ball will experience less air resistance and will hit the ground first.

____150. If one object exerts a force on a second object, the second object exerts an equal and opposite force on the first. This is a statement of
    A.   Newton's Law of Gravity.
    B.   Newton's Fourth Law of Motion.
    C.   Newton's Second Law of Motion.
    D.   Newton's Third Law of Motion.
    E.   Newton's First Law of Motion.

____151. For every action there is an equal and opposite reaction. This is a statement of
    A.   Newton's Third Law of Motion.
    B.   Newton's First Law of Motion.
    C.   Newton's Second Law of Motion.
    D.   Newton's Law of Action.
    E.   Newton's Fourth Law of Motion.

____152. When A exerts a force on B, then B exerts an equal and opposite force on A. This is a statement of
    A.   Newton's Third Law of Motion.
    B.   Newton's Second Law of Motion.
    C.   Newton's Law of Forces.
    D.   Newton's First Law of Motion.
    E.   Newton's Fourth Law of Motion.

____153. When a rifle is fired, the rifle exerts a force on the bullet and
    A.   the bullet accelerates at the same rate as the rifle.
    B.   the bullet exerts a force of equal magnitude on the rifle.
    C.   the bullet exerts a force of lesser magnitude on the rifle.
    D.   the bullet exerts a force of greater magnitude on the rifle.
    E.   the bullet does not exert any force on the rifle.

____154. When a rock is dropped, the Earth exerts a force on the rock and
  A.   the rock accelerates at the same rate as the Earth.
  B.   the rock exerts a force of lesser magnitude on the Earth.
  C.   the rock does not exert any force on the Earth.
  D.   the rock exerts a force of greater magnitude on the Earth.
  E.   the rock exerts a force of equal magnitude on the Earth.

____155. When a car accelerates along a road, the force that accelerates the car is
  A.   the force of the car's exhaust gases pushing the car forward.
  B.   the force exerted by the wind on the car.
  C.   the force of gravity on the car.
  D.   the frictional force the tires exert on the road.
  E.   the frictional force the road exerts on the tires.

____156. The resultant of vectors AB and AC is a vector extending from point __ to point __ .
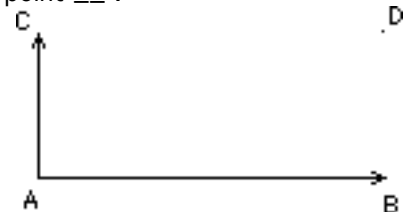
  A.   B; C
  B.   C; D
  C.   A; D
  D.   C; B
  E.   B; D

____157. A boat heads due north to cross a 1-km-wide river that flows due west.
  If the boat's speed is 1 km/h with respect to the water and the river current is also 1 km/h, where will
  the boat land on the north shore?
  A.   1 km east of its original target point.
  B.   1.41 km east of its original target point.
  C.   at its original target point.
  D.   1.41 km west of its original target point.
  E.   1 km west of its original target point.

____158. A boat heads due north to cross a 1-km-wide river that flows due east.
  If the boat's speed is 1 km/h with respect to the water and the river current is also 1 km/h, where will
  the boat land on the north shore?
  A.   1.41 km west of its original target point.
  B.   1 km west of its original target point.
  C.   at its original target point.
  D.   1.41 km east of its original target point.
  E.   1 km east of its original target point.

____159. An airplane flying east at an airspeed of 200 km/h has a tailwind blowing from the west at 50 km/h. How
  far will the plane fly relative to the ground in two hours?
  A.   250 km
  B.   400 km
  C.   500 km
  D.   300 km
  E.   200 km

____160. An airplane flying east at an airspeed of 200 km/h has a tailwind blowing from the east at 50 km/h. How far will the plane fly relative to the ground in two hours?
   A.   500 km
   B.   250 km
   C.   200 km
   D.   400 km
   E.   300 km

____161. An airplane heading east at an airspeed of 100 km/h has a crosswind blowing from the north at 100 km/h. What will be the airplane's velocity relative to the ground?
   A.   141 km/h to the northeast
   B.   100 km/h to the southeast
   C.   100 km/h to the east
   D.   100 km/h to the northeast
   E.   141 km/h to the southeast

____162. An airplane heading east at an airspeed of 100 km/h has a crosswind blowing from the south at 100 km/h. What will be the airplane's velocity relative to the ground?
   A.   100 km/h to the southeast
   B.   141 km/h to the southeast
   C.   100 km/h to the east
   D.   141 km/h to the northeast
   E.   100 km/h to the northeast

____163. An airplane heading west at an airspeed of 100 km/h has a crosswind blowing from the north at 100 km/h. What will be the airplane's velocity relative to the ground?
   A.   141 km/h to the northeast
   B.   141 km/h to the southwest
   C.   141 km/h to the northwest
   D.   100 km/h to the west
   E.   141 km/h to the southeast

____164. An airplane heading west at an airspeed of 100 km/h has a crosswind blowing from the south at 100 km/h. What will be the airplane's velocity relative to the ground?
   A.   100 km/h to the west
   B.   141 km/h to the northeast
   C.   141 km/h to the southeast
   D.   141 km/h to the northwest
   E.   141 km/h to the southwest

____165. An airplane heading west at an airspeed of 100 km/h has a crosswind blowing from the south at 100 km/h. What will be the airplane's velocity relative to the ground?
   A.   141 km/h
   B.   71 km/h
   C.   0 km/h
   D.   200 km/h
   E.   100 km/h

____166. A vector quantity is completely described by specifying
   A.   its color.
   B.   both its magnitude and its direction.
   C.   either its magnitude or its direction.
   D.   its magnitude.
   E.   its direction.

____167. A scalar quantity is completely described by specifying
  A. either its magnitude or its direction.
  B. its magnitude.
  C. its color.
  D. both its magnitude and its direction.
  E. its direction.

____168. ____ are examples of vector quantities.
  A. Velocity and acceleration
  B. Mass and volume
  C. Volume and velocity
  D. Acceleration and time
  E. Time and mass

____169. ____ are examples of scalar quantities.
  A. Volume and velocity
  B. Mass and volume
  C. Acceleration and time
  D. Force and mass
  E. Velocity and acceleration

____170. ____ are examples of scalar quantities.
  A. Time and mass
  B. Acceleration and time
  C. Velocity and acceleration
  D. Mass and force
  E. Force and velocity

____171. ____ are examples of vector quantities.
  A. Mass and velocity
  B. Volume and acceleration
  C. Volume and velocity
  D. Acceleration and force
  E. Force and mass

____172. Which of the following specifies a vector quantity?
  A. Mankato is about 140 kilometers from the Twin Cities.
  B. The lectures in this class are normally 80 minutes long.
  C. The boy had a mass of 40 kilograms.
  D. Honest, officer, we were only going 55 miles per hour!
  E. Gravity accelerates falling objects downward at 9.8 m/s^2.

____173. Which of the following specifies a vector quantity?
  A. The lectures in this class are normally 80 minutes long.
  B. The truck accelerated at 9.8 m/s^2.
  C. The boy had a mass of 40 kilograms.
  D. Mankato is about 140 kilometers southwest of the Twin Cities.
  E. Honest, officer, we were only going 55 miles per hour!