Answer the following questions:

1) Which two terms represent a vector quantity and the scalar quantity of the vector's magnitude, respectively?
   A) displacement and distance   C) weight and force
   B) acceleration and velocity   D) speed and time

2) Distance is to displacement as
   A) velocity is to acceleration  C) force is to weight  D) impulse is to momentum
   B) speed is to velocity

3) A moving body must undergo a change of
   A) position   B) direction   C) acceleration   D) velocity

4) A blinking light of constant period is situated on a lab cart. Which diagram best represents a photograph of the light as the cart moves with constant velocity?
   A) •••••• C) •••••••
   B) •••••• D) •••••••

5) The graph below represents the motion of a body that is moving with

   A) increasing acceleration   C) constant speed
   B) decreasing acceleration   D) increasing speed

6) Which graph represents an object moving at a constant speed for the entire time interval?

   A) Distance
   B) Distance
   C) Distance
   D) Distance

7) What is the distance traveled by an object that moves with an average speed of 6.0 meters per second for 8.0 seconds?
   A) 1.3 m   B) 14 m   C) 48 m   D) 0.75 m
8) A baseball pitcher throws a fastball at 42 meters per second. If the batter is 18 meters from the pitcher, approximately how much time does it take for the ball to reach the batter?
   A) 0.43 s  B) 1.9 s  C) 0.86 s  D) 2.3 s

9) The average speed of a plane was 600 kilometers per hour. How long did it take the plane to travel 120 kilometers?
   A) 0.2 hour  B) 0.7 hour  C) 5 hours  D) 0.5 hour

10) A car travels between the 100.-meter and 250.-meter highway markers in 10. seconds. The average speed of the car during this interval is
   A) 25 m/s  B) 10. m/s  C) 15 m/s  D) 35 m/s

11) The distance-time graph below represents the position of an object moving in a straight line. What is the speed of the object during the time interval \( t = 2.0 \) seconds to \( t = 4.0 \) seconds?

   ![Distance-Time Graph]

   A) 0.0 m/s  B) 10. m/s  C) 7.5 m/s  D) 5.0 m/s

12) The graph below represents the motion of an object traveling in a straight line as a function of time. What is the average speed of the object during the first four seconds?

   ![Displacement-Time Graph]

   A) 2 m/s  B) 1 m/s  C) 0 m/s  D) 0.5 m/s

13) Acceleration is a vector quantity that represents the time-rate of change in
   A) energy  B) distance  C) momentum  D) velocity

14) Which statement about the movement of an object with zero acceleration is true?
   A) The object may be speeding up.
   B) The object may be in motion.
   C) The object may be slowing down.
   D) The object must be at rest.

15) If an object is traveling east with a decreasing speed, the direction of the object's acceleration is
   A) west  B) east  C) north  D) south

16) A locomotive starts from rest and accelerates at 0.12 meter per second\(^2\) to a speed of 2.4 meters per second in 20. seconds. This motion could best be described as
   A) increasing acceleration and increasing velocity
   B) constant acceleration and increasing velocity
   C) constant acceleration and constant velocity
   D) increasing acceleration and constant velocity
17) The graph below represents the motion of a body moving along a straight line.

![Graph](image)

According to the graph, which quantity related to the motion of the body is constant?
A) acceleration  B) velocity  C) speed  D) displacement

18) Which graph best represents the motion of an object sliding down a frictionless inclined plane?

![Graph Options](image)

19) Which graph best represents the motion of an object initially at rest and accelerating uniformly?

![Graph Options](image)
20) The graph below shows the relationship between speed and time for two objects, A and B.

![Graph](image)

Compared with the acceleration of object B, the acceleration of object A is
A) the same  B) one-third as great  C) three times as great  D) twice as great

21) A bicyclist accelerates from rest to a speed of 5.0 meters per second in 10 seconds. During the same 10 seconds, a car accelerates from a speed of 22 meters per second to a speed of 27 meters per second. Compared to the acceleration of the bicycle, the acceleration of the car is
A) less  B) greater  C) the same

22) Which pair of graphs represents the same motion?
A)
![Graph](image)
B)
![Graph](image)
C)
![Graph](image)
D)
![Graph](image)

23) The diagram below shows a graph of distance as a function of time for an object in straight-line motion.

![Graph](image)

According to the graph, the object most likely has
A) a decreasing mass  B) an increasing speed  C) a constant momentum  D) a decreasing acceleration

24) The graph below represents the velocity-time relationship for a 2.0-kilogram mass moving along a horizontal frictionless surface.

![Graph](image)

What distance does the mass move during interval EF?
A) 3.0 m  B) 2.0 m  C) 6.0 m  D) 1.0 m

25) An object initially at rest accelerates at 5 meters per second\(^2\) until it attains a speed of 30 meters per second. What distance does the object move while accelerating?
A) 30 m  B) 3 m  C) 90 m  D) 600 m
26) A jogger accelerates at a constant rate as she travels 5.0 meters along a straight track from point A to point B, as shown in the diagram below.

If her speed was 2.0 meters per second at point A and will be 3.0 meters per second at point B, how long will it take her to go from A to B?
A) 1.0 s  B) 4.2 s  C) 3.5 s  D) 2.0 s

27) Oil drips at 0.4-second intervals from a car that has an oil leak. Which pattern best represents the spacing of oil drops as the car accelerates uniformly from rest?
A) ••••  B) •••••••  C) •••••••  D) •••••••••

28) The graph below represents the relationship between speed and time for a car moving in a straight line.

The magnitude of the car's acceleration is
A) 0.01 m/s²  B) 10 m/s²  C) 0.10 m/s²  D) 1.0 m/s²

29) Which is constant for a freely falling object?
A) acceleration  B) velocity  C) speed  D) displacement
30) As shown in the diagram below, an astronaut on the Moon is holding a baseball and a balloon. The astronaut releases both objects at the same time.

What does the astronaut observe? [NOTE: The Moon has no atmosphere.]
A) The baseball and balloon fall at the same rate.
B) The baseball and balloon remain suspended and do not fall.
C) The baseball falls slower than the balloon.
D) The baseball falls faster than the balloon.

31) Which combination of graphs best describes free-fall motion? [Neglect air resistance.]

32) Which two quantities are measured in the same units?
A) weight and force
B) mass and weight
C) velocity and acceleration
D) force and momentum

33) Which two graphs represent the motion of an object on which the net force is zero?

34) A box initially at rest on a level floor is being acted upon by a variable horizontal force, as shown in the diagram below.

Compared to the force required to start the box moving, the force required to keep it moving at constant speed is
A) the same
B) less
C) greater
35) A 150-newton force, \( F_1 \), and a 200-newton force, \( F_2 \), are applied simultaneously to the same point on a large crate resting on a frictionless, horizontal surface. Which diagram shows the forces positioned to give the crate the greatest acceleration?

A) \[
\begin{array}{c}
\text{HORIZONTAL} \\
F_1 \\
F_2 \\
\end{array}
\]

B) \[
\begin{array}{c}
\text{VERTICAL} \\
F_1 \\
F_2 \\
\end{array}
\]

C) \[
\begin{array}{c}
\text{DIAGONAL} \\
F_1 \\
F_2 \\
\end{array}
\]

D) \[
\begin{array}{c}
\text{DIAGONAL} \\
F_1 \\
F_2 \\
\end{array}
\]

36) A cart rolls down an inclined plane with constant speed as shown in the diagram below. Which arrow represents the direction of the frictional force?

A) \[
\begin{array}{c}
\text{UPWARD} \\
\end{array}
\]

B) \[
\begin{array}{c}
\text{DOWNWARD} \\
\end{array}
\]

C) \[
\begin{array}{c}
\text{TOWARDS CART} \\
\end{array}
\]

D) \[
\begin{array}{c}
\text{AWAY FROM CART} \\
\end{array}
\]

37) The diagram below represents a box shown sliding down an incline plane. Toward which point will the force of friction on the box be directed?

A) \[
\begin{array}{c}
1 \\
\end{array}
\]

B) \[
\begin{array}{c}
2 \\
\end{array}
\]

C) \[
\begin{array}{c}
3 \\
\end{array}
\]

D) \[
\begin{array}{c}
4 \\
\end{array}
\]

38) A box decelerates as it moves to the right along a horizontal surface, as shown in the diagram below.

Which vector best represents the force of friction on the box?

A) \[
\begin{array}{c}
\uparrow \\
\end{array}
\]

B) \[
\begin{array}{c}
\downarrow \\
\end{array}
\]

C) \[
\begin{array}{c}
\rightarrow \\
\end{array}
\]

D) \[
\begin{array}{c}
\leftarrow \\
\end{array}
\]

39) A horizontal force is used to pull a 5.0-kilogram cart at a constant speed of 5.0 meters per second across the floor as shown in the diagram below.

If the force of friction between the cart and the floor is 10. newtons, the magnitude of the horizontal force along the handle of the cart is

A) 5.0 N  
B) 50. N  
C) 10. N  
D) 25 N
40) In the graph below, the acceleration of an object is plotted against the unbalanced force on the object.

What is the object's mass?
A) 2 kg  B) 0.5 kg  C) 0.2 kg  D) 1 kg

Questions 41 and 42 refer to the following:

A 10-kilogram object, starting from rest, slides down a frictionless incline with a constant acceleration of 2.0 m/sec^2 for 4.0 seconds.

41) What is the approximate weight of the object?
A) 1,000 newtons  B) 100 newtons  C) 1 newton  D) 10 newtons

42) To produce this acceleration, what is the force on the object?
A) 10 newtons  B) 5.0 newtons  C) 2.0 x 10^1 newtons  D) 2.0 x 10^2 newtons

43) Two forces are applied to a 2.0-kilogram block on a frictionless, horizontal surface, as shown in the diagram below.

The acceleration of the block is
A) 5.0 m/s^2 to the right  B) 3.0 m/s^2 to the right  C) 3.0 m/s^2 to the left  D) 5.0 m/s^2 to the left

44) The graph below shows the weight of three objects on planet X as a function of their mass.

The acceleration due to gravity on planet X is approximately
A) 6.0 m/s^2  B) 9.8 m/s^2  C) 50. m/s^2  D) 0.17 m/s^2
45) As shown in the diagram below, an inflated balloon released from rest moves horizontally with velocity \( v \).

\[
\text{AIR} \quad \text{BALLOON} \quad \text{\( v \)}
\]

The velocity of the balloon is most likely cause by

A) gravitational attraction  
B) action-reaction  
C) centripetal force  
D) rolling friction

46) A student weighing 500 newtons stands on a spring scale in an elevator. If the scale reads 520 newtons, the elevator must be

A) moving upward at constant speed  
B) accelerating downward  
C) moving downward at constant speed  
D) accelerating upward

47) As the unbalanced force applied to an object increases, the time rate of change of the object's momentum

A) increases  
B) decreases  
C) remains the same

48) A 3.0-kilogram mass weighs 15 newtons at a given point in the Earth's gravitational field. What is the magnitude of the acceleration due to the gravity at this point?

A) 45 m/s²  
B) 5.0 m/s²  
C) 0.20 m/s²  
D) 9.8 m/s²

49) Two frictionless blocks, having masses of 8.0 kilograms and 2.0 kilograms, rest on a horizontal surface. If a force applied to the 8.0-kilogram block gives it an acceleration of 5.0 m/sec², then the same force will give the 2.0-kilogram block an acceleration of

A) 2.5 m/sec²  
B) 20. m/sec²  
C) 1.2 m/sec²  
D) 10. m/sec²

50) A 50.0-kilogram object in outer space is attracted to a nearby planet with a net force of 400 newtons. What is the magnitude of the object's acceleration?

A) 9.81 m/s²  
B) 8.00 m/s²  
C) 2,000 m/s²  
D) 78.4 m/s²