Kinematics Graphs Review 2

True/False

Indicate whether the sentence or statement is true or false.

____  1. The slope of a position-time graph represents the velocity.
____  2. An object dropped from a window falls to the ground. The position-time graph representing the object's motion would be a straight line.
____  3. A sprinter darts from the starting blocks at the sound of the starter's pistol. The position-time graph representing the sprinter's motion during the first few strides would be a straight line.
____  4. A car accelerates uniformly when the traffic light turns green. The velocity-time graph representing the car's motion would be a straight line.
____  5. The slope of the tangent to a point on a curve that is part of a position-time graph represents the instantaneous velocity.
____  6. The area under a position-time graph represents the displacement.
____  7. A velocity-time graph that consists of a straight non-horizontal line represents an object that is travelling with uniform motion.
____  8. The slope of the line that joins two points on a velocity-time graph represents the average acceleration during that time interval.
____  9. The velocity of a passenger with respect to a train moving east would be less if the passenger is walking west at a particular speed than it would be if the passenger is walking east at the same speed.
____ 10. When a vector is multiplied by a scalar the resultant vector's direction is unchanged.
____ 11. Consider a trip from your home to your school and back home again. The magnitude of your displacement is equivalent to your distance travelled.
____ 12. An airplane is flying on a course directed 60º E of S. If this course is maintained, the plane will fly farther south than east.
____ 13. Consider one complete orbit around Earth as taken by astronauts aboard a space shuttle. The magnitude of the average velocity is equivalent to the average speed.
____ 14. The valve on the tire of a bicycle that is travelling due west at a constant speed is exhibiting "uniform motion."
____ 15. An object starts from rest and accelerates uniformly. It will travel one third as far during the first second of its motion than in the subsequent second.
____ 16. An object is thrown vertically upward. At the top of its flight, both the object's velocity and acceleration are momentarily zero.
____ 17. Two objects accelerate from rest with the acceleration of object A twice that of object B. After accelerating for a given time, object A will have travelled twice the distance of object B.
____ 18. Two objects accelerate from rest with the acceleration of object A twice that of object B. After accelerating for a given time, the speed of object A will be twice that of object B.

Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.
19. Which of the following is a "scalar" quantity?
   a. distance
   b. velocity
   c. acceleration
   d. displacement
   e. none of the above

20. Which of the following would be considered a "base" quantity rather than a "derived" quantity?
   a. speed
   b. velocity
   c. distance
   d. acceleration
   e. none of the above

21. How many "base" quantities are there from which all other quantities are derived?
   a. three
   b. four
   c. five
   d. six
   e. seven

22. A spark timer/air table produced the tape pictured below. The object, moving to the right, was

   a. moving with uniform motion
   b. speeding up
   c. slowing down
   d. travelling with constant speed
   e. accelerating then moving with constant speed

23. The term "uniform motion" means
   a. acceleration is constant
   b. speed is constant
   c. velocity is constant
   d. displacement is constant
   e. velocity is zero

24. A 400-m, 800-m, and 1600-m race are all run around the same 400-m oval track. The winning times for the races were 50 s, 2 min, and 4 min 10 s respectively. Which of the following statements is true?
   a. All runners have the same average velocity.
   b. The 400-m runner has the greatest average velocity.
   c. The 800-m runner has the greatest average velocity.
   d. The 1600-m runner has the greatest average velocity.
   e. All runners have the same average speed.

25. An 80.4-km trip takes a time of 0.75 h to complete. The average speed, expressed in the correct manner, is
   a. 107.2 km/h
   b. 1.072 \times 10^2 \text{ km/h}
   c. 29.8 m/s
   d. 1 \times 10^2 \text{ km/h}
   e. 1.1 \times 10^2 \text{ km/h}

26. Using a variety of stopwatches, four students reported the time for a ball to drop to the ground from the same height. The recorded times were 1.85 s, 1.8 s, 1.9 s, and 2 s. The average time, expressed in the correct manner, is
   a. 1.888 s
   b. 1.89 s
   c. 1.8 s
   d. 1.9 s
   e. 2 s

27. The slope of a position-time graph always represents
   a. displacement
   b. distance
   c. velocity
   d. change in velocity
   e. acceleration

28. The slope of a velocity-time graph always represents
29. The area under a velocity-time graph always represents
   a. displacement  
   b. distance  
   c. change in velocity  
   d. acceleration  
   e. change in acceleration

30. The area under an acceleration-time graph always represents
   a. displacement  
   b. change in velocity  
   c. change in acceleration  
   d. distance  
   e. velocity

31. Study the position-time graph pictured below and select the statement that is true.

   ![Position vs. Time Graph]

   a. The object accelerates, stops, then accelerates in the opposite direction.  
   b. The object's speed is greatest during the first segment.  
   c. The object's acceleration is greatest during the last segment.  
   d. The object's average velocity is zero.  
   e. The object travels a greater distance in the first segment than in the last segment.

32. The position-time graph pictured below represents the motions of two objects, A and B. Which of the following statements concerning the objects' motions is true?

   ![Position vs. Time Graph]

   a. Object B travels the greater distance.  
   b. Object A has the greater speed.  
   c. Object A leaves the reference point at an earlier time.  
   d. Both objects have the same speed at the point where the lines cross.  
   e. Object A is travelling for a longer period of time.
33. The position-time graph pictured below represents a race between three contestants A, B, and C. The race begins at time zero at the sound of the starter's pistol. Which of the following statements is true?

- a. The runner who started last finished first.
- b. The fastest runner won the race.
- c. The runner with a head start won the race.
- d. Only one runner began at the sound of the starter's pistol.
- e. All runners ran the same distance.

34. The position-time graph pictured below depicts a person, P, running to catch a bus, B, that has just begun to pull away. Which of the following statements is true?

- a. The person has no chance of catching the bus.
- b. The person's acceleration is greater than that of the bus.
- c. The person has two opportunities to catch up to the bus.
- d. The speed of the bus is always greater than that of the person.
- e. The person's speed is always greater than that of the bus.

35. The position-time graph that depicts a ball thrown vertically upward that returns to the same position is

- a. A
- b. B
- c. C
- d. D
- e. E
36. The position-time graph that represents "uniform motion" is

- A
- B
- C
- D
- E

37. The velocity-time graph that represents "uniform motion" is

- A
- B
- C
- D
- E

38. The velocity-time graph pictured below depicts the motion of a motorcycle. Which of the following statements is true?

- a. The motorcycle is always experiencing an acceleration.
- b. The motorcycle's greatest speed occurs toward the end of the recorded time interval.
- c. The motorcycle's average acceleration is zero.
- d. The motorcycle eventually reaches uniform motion.
- e. The motorcycle accelerates until it reaches a constant speed.

39. The velocity-time graph pictured below represents the motion of a police car, P, in pursuit of a motorcycle, M. The motorcycle has just passed the police car. Which of the following statements is true?

- a. Both vehicles are at rest when the pursuit begins.
- b. The police car eventually catches the motorcycle.
- c. The motorcycle accelerates and then slows down.
- d. At the end of the recorded time interval, the police car has yet to catch the motorcycle.
- e. The police car passes the motorcycle.
40. Consider the following velocity-time graph and select the statement that is true.

\[ v \text{ vs. } t \]

- a. At no time can the motion be considered "uniform."
- b. The object returns to its original position.
- c. The object travels in one direction and then the other.
- d. The object is accelerating throughout the entire recorded time.
- e. The object speeds up and later slows down.

41. Which of the following velocity-time graphs represents the motion of a ball thrown vertically upward?

- a. A
- b. B
- c. C
- d. D
- e. E

42. The following velocity-time graph depicts the motions of two objects, A and B. Which of the statements describing the graph is true?

\[ v \text{ vs. } t \]

- a. Both objects are accelerating uniformly.
- b. The two objects are travelling in opposite directions.
- c. Both objects start from rest.
- d. Object A travels farther than object B.
- e. Object B travels farther than object A.
43. Which statement describes the motion represented by the following acceleration-time graph?

![Acceleration vs. Time Graph]

a. The object is moving with uniform motion.

b. The object has a constant velocity.

c. The object has a uniform acceleration.

d. The object is stopped.

e. The object has a changing acceleration.

44. A ball is thrown vertically upward into the air. Which of the following acceleration-time graphs represents the ball's motion?

![Acceleration vs. Time Graphs]

a. A
b. B
c. C
d. D
e. E

45. Four of the five graphs pictured below could all represent the same motion. Which graph does not belong to this group?

![Distance vs. Time Graphs]

a. A
b. B
c. C
d. D
e. E

46. A cyclist rides a bicycle 4.0 km west, then 3.0 km north. What is the cyclist's displacement?

a. 7.0 km [37° N of W]

b. 7.0 km [37° W of N]

c. 5.0 km [37° N of W]

47. A taxi cab drives 2.0 km [W], then 3.0 km [N], then 4.0 km [W], and finally 5.0 km [N]. The entire trip takes 0.30 h. What is the taxi's average velocity?

a. 47 km/h [53° W of N]

b. 47 km/h [53° N of W]

c. 33 km/h [53° N of W]
48. A motorcycle accelerates from rest at 6.0 m/s\(^2\). How much farther will it travel during the second 3.0 s of its motion than during the first 3.0 s?
   a. 98 m   
   b. 81 m   
   c. 54 m   
   d. 27 m   
   e. 15 m

49. The position-time graph below depicts the motions of two objects, A and B. Which of the following statements concerning the objects' motions is **NOT** true?

   ![Position vs. Time Graph]

   a. The two objects have the same speed.
   b. The two objects travel the same distance.
   c. The two objects travel with uniform motion.
   d. The two objects travel for the same amount of time.
   e. The two objects have the same velocity.

50. What type of motion is depicted by the following acceleration-time graph?

   ![Acceleration vs. Time Graph]

   a. constant velocity
   b. non-uniformly changing acceleration
   c. constant acceleration
   d. uniformly changing acceleration
   e. uniform motion

51. The diagram below shows the first three legs of a trip: A to B, B to C, and C to D. If a person returns from point D to point A, what is the displacement for this fourth and final leg?

   ![Trip Diagram]

   a. 7 km [37° W of N]   
   b. 5 km [37° W of N]   
   c. 5 km [37° E of S]   
   d. 7 km [37° E of S]   
   e. 5 km [37° N of E]
Completion
*Complete each sentence or statement.*

52. In mechanics, we are primarily concerned with the base units for time, length, and mass. In addition to these, there are only ____________________ other base quantities from which all other units are derived.

53. Consider a race around a circular track. The values of average speed will likely be ____________________ for all competitors; but the value for the average velocity for all competitors will be ____________________.

54. An object in uniform motion is travelling with constant ____________________.

55. Whenever the slope is found on a position-time graph, one is finding the ____________________.

56. Whenever the slope is taken on a ____________________ graph, one is finding the acceleration.

57. When the ____________________ a velocity-time graph is taken, one is finding the displacement.

58. Plane A flies from Paris to New York, while plane B makes the same trip via London. Assume that the total time taken for both planes is the same. Considering the two trips, both planes have the same average ________________ but different average ________________.

59. An object that travels ever-increasing distances in successive equal time intervals is undergoing ____________________.

60. Two observers watching the same object can have very different conclusions about the object's motion depending on the observers' ____________________.
Kinematics Graphs Review 2
Answer Section

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