Unit 1: Graphing Motion

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

____ 1. Which of the following is a "scalar" quantity?
a. distance
b. velocity
c. acceleration
d. displacement

____ 2. Which of the following would be considered a "base" quantity rather than a "derived" quantity?
a. speed
b. velocity
c. distance
d. acceleration

____ 3. The term "uniform motion" means
a. velocity is constant
b. acceleration is constant
c. displacement is constant
d. velocity is zero

____ 4. 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 speed.
b. The 1600-m runner has the greatest average velocity.
c. All runners have the same average velocity.
d. The 400-m runner has the greatest average velocity.

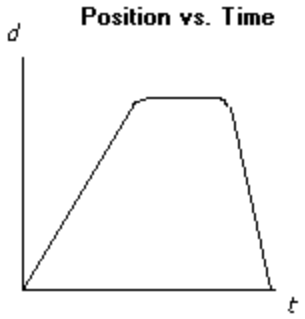
____ 5. An 80.4-km trip takes a time of 0.75 h to complete. The average speed, expressed in the correct manner, is
a. 29.8 m/s
b. 1.1×10^2 km/h
c. 1×10^2 km/h
d. 1.072×10^2 km/h

____ 6. The slope of a position-time graph always represents
a. velocity
b. acceleration
c. distance
d. displacement

____ 7. The slope of a velocity-time graph always represents
a. change in acceleration
b. acceleration
c. change in velocity
d. distance

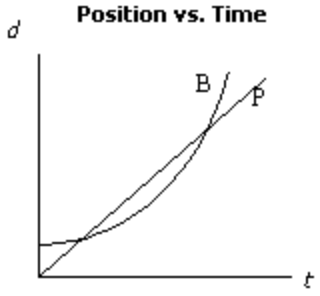
____ 8. The area under a velocity-time graph always represents
a. displacement
b. acceleration
c. distance
d. change in velocity

____ 9. Study the position-time graph pictured below and select the statement that is true.



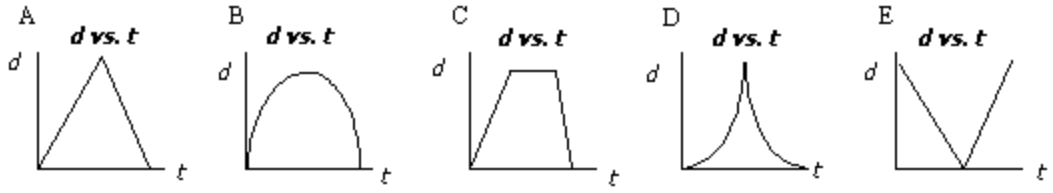
a. The object's average velocity is zero.
b. The object travels a greater distance in the first segment than in the last segment.
c. The object's acceleration is greatest during the last segment.
d. The object's speed is greatest during the first segment.

____ 10. 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?



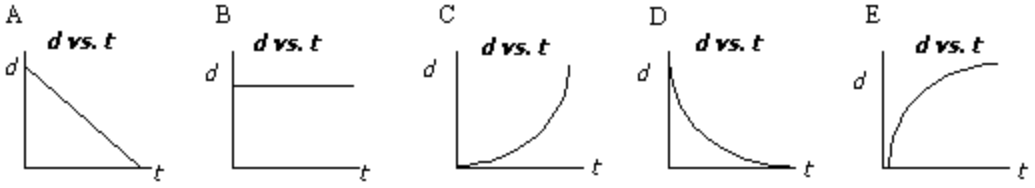
a. The person has two opportunities to catch up to the bus.
b. The person has no chance of catching the bus.
c. The person's speed is always greater than that of the bus.
d. The person's acceleration is greater than that of the bus.

____ 11. The position-time graph that depicts a ball thrown vertically upward that returns to the same position is



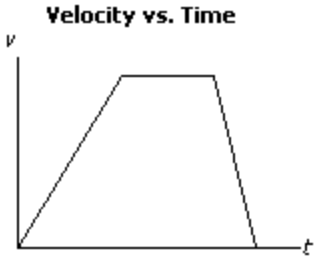
a. A
b. B
c. C
d. D
e. E

____ 12. The position-time graph that represents "uniform motion" is



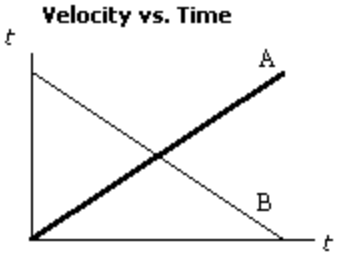
a. A
b. B
c. C
d. D
e. E

____ 13. Consider the following velocity-time graph and select the statement that is true.



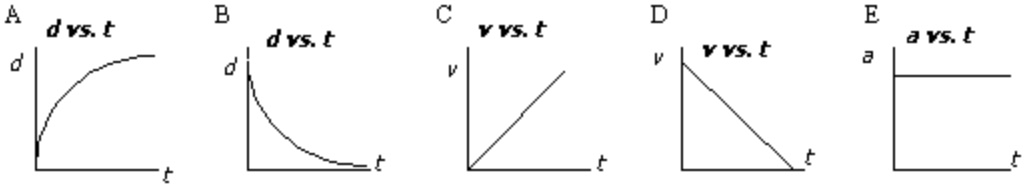
a. The object travels in one direction and then the other.
b. The object is accelerating throughout the entire recorded time.
c. At no time can the motion be considered "uniform."
d. The object speeds up and later slows down.

____ 14. The following velocity-time graph depicts the motions of two objects, A and B. Which of the statements describing the graph is true?



a. The two objects are travelling in opposite directions.
b. Object B travels farther than object A.
c. Both objects are accelerating uniformly.
d. Object A travels farther than object B.

____ 15. Four of the five graphs pictured below could all represent the same motion. Which graph does not belong to this group?



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

____ 16. Which of the following speeds is the fastest?

a. 1.4×10^2 km/h
b. 1.4×10^5 m/h
c. 4.0×10^3 cm/s
d. 4.2×10^{-2} km/s

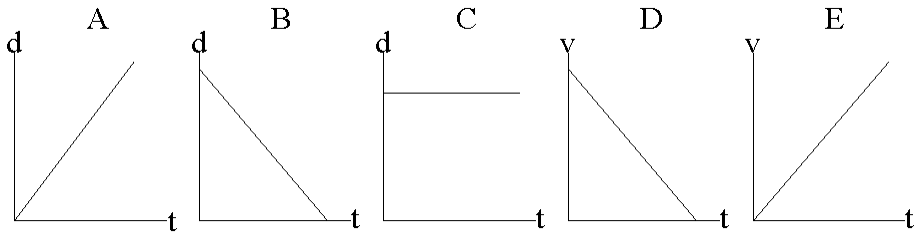
____ 17. In a triathlon participants swim for 750 m, bike for 30 km, and run for 5 km. If the time taken to complete the entire course is 1.5 h, the average speed, expressed in the proper manner, is (Assume all distances are accurate to the number of digits given.)

a. 23.83 km/h
b. 2×10^1 km/h
c. 23.833 km/h
d. 24 km/h

____ 18. Two hikers set out from the same spot and arrive at the same destination but they take different routes. Which of the following quantities must be the same for both hikers?

a. average speed
b. distance
c. acceleration
d. displacement

____ 19. Which of the following graphs does NOT depict uniform motion?



a. C only
b. B and D
c. A and B
d. D and E

Short Answer

20. Describe the difference between "scalar" and "vector" quantities.

21. Describe the difference between "base" and "derived" quantities. Give examples to illustrate your answer.

22. Explain what is meant by the term "uniform motion".

Problem

23. An impatient motorist considers speeding as he travels between two cities. If the trip normally takes 2.8 h at an average speed of 100.0 km/h, how much time will be saved if he exceeds the speed limit by 10.0 km/h?

24. Two friends plan to meet at a cottage for a weekend retreat. One person must drive a distance of 1.5×10^2 km at an average speed of 85 km/h. The other person has only 90.0 km to travel and averages a speed of 1.0×10^2 km/h. If they both depart at the same time, how much earlier does the one friend arrive than the other. (Give your answer in minutes.)

Unit 1: Graphing Motion
Answer Section

MULTIPLE CHOICE

1. A
2. C
3. A
4. C
5. B
6. A
7. B
8. A
9. A
10. A
11. B
12. A
13. D
14. C
15. C
16. D
17. B
18. D
19. D

SHORT ANSWER

20. Scalar quantities only have magnitude, whereas vector quantities have both magnitude and direction.
21. Base quantities are fundamental, whereas derived quantities are comprised of a combination of base quantities. For example, time and distance are both base quantities; however, speed is a derived quantity (a combination of both distance and time).
22. An object that is travelling with uniform motion has a constant velocity. Both the object's speed and direction of travel are unchanging.

PROBLEM

23. distance to travel

$$\Delta d = v\Delta t$$
$$= 100\,\text{km/h}(2.8\text{h})$$
$$= 280\,\text{km}$$

time to travel if speeding (v = 110 km/h)

$$\Delta t = \frac{\Delta d}{v}$$

$$= \frac{280\,\text{km}}{110\,\text{km/h}}$$

$$= 2.55\,\text{h}$$

The time saved is $2.8\,\text{h} - 2.55 = 0.25\text{h}$

$$= 15\,\text{min}$$

24. time to arrive for person A

$$\Delta t = \frac{\Delta d}{v}$$

$$= \frac{150\,\text{km}}{85\,\text{km/h}}$$

$$= 1.76\,\text{h}$$

time to arrive for person B

$$\Delta t = \frac{\Delta d}{v}$$

$$= \frac{90\,\text{km}}{100\,\text{km/h}}$$

$$= 0.90\,\text{h}$$

time difference

$1.76\,\text{h} - 0.90\,\text{h} = 0.86\,\text{h}$

$$= 52\,\text{min}$$

Person B arrives 52 min earlier than person A.