

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) A 8.7 hour trip is made at an average speed of 73.0 km/hr. If the first third of the trip (chronologically) was driven at 96.5 km/hr, what was the average speed for the rest of the journey? 1) _____
A) 67 km/hr B) 61 km/hr C) 85 km/hr D) 51 km/hr

Answer: B

- 2) If the fastest you can safely drive is 65 mi/h, what is the longest time you can stop for dinner if you must travel 541 mi in 9.6 h total? 2) _____
A) 1.0 h B) 1.4 h
C) 1.3 h D) You can't stop at all.

Answer: C

- 3) A car travels 95 km to the north at 70.0 km/h, then turns around and travels 21.9 km at 80.0 km/h. What is the difference between the average speed and the average velocity on this trip? 3) _____
A) 27 km/h B) 24 km/h C) 32 km/h D) 19 km/h

Answer: A

- 4) A sports car has an average acceleration of $13.1 \frac{\text{miles}}{\text{hour} \cdot \text{sec}}$. How long does it take for the car to reach 60.0 mi/h, if it starts from rest? 4) _____
A) 5.5 s B) 4.6 s C) 3.1 s D) 8.8 s

Answer: B

- 5) A car is travelling north at 17.7 m/s. After 12 s its velocity is 14.1 m/s in the same direction. Find the magnitude and direction of the car's average acceleration. 5) _____
A) 0.30 m/s^2 , North B) 2.7 m/s^2 , North
C) 2.7 m/s^2 , South D) 0.30 m/s^2 , South

Answer: D

- 6) Acceleration is sometimes expressed in multiples of g , where $g = 9.8 \text{ m/s}^2$ is the acceleration due to the earth's gravity. In a car crash, the car's velocity may go from 26 m/s to 0 m/s in 0.15 s. How many g 's are experienced, on average, by the driver? 6) _____
A) 13 g B) 18 g C) 23 g D) 22 g

Answer: B

- 7) A car accelerates from 10.0 m/s to 30 m/s at a rate of 3.0 m/s^2 . How far does it travel while accelerating? 7) _____
A) 226 m B) 399 m C) 133 m D) 80 m

Answer: C

- 8) A dragster travels $1/4$ mi in 6.7 s. Assuming that acceleration is constant and the dragster is initially at rest, what is its velocity when it crosses the finish line? 8) _____
A) 296 mi/h B) 188 mi/h C) 135 mi/h D) 269 mi/h

Answer: D

- 9) The average velocity of a car over a certain time interval is 37 mi/h. If the velocity of the car was 65 mi/h at the end of this interval, what was its initial velocity? Assume that acceleration was constant. 9) _____
A) 9 mi/h B) 57 mi/h C) 4.0 mi/h D) 13 mi/h

Answer: A

- 10) Human reaction times are worsened by alcohol. How much farther would a drunk driver's car travel before he hits the brakes than a sober driver's car? Assume both cars are initially traveling at 49.0 mi/h, the sober driver takes .33 s and the drunk driver takes 1.0 s to hit the brakes in a crisis. 10) _____
 A) 48 ft B) 34 ft C) 58 ft D) 53 ft

Answer: A

- 11) A bicyclist starts a timed race at 6.0 mi/h. In order to win, he must average 21 mi/h. Assuming constant acceleration from the start, how fast must he be traveling at the end of the race? 11) _____
 A) 42 mi/h B) 36 mi/h C) 24 mi/h D) 30 mi/h

Answer: B

- 12) An airplane needs to reach a velocity of 226.0 km/h to take off. On a 2000 m runway, what is the minimum acceleration necessary for the plane to take flight? 12) _____
 A) 0.99 m/s² B) 1.1 m/s² C) 1.3 m/s² D) 1.2 m/s²

Answer: A

- 13) Assuming equal rates of deceleration in both cases, how much further would you travel if braking from 61 mi/h to rest than from 32 mi/h? 13) _____
 A) 4.3 times farther B) 3.6 times farther
 C) 2.9 times farther D) 4.7 times farther

Answer: B

- 14) The position of an object is given by $x = bt^2 - ct$, where $b = 2.0 \text{ m/s}^2$ and $c = 6.7 \text{ m/s}$. What is the instantaneous velocity of the object when $t = 2.2$? 14) _____
 A) 2.1 m/s B) 2.3 m/s C) 1.7 m/s D) 2.7 m/s

Answer: A

- 15) An object starts moving at $t = 0$, and its position is given by $x = bt^3 - Ct^2$. At what time (other than $t = 0$) is the instantaneous velocity equal to the average velocity? Assume $b = 4.2 \text{ m/s}^3$ and $C = 3.2 \text{ m/s}^2$. 15) _____
 A) 0.34 s B) 0.38 s C) 0.46 s D) 0.27 s

Answer: B

- 16) The position of an object is given by $x = bt^3 - ct^2 + dt$. What is the instantaneous acceleration of the object when $t = 0.7 \text{ s}$? Assume $b = 4.1 \text{ m/s}^3$, $c = 2.2 \text{ m/s}^2$ and $d = 1.7 \text{ m/s}$. 16) _____
 A) -13 m/s² B) 2.9 m/s² C) 13 m/s² D) 4.6 m/s²

Answer: C

Solve the problem. Disregard air resistance.

- 17) A ball is thrown straight upward with a velocity of 39 m/s. How much time passes before the ball strikes the ground? 17) _____
 A) 4.0 s B) 1.2 s C) 2.4 s D) 8.0 s

Answer: D

- 18) A package is dropped from a helicopter moving upward at 15 m/s. If it takes 16.0 s before the package strikes the ground, how high above the ground was the package when it was released? 18) _____
 A) 1200 m B) 1500 m C) 810 m D) 1000 m

Answer: D

- 19) At the same moment, one rock is dropped and one is thrown downward with an initial velocity of 10 m/s from the top of a 300 m building. How much earlier does the thrown rock strike the ground? 19) _____
A) 0.95 s B) 0.85 s
C) 0.66 s D) They land at exactly the same time.

Answer: A

- 20) Two ramps of equal length are situated such that ramp #1 has a slope (with respect to the horizon) of 30° , and ramp #2 has a slope of 60° . Neglecting friction, roughly by what factor is the time it takes a ball to roll down ramp #1 larger than the time it takes a ball to roll down ramp #2? 20) _____
A) 1.3 B) 2.0 C) 1.7 D) 1.0

Answer: A

- 21) A sports car can go from rest to 32 m/s in 3.88 s. The same car can come to a full stop from that speed in 3.96 s. What is the ratio of starting to stopping accelerations? 21) _____
A) -1.0 B) 0.98 C) 1.0 D) -0.98

Answer: A

- 22) A baseball is hit with a bat and, as a result, its direction is completely reversed and its speed is doubled. If the actual contact with the bat lasts 0.31 s, what is the ratio of the acceleration to the original velocity? 22) _____
A) -0.10 s^{-1} B) -6.5 s^{-1} C) -3.2 s^{-1} D) -9.7 s^{-1}

Answer: D

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

- 23) Negative acceleration is called deceleration because an object is slowing down. 23) _____
Answer: True False

- 24) If an object stops moving at a point, then its acceleration must be zero at that point. 24) _____
Answer: True False

- 25) It is physically impossible for an object to have a negative acceleration and yet be speeding up. 25) _____
Answer: True False

- 26) It is not physically possible for the "position versus time" graph of a moving animal to be either perfectly vertical or perfectly horizontal. 26) _____
Answer: True False

- 27) The acceleration is always the slope of the "velocity versus time" graph and the velocity is always the slope of the "position versus time" graph. 27) _____
Answer: True False

- 28) If the "velocity versus time" graph of an object is a horizontal line, that object cannot be accelerating. 28) _____
Answer: True False

29) The equation $s_f = s_i + v_{iS} \Delta t + \frac{1}{2} a_S (\Delta t)^2$ is valid for all types of motion because it is a fundamental equation of physics. 29) _____

Answer: True False

30) The equation $v_{fS}^2 = v_{iS}^2 + 2a_S \Delta x$ applies to motion for which the "velocity versus time" graph is a straight line. 30) _____

Answer: True False

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

31) Is there any situation in which the average velocity of an object can be greater than the object's average speed? Support your answer. 31) _____

Answer: The average velocity can never be greater than the average speed. The two averages will be equal for motion along a single straight path; otherwise the average speed is always greater.

32) What quantity is measured by your speedometer (be as specific as possible)? 32) _____

Answer: Your speedometer tells you the instantaneous speed of your car.

33) You go on a long trip and try to determine your average velocity by using the miles on your car's tripometer and the time the trip required. Why would the answer using this information most likely not be correct? 33) _____

Answer: Unless the trip was along a perfect straight line, the distance on the tripometer would not be your displacement. The quantity calculated would thus be your average speed, not your average velocity.

34) The position of an object is given by $x = bt$, where t is time and b is a constant. Is it possible to determine the acceleration of this object from the given information? If so, what is it? 34) _____

Answer: Since $v = \frac{dx}{dt} = b$

and $a = \frac{dv}{dt} = 0$

we can conclude that the acceleration is 0 m/s^2 . (i.e., constant velocity).

35) It is possible to have a negative average velocity, depending on the choice of coordinate system. Is it possible for an object to have a negative average speed? 35) _____

Answer: No. An object's average speed must always be greater than or equal to zero, regardless of coordinate system.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

36) An object is dropped from rest into a pit, and accelerates due to gravity at roughly 10 m/s^2 . It hits the ground in 5 seconds. A rock is then dropped from rest into a second pit, and hits the ground in 10 seconds. How much deeper is the second pit, compared to the first pit? 36) _____

- A) three times deeper
- B) five times deeper
- C) four times deeper
- D) two times deeper

Answer: C

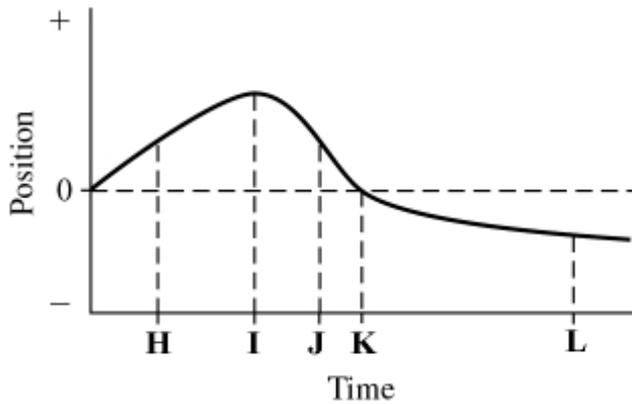
- 37) A skier begins skiing straight down a hill having a constant slope, starting from rest. If friction is negligible, as the skier goes down the hill, his/her 37) _____
 A) acceleration is zero.
 B) acceleration increases with time.
 C) acceleration is constant, with a value of roughly 10 m/s/s.
 D) acceleration is constant, with a value less than 10 m/s/s.

Answer: D

- 38) A person in a car is driving down a straight road. The instantaneous acceleration is decreasing with time, but is directed in the direction of the car's motion. The speed of the car is 38) _____
 A) constant. B) increasing with time. C) decreasing with time.

Answer: B

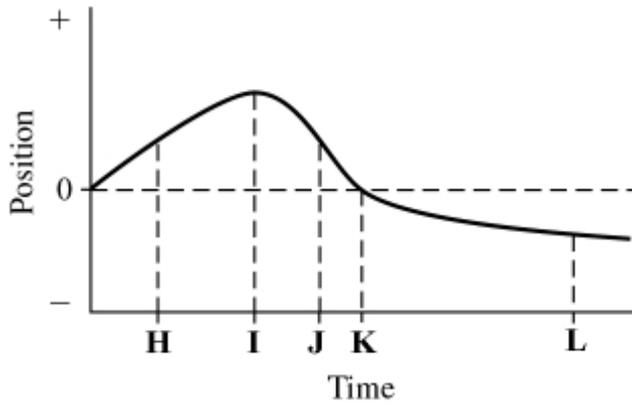
- 39) The plot below shows the position of an object as a function of time. The letters H-L represent particular moments of time. At which moment in time is the speed of the object the highest? 39) _____



- A) L B) I C) J D) H E) K

Answer: C

- 40) The plot below shows the position of an object as a function of time. The letters H-L represent particular moments of time. At which moment in time is the speed of the object equal to zero? 40) _____



- A) K B) J C) L D) I E) H

Answer: D

- 41) A racing car accelerates uniformly from rest along a straight track. This track has markers spaced at equal distances along it from the start, as shown below. The car reaches a speed of 140 km/h as it passes marker 2. 41) _____



Whereabouts on the track was the car when it was travelling at half this speed, i.e., at 70 km/h? Explain your reasoning.

- A) At marker 1
- B) Before marker 1
- C) Between marker 1 and marker 2

Answer: B

- 42) Two identical stones are dropped from a tall building, *one after the other*. Assume air resistance is negligible. While both stones are falling, what will happen to the vertical distance between them? 42) _____

- A) It will decrease.
- B) It will increase.
- C) It will remain the same.
- D) It will first increase and then remain constant.

Answer: B

- 43) Two identical objects A and B fall from rest from different heights to the ground. If object B takes *twice* as long as A to reach the ground, what is the ratio of the heights from which A and B fell? Neglect air resistance. 43) _____

- A) 1 : 8
- B) 1 : 2
- C) 1 : $\sqrt{2}$
- D) 1 : 4

Answer: D

- 44) A ball is thrown vertically upward and then comes back down. During the ball's flight up and down, its velocity and acceleration vectors are . . . 44) _____

- A) first in the same direction and then in opposite directions.
- B) always in opposite directions.
- C) first in opposite directions and then in the same direction.
- D) always in the same direction.

Answer: C

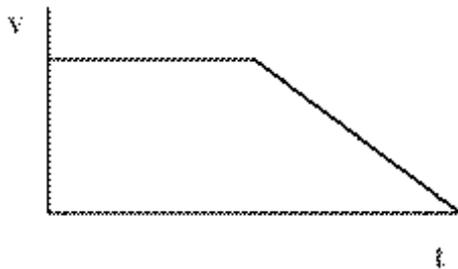
45) A trolley starts from rest and runs down a sloping track section onto a second level section as shown. Friction is negligible.

45) _____

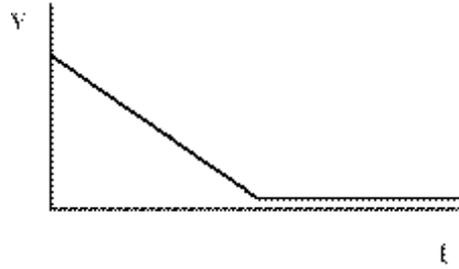


Which velocity-time graph below best represents the trolley's motion on both sections? Justify your answer.

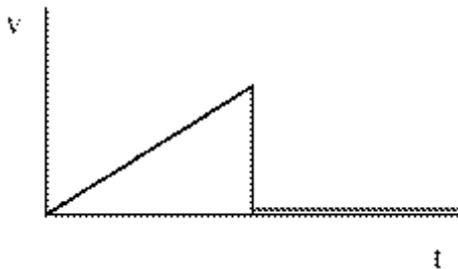
A)



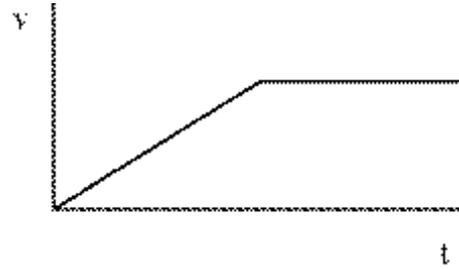
B)



C)



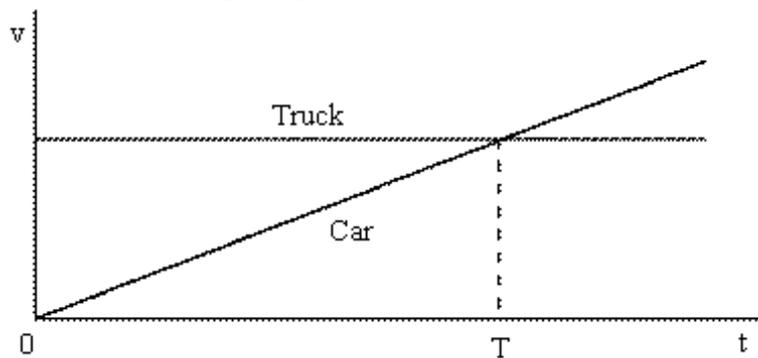
D)



Answer: D

46) The motions of a car and a truck along a straight road are represented by the velocity-time graphs below. The two vehicles are initially alongside each other at time $t = 0$.

46) _____



At time T , what is true of the distances travelled by the vehicles since time $t = 0$?

- A) The car will have travelled further than the truck.
- B) They will have travelled the same distance.
- C) The truck will not have moved.
- D) The truck will have travelled further than the car.

Answer: D