Name_____

AP PHYSICS - MECHANICS

Ch 2. Kinematics in 1-D Multiple Choice Questions

_____ 1. Which of the following quantities has units of a velocity? (There could be more than one correct choice.)
   A) 40 km southwest
   B) -120 m/s
   C) 9.8 m/s^2 downward
   D) 186,000 mi
   E) 9.8 m/s downward

_____ 2. You drive 6.0 km at 50 km/h and then another 6.0 km at 90 km/h. Your average speed over the 12 km drive will be
   A) greater than 70 km/h.
   B) equal to 70 km/h.
   C) less than 70 km/h.
   D) exactly 38 km/h.
   E) It cannot be determined from the information given because we must also know directions traveled.

_____3. Which of the following situations is *impossible*?
   A) An object has velocity directed east and acceleration directed west.
   B) An object has velocity directed east and acceleration directed east.
   C) An object has zero velocity but non-zero acceleration.
   D) An object has constant non-zero acceleration and changing velocity.
   E) An object has constant non-zero velocity and changing acceleration.

_____4. If the acceleration of an object is zero, then that object cannot be moving.
   A) True
   B) False

_____5. If the velocity of an object is zero, then that object cannot be accelerating.
   A) True
   B) False

_____6. An object moving in the +x direction experiences an acceleration of +2.0 m/s^2. This means the object
A) travels 2.0 m in every second.
B) is traveling at 2.0 m/s.
C) is decreasing its velocity by 2.0 m/s every second.
D) is increasing its velocity by 2.0 m/s every second.

_____7. Under what condition is average velocity equal to the average of the object's initial and final velocity?
A) This can only occur if there is no acceleration.
B) The acceleration is constant.
C) This can occur only when the velocity is zero.
D) The acceleration must be constantly increasing.
E) The acceleration must be constantly decreasing.

_____8. 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 in the figure. The car reaches a speed of 140 km/h as it passes marker 2.

speed = 0   speed = 140 km/h

Start   Marker 1   Marker 2
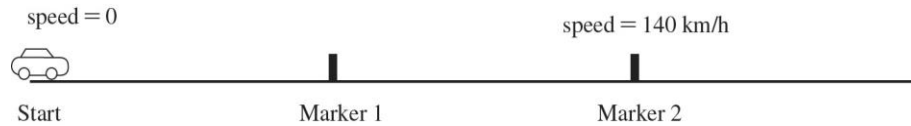
Where on the track was the car when it was traveling at half this speed, that is at 70 km/h?
A) Before marker 1
B) At marker 1
C) Between marker 1 and marker 2

_____9. When a ball is thrown straight up with no air resistance, the acceleration at its highest point
A) is upward
B) is downward
C) is zero
D) reverses from upward to downward
E) reverses from downward to upward

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_____10. A 10-kg rock and 20-kg rock are dropped from the same height and experience no significant air resistance. If it takes the 20-kg rock a time T to reach the ground, what time will it take the 10-kg rock to reach the ground?
A) $4T$
B) $2T$
C) T
D) $T/2$
E) $T/4$

_____11. Two objects are dropped from a bridge, an interval of 1.0 s apart. Air resistance is negligible. During the time that both objects continue to fall, their separation
A) increases.
B) decreases.
C) stays constant.
D) increases at first, but then stays constant.
E) decreases at first, but then stays constant.

_____12. Ball A is dropped from the top of a building. One second later, ball B is dropped from the same building. Neglect air resistance. As time progresses, the difference in their speeds
A) increases.
B) remains constant.
C) decreases.
D) cannot be determined from the information given.

_____13. An object is moving with constant non-zero acceleration in the $+x$ direction. The position versus time graph of this object is
A) a horizontal straight line.
B) a vertical straight line.
C) a straight line making an angle with the time axis.
D) a parabolic curve.

_____14. An object is moving with constant non-zero acceleration in the $+x$ direction. The velocity versus time graph of this object is
A) a horizontal straight line.
B) a vertical straight line.
C) a straight line making an angle with the time axis.
D) a parabolic curve.

_____15. If the velocity versus time graph of an object is a horizontal line, the object is
A) moving with zero acceleration.
B) moving with constant non-zero acceleration.
C) at rest.
D) moving with increasing speed.

_____16. The motions of a car and a truck along a straight road are represented by the velocity-time graphs in the figure. The two vehicles are initially alongside each other at time $t = 0$.
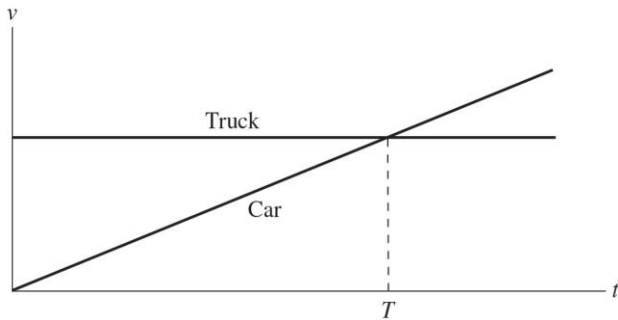
At time T, what is true of the *distances* traveled by the vehicles since time $t = 0$?
A) They will have traveled the same distance.
B) The truck will not have moved.
C) The car will have travelled further than the truck.
D) The truck will have travelled further than the car.

_____17. Which of the following graphs represent an object having zero acceleration?
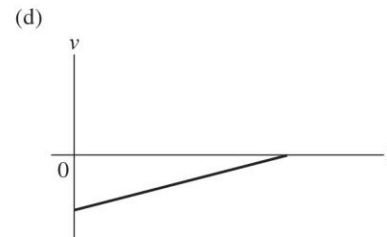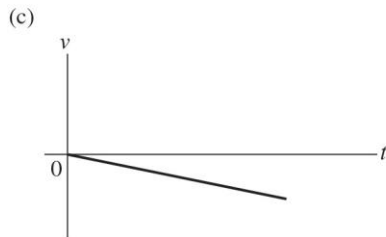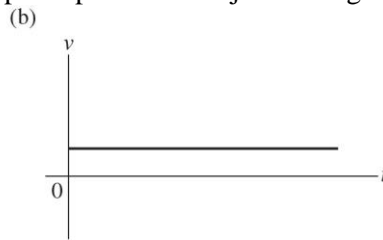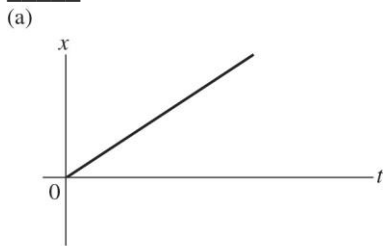
A) only graph a
B) only graph b
C) graphs a and b
D) graphs b and c
E) graphs c and d

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_____18. A child standing on a bridge throws a rock straight down. The rock leaves the child's hand at time $t = 0$ s. If we take upward as the positive direction, which of the graphs shown below best represents the acceleration of the stone as a function of time?
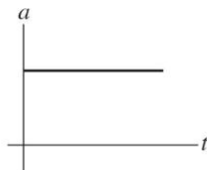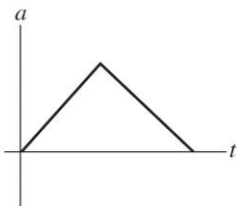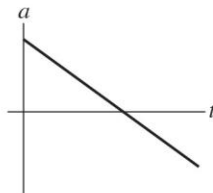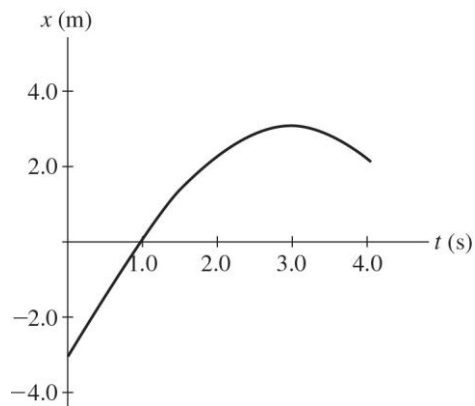
A)
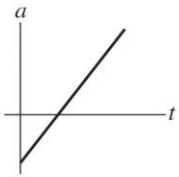
B)
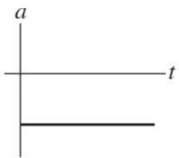
D)

C)

E)

_____19. The graph in the figure shows the position of a particle as it travels along the x-axis.

At what value of t is the speed of the particle equal to 0 m/s?
A) 0 s
B) 1 s
C) 2 s
D) 3 s
E) 4 s

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_____20. What must be your average speed in order to travel 350 km in 5.15 h?
  A) 66.0 km/h
  B) 67.0 km/h
  C) 68.0 km/h
  D) 69.0 km/h

_____21. A motorist travels 160 km at 80 km/h and 160 km at 100 km/h. What is the average speed of the motorist for this trip?
  A) 84 km/h
  B) 89 km/h
  C) 90 km/h
  D) 91 km/h

_____22. An airplane travels at 300 mi/h south for 2.00 h and then at 250 mi/h north for 750 miles. What is the average speed for the trip?
  A) 260 mi/h
  B) 270 mi/h
  C) 275 mi/h
  D) 280 mi/h

_____23. A runner runs around a track consisting of two parallel lines 96 m long connected at the ends by two semicircles with a radius of 49 m. She completes one lap in 100 seconds. What is her average velocity?
  A) 2.5 m/s
  B) 5.0 m/s
  C) 10 m/s
  D) 0 m/s
  E) 1.3 m/s

_____24. You leave on a 549-mi trip in order to attend a meeting that will start 10.8 h after you begin your trip. Along the way you plan to stop for dinner. If the fastest you can safely drive is 65 mi/h, what is the longest time you can spend over dinner and still arrive just in time for the meeting?
  A) 2.4 h
  B) 2.6 h
  C) 1.9 h
  D) You can't stop at all.

_____25. An airplane increases its speed at the average rate of 15 m/s^2. How much time does it take to increase its speed from 100 m/s to 160 m/s?
   A) 17 s
   B) 0.058 s
   C) 4.0 s
   D) 0.25 s

_____26. A car is traveling 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.
   A) 0.30 m/s^2, south
   B) 2.7 m/s^2, south
   C) 0.30 m/s^2, north
   D) 2.7 m/s^2, north

_____27. A car initially traveling at 60 km/h accelerates at a constant rate of 2.0 m/s^2. How much time is required for the car to reach a speed of 90 km/h?
   A) 15 s
   B) 30 s
   C) 45 s
   D) 4.2 s

_____28. A car travels at 15 m/s for 10 s. It then speeds up with a constant acceleration of 2.0 m/s^2 for 15 s. At the end of this time, what is its velocity?
   A) 15 m/s
   B) 30 m/s
   C) 45 m/s
   D) 375 m/s

_____29. A jet plane is launched from a catapult on an aircraft carrier. In 2.0 s it reaches a speed of 42 m/s at the end of the catapult. Assuming the acceleration is constant, how far did it travel during those 2.0 s?
   A) 16 m
   B) 24 m
   C) 42 m
   D) 84 m

_____30. A car increases its forward velocity uniformly from 40 m/s to 80 m/s while traveling a distance of 200 m. What is its acceleration during this time?
A) 8.0 m/s^2
B) 9.6 m/s^2
C) 12 m/s^2
D) 24 m/s^2

_____31. An object is moving in a straight line with constant acceleration. Initially it is traveling at 16 m/s. Three seconds later it is traveling at 10 m/s. How far does it move during this time?
A) 30 m
B) 39 m
C) 48 m
D) 57 m

_____32. Starting from rest, a dragster travels a straight 1/4 mi racetrack in 6.70 s with constant acceleration. What is its velocity when it crosses the finish line?
A) 269 mi/h
B) 188 mi/h
C) 296 mi/h
D) 135 mi/h

_____33. Assuming equal rates of uniform acceleration in both cases, how much further would you travel if braking from $56\,\text{mi/h}$ to rest than from $28\,\text{mi/h}$?
A) 4 times farther
B) 3.2 times farther
C) 4.8 times farther
D) 5.2 times farther

_____34. A train starts from rest and accelerates uniformly until it has traveled 2.1 km and acquired a forward velocity of $24\,\text{m/s}$. The train then moves at a constant velocity of $24\,\text{m/s}$ for 400 s. The train then slows down uniformly at $0.065\,\text{m/s}^2$, until it is brought to a halt. The distance traveled by the train while slowing down is closest to
A) 4.4 km.
B) 4.2 km.
C) 4.0 km.
D) 3.8 km.
E) 3.6 km.

_____35. A car starts from rest and accelerates at a steady 6.00 m/s^2. How far does it travel in the first 3.00 s?
A) 9.00 m
B) 18.0 m
C) 27.0 m
D) 36.0 m
E) 54.0 m

_____36. A car is traveling at 26.0 m/s when the driver suddenly applies the brakes, causing the car to slow down with constant acceleration. The car comes to a stop in a distance of 120 m. How fast was the car moving when it was 60.0 m past the point where the brakes were applied?
A) 22.5 m/s
B) 18.4 m/s
C) 15.0 m/s
D) 12.1 m/s
E) 9.20 m/s

_____37. A stone is thrown with an initial upward velocity of 7.0 m/s and experiences negligible air resistance. If we take upward as the positive direction, what is the velocity of the stone after 0.50 s?
A) 2.1 m/s
B) 4.9 m/s
C) -2.1 m/s
D) -4.9 m/s
E) 0.00 m/s

_____38. A ball is thrown upward with a speed of 12 m/s on the surface of planet X where the acceleration due to gravity is 1.5 m/s^2 and there is no atmosphere. What is the maximum height reached by the ball?
A) 8.0 m
B) 18 m
C) 48 m
D) 144 m

_____39. Human reaction time is usually greater than 0.10 s. If your friend holds a ruler between your fingers and releases it without warning, how far can you expect the ruler to fall before you catch it, assuming negligible air resistance?
A) At least 3.0 cm
B) At least 4.9 cm
C) At least 6.8 cm
D) At least 9.8 cm

_____40. A bullet shot straight up returns to its starting point in 10 s. What is the initial speed of the bullet, assuming negligible air resistance?
A) 9.8 m/s
B) 25 m/s
C) 49 m/s
D) 98 m/s

_____41. A ball is thrown downward from the top of a building with an initial speed of 25 m/s. It strikes the ground after 2.0 s. How high is the building, assuming negligible air resistance?
A) 20 m
B) 30 m
C) 50 m
D) 70 m

_____42. A ball is projected upward at time $t = 0$ s, from a point on a flat roof 90 m above the ground. The ball rises and then falls with insignificant air resistance, missing the roof, and strikes the ground. The initial velocity of the ball is 80.5 m/s. Consider all quantities as positive in the upward direction. The vertical velocity of the ball when it is 89 m above the ground is closest to
A) -81 m/s.
B) -64 m/s.
C) -48 m/s.
D) -32 m/s.
E) -97 m/s.

_____43. A toy rocket is launched vertically from ground level at time $t = 0$ s. The rocket engine provides constant upward acceleration during the burn phase. At the instant of engine burnout, the rocket has risen to 49.0 m and acquired an upward velocity of 60.0 m/s. The rocket continues to rise with insignificant air resistance in unpowered flight, reaches maximum height, and falls back to the ground. The maximum height reached by the rocket is closest to
A) 233 m.
B) 221 m.
C) 209 m.
D) 244 m.
E) 256 m.

_____44. A package is dropped from a helicopter that is moving upward at 15 m/s. If it takes 8.0 s before the package strikes the ground, how high above the ground was the package when it was released? Neglect air resistance.
A) 100 m.
B) 140 m.
C) 190 m.
D) 230 m.
E) 300 m.

_____45. To determine the height of a bridge above the water, a person drops a stone and measures the time it takes for it to hit the water. If the height of the bridge is 41 m, how long will it take for the stone to hit the water? Neglect air resistance.
A) 2.3 s
B) 2.6 s
C) 2.9 s
D) 3.2 s
E) 3.6 s

_____46. Abby throws a ball straight up and times it. She sees that the ball goes by the top of a flagpole after 0.50 s and reaches the level of the top of the pole after a total elapsed time of 4.1 s. What was the speed of the ball at launch? Neglect air resistance.
A) 11 m/s
B) 23 m/s
C) 34 m/s
D) 45 m/s
E) 48 m/s

_____47. The graph in the figure shows the position of a particle as it travels along the x-axis. What is the magnitude of the average velocity of the particle between $t = 1.0$ s and $t = 4.0$ s?
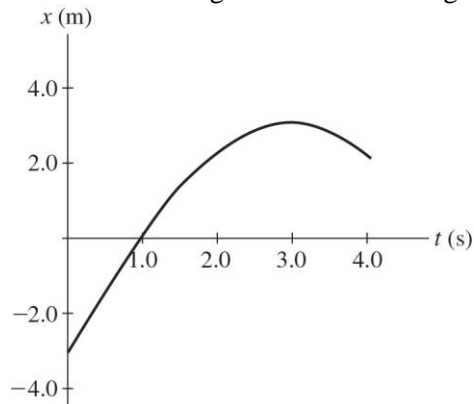
A) 0.25 m/s
B) 0.50 m/s
C) 0.67 m/s
D) 1.0 m/s
E) 1.3 m/s

_____48. The graph in the figure shows the velocity of a particle as it travels along the x-axis. What is the magnitude of the average acceleration of the particle between $t = 1.0$ s and $t = 4.0$ s?
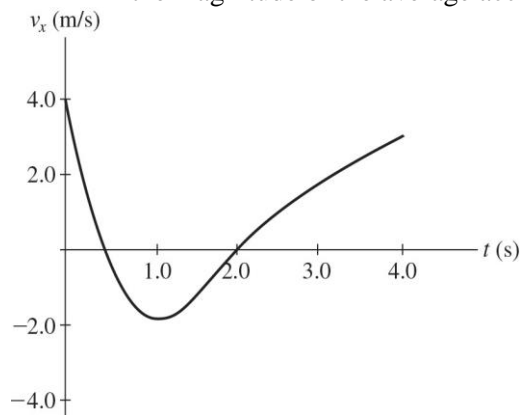
A) 0.33 m/s^2
B) 1.7 m/s^2
C) 2.0 m/s^2
D) 2.5 m/s^2
E) 3.0 m/s^2

Answers:

1. B,E		25. C
2. C		26. A
3. E		27. D
4. B		28. C
5. B		29. C
6. D		30. C
7. B		31. B
8. A		32. A
9. B		33. A
10. C		34. A
11. A		35. C
12. B		36. B
13. D		37. A
14. C		38. C
15. A		39. B
16. D		40. C
17. C		41. D
18. B		42. A
19. D		43. A
20. C		44. C
21. B		45. C
22. B		46. B
23. D		47. C
24. A		48. B

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