Halliday/Resnick/Walker
Fundamentals of Physics 8th edition

Classroom Response System Questions

Chapter 2 Motion Along a Straight Line

Interactive Lecture Questions
2.3.1. In the morning, a bird is in Tampa, Florida. In the afternoon, the bird is near Orlando, Florida. Given this information, which one of the following statements best describes the relationship between the magnitude of the bird’s displacement and the distance the bird traveled?

a) The distance traveled is either greater than or equal to the magnitude of bird’s displacement.

b) The distance traveled is either less than or equal to the magnitude of bird’s displacement.

c) The distance traveled is equal to the magnitude of bird’s displacement.

d) The distance traveled is either less than or greater than the magnitude of bird’s displacement.

e) The distance traveled is greater than the magnitude of bird’s displacement.
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e) The distance traveled is greater than the magnitude of bird’s displacement.
2.5.1. A race car, traveling at constant speed, makes one lap around a circular track of radius \( r \) in a time \( t \). The circumference of a circle is given by \( C = 2\pi r \). Which one of the following statements concerning this car is true?

a) The displacement of the car does not change with time.

b) The instantaneous velocity of the car is constant.

c) The average speed of the car is the same over any time interval.

d) The average velocity of the car is the same over any time interval.

e) The average speed of the car over any time interval is equal to the magnitude of the average velocity over the same time interval.
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2.5.2. A turtle and a rabbit are to have a race. The turtle’s average speed is 0.9 m/s. The rabbit’s average speed is 9 m/s. The distance from the starting line to the finish line is 1500 m. The rabbit decides to let the turtle run before he starts running to give the turtle a head start. What, approximately, is the maximum time the rabbit can wait before starting to run and still win the race?

a) 15 minutes

b) 18 minutes

c) 20 minutes

d) 22 minutes

e) 25 minutes
2.5.2. A turtle and a rabbit are to have a race. The turtle’s average speed is 0.9 m/s. The rabbit’s average speed is 9 m/s. The distance from the starting line to the finish line is 1500 m. The rabbit decides to let the turtle run before he starts running to give the turtle a head start. What, approximately, is the maximum time the rabbit can wait before starting to run and still win the race?

a) 15 minutes
b) 18 minutes
c) 20 minutes
d) 22 minutes
e) 25 minutes
2.5.3. A turtle, moving at a constant velocity of 0.9 m/s due south, is in a race with a rabbit, who runs at a moderate speed of 9 m/s. When the turtle is 45 m from the finish line, the rabbit begins taunting the turtle by running from the turtle to the finish line (without crossing it) and back to the turtle. The rabbit continues going back and forth between the turtle and the finish line until the turtle crosses the finish line. About how many meters does the rabbit travel as the turtle travels that last 45 m? Assume the rabbit always runs at 9 m/s and doesn’t lose any time changing direction.

a) 180 m  
b) 270 m  
c) 360 m  
d) 450 m  
e) 540 m
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a) 180 m
b) 270 m
c) 360 m
d) 450 m
e) 540 m
2.5.4. A dog is initially walking due east. He stops, noticing a cat behind him. He runs due west and stops when the cat disappears into some bushes. He starts walking due east again. Then, a motorcycle passes him and he runs due east after it. The dog gets tired and stops running. Which of the following graphs correctly represent the position versus time of the dog?

- **a)**
  ![Graph a)

- **b)**
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- **c)**
  ![Graph c)

- **d)**
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2.6.1. Which of the following velocity vs. time graphs represents an object with a negative constant acceleration?
2.6.1. Which of the following velocity vs. time graphs represents an object with a negative constant acceleration?
2.6.2. Complete the following statement: For an object moving at constant acceleration, the distance traveled

a) increases for each second that the object moves.

b) is the same regardless of the time that the object moves.

c) is the same for each second that the object moves.

d) cannot be determined, even if the elapsed time is known.

e) decreases for each second that the object moves.
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e) decreases for each second that the object moves.
2.6.3. Complete the following statement: For an object moving with a negative velocity and a positive acceleration, the distance traveled

a) increases for each second that the object moves.

b) is the same regardless of the time that the object moves.

c) is the same for each second that the object moves.

d) cannot be determined, even if the elapsed time is known.

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d) cannot be determined, even if the elapsed time is known.

e) decreases for each second that the object moves.
2.6.5. At one particular moment, a subway train is moving with a positive velocity and negative acceleration. Which of the following phrases best describes the motion of this train? Assume the front of the train is pointing in the positive $x$ direction.

a) The train is moving forward as it slows down.

b) The train is moving in reverse as it slows down.

c) The train is moving faster as it moves forward.

d) The train is moving faster as it moves in reverse.

e) There is no way to determine whether the train is moving forward or in reverse.
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c) The train is moving faster as it moves forward.

d) The train is moving faster as it moves in reverse.

e) There is no way to determine whether the train is moving forward or in reverse.
2.6.6. A ball is thrown toward a wall, bounces, and returns to the thrower with the same speed as it had before it bounced. Which one of the following statements correctly describes this situation?

a) The ball was not accelerated during its contact with the wall because its speed remained constant.

b) The instantaneous velocity of the ball from the time it left the thrower’s hand was constant.

c) The only time that the ball had acceleration was when the ball started from rest and left the hand of the thrower and again when the ball returned to the hand and was stopped.

d) During this situation, the ball was never accelerated.

e) The ball was accelerated during its contact with the wall because its direction changed.
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d) During this situation, the ball was never accelerated.

e) The ball was accelerated during its contact with the wall because its direction changed.
2.6.7. In an air race, two planes are traveling due east. Plane One has a larger acceleration than Plane Two. Both accelerations are in the same direction. Which one of the following statements is true concerning this situation?

a) In the same time interval, the change in the velocity of the Plane Two is greater than that of Plane One.

b) In the same time interval, the change in the velocity of the Plane One is greater than that of Plane Two.

c) Within the time interval, the velocity of the Plane Two remains greater than that of Plane One.

d) Within the time interval, the velocity of the Plane One remains greater than that of Plane Two.

e) Too little information is given to compare the velocities of the planes or how the velocities are changing.
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b) In the same time interval, the change in the velocity of the Plane One is greater than that of Plane Two.

c) Within the time interval, the velocity of the Plane Two remains greater than that of Plane One.

d) Within the time interval, the velocity of the Plane One remains greater than that of Plane Two.

e) Too little information is given to compare the velocities of the planes or how the velocities are changing.
2.6.8. Two cars travel along a level highway. An observer notices that the distance between the cars is increasing. Which one of the following statements concerning this situation is necessarily true?

a) Both cars could be accelerating at the same rate.

b) The leading car has the greater acceleration.

c) The trailing car has the smaller acceleration.

d) The velocity of each car is increasing.

e) At least one of the cars has a non-zero acceleration.
2.6.8. Two cars travel along a level highway. An observer notices that the distance between the cars is *increasing*. Which one of the following statements concerning this situation is *necessarily* true?

- a) Both cars could be accelerating at the same rate.
- b) The leading car has the greater acceleration.
- c) The trailing car has the smaller acceleration.
- d) The velocity of each car is increasing.
- e) At least one of the cars has a *non-zero* acceleration.
2.6.9. A police cruiser is parked by the side of the road when a speeding car passes. The cruiser follows the speeding car. Consider the following diagrams where the dots represent the cruiser’s position at 0.5-s intervals. Which diagram(s) are possible representations of the cruiser’s motion?

a) A only

b) B, D, or E only

c) C only

d) E only

e) A or C only
2.6.9. A police cruiser is parked by the side of the road when a speeding car passes. The cruiser follows the speeding car. Consider the following diagrams where the dots represent the cruiser’s position at 0.5-s intervals. Which diagram(s) are possible representations of the cruiser’s motion?

a) A only

b) B, D, or E only

c) C only

d) E only

e) A or C only
2.6.10. Starting from rest, two objects accelerate with the same constant acceleration. Object A accelerates for three times as much time as object B, however. Which one of the following statements is true concerning these objects at the end of their respective periods of acceleration?

a) Object A will travel three times as far as object B.

b) Object A will travel nine times as far as object B.

c) Object A will travel eight times as far as object B.

d) Object A will be moving 1.5 times faster than object B.

e) Object A will be moving nine times faster than object B.
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c) Object A will travel eight times as far as object B.

d) Object A will be moving 1.5 times faster than object B.

e) Object A will be moving nine times faster than object B.
2.6.11. The graph below represents the speed of a car traveling due east for a portion of its travel along a horizontal road. Which of the following statements concerning this graph is true?

a) The car initially increases its speed, but then the speed decreases at a constant rate until the car stops.

b) The speed of the car is initially constant, but then it has a variable positive acceleration before it stops.

c) The car initially has a positive acceleration, but then it has a variable negative acceleration before it stops.

d) The car initially has a positive acceleration, but then it has a variable positive acceleration before it stops.

e) No information about the acceleration of the car can be determined from this graph.
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b) The speed of the car is initially constant, but then it has a variable positive acceleration before it stops.

c) The car initially has a positive acceleration, but then it has a variable negative acceleration before it stops.

d) The car initially has a positive acceleration, but then it has a variable positive acceleration before it stops.

e) No information about the acceleration of the car can be determined from this graph.
2.6.12. The drawing shows the position of a rolling ball at one second intervals. Which one of the following phrases best describes the motion of this ball?

a) constant position

b) constant velocity

c) increasing velocity

d) constant acceleration

e) decreasing velocity
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a) constant position

b) constant velocity

c) increasing velocity

d) constant acceleration

e) decreasing velocity

b) constant velocity
2.7.1. An object moves horizontally with a constant acceleration. At time $t = 0$ s, the object is at $x = 0$ m. For which of the following combinations of initial velocity and acceleration will the object be at $x = -1.5$ m at time $t = 3$ s?

a) $v_0 = +2$ m/s, $a = +2$ m/s

b) $v_0 = -2$ m/s, $a = +2$ m/s

c) $v_0 = +2$ m/s, $a = -2$ m/s

d) $v_0 = -2$ m/s, $a = -2$ m/s

e) $v_0 = +1$ m/s, $a = -1$ m/s
2.7.1. An object moves horizontally with a constant acceleration. At time \( t = 0 \) s, the object is at \( x = 0 \) m. For which of the following combinations of initial velocity and acceleration will the object be at \( x = -1.5 \) m at time \( t = 3 \) s?

a) \( v_0 = +2 \) m/s, \( a = +2 \) m/s

b) \( v_0 = -2 \) m/s, \( a = +2 \) m/s

c) \( v_0 = +2 \) m/s, \( a = -2 \) m/s

d) \( v_0 = -2 \) m/s, \( a = -2 \) m/s

e) \( v_0 = +1 \) m/s, \( a = -1 \) m/s
2.7.2. An airplane starts from rest at the end of a runway and accelerates at a constant rate. In the \textit{first second}, the airplane travels 1.11 m. What is the speed of the airplane at the end of the second second?

a) 1.11 m/s  
b) 2.22 m/s  
c) 3.33 m/s  
d) 4.44 m/s  
e) 5.55 m/s
2.7.2. An airplane starts from rest at the end of a runway and accelerates at a constant rate. In the first second, the airplane travels 1.11 m. What is the speed of the airplane at the end of the second second?

a) 1.11 m/s
b) 2.22 m/s
c) 3.33 m/s
d) 4.44 m/s
e) 5.55 m/s
2.7.3. An airplane starts from rest at the end of a runway and accelerates at a constant rate. In the first second, the airplane travels 1.11 m. How much additional distance will the airplane travel during the second second of its motion?

a) 1.11 m
b) 2.22 m
c) 3.33 m
d) 4.44 m
e) 5.55 m
2.7.3. An airplane starts from rest at the end of a runway and accelerates at a constant rate. In the *first second*, the airplane travels 1.11 m. How much additional distance will the airplane travel during the *second* second of its motion?

a) 1.11 m

b) 2.22 m

c) 3.33 m

d) 4.44 m

e) 5.55 m
2.7.4. A passenger train starts from rest and leaves a station with a constant acceleration. During a certain time interval, the displacement of the train increases to three times the value it had at the start of that interval. During that same time interval, determine the increase in the train’s velocity? Let $v$ represent the speed of the train at the end of the time interval and $v_0$ represent the speed at the beginning of the interval.

a) $v = v_0$

b) $v = 1.4v_0$

c) $v = 1.7v_0$

d) $v = 2.0v_0$

e) $v = 3.0v_0$
2.7.4. A passenger train starts from rest and leaves a station with a constant acceleration. During a certain time interval, the displacement of the train increases to three times the value it had at the start of that interval. During that same time interval, determine the increase in the train’s velocity? Let \( v \) represent the speed of the train at the end of the time interval and \( v_0 \) represent the speed at the beginning of the interval.

a) \( v = v_0 \)

b) \( v = 1.4v_0 \)

c) \( v = 1.7v_0 \)

d) \( v = 2.0v_0 \)

e) \( v = 3.0v_0 \)
2.7.5. Consider the graph the position versus time graph shown. Which curve on the graph best represents a constantly accelerating car?

a) A  
b) B  
c) C  
d) D  
e) None of the curves represent a constantly accelerating car.
2.7.5. Consider the graph the position versus time graph shown. Which curve on the graph best represents a constantly accelerating car?

a) A
b) B

c) C

d) D

e) None of the curves represent a constantly accelerating car.
2.7.6. Consider the graph the position versus time graph shown. Which curve on the graph best represents a car that is initially moving in one direction and then reverses directions?

a) A  
b) B  
c) C  
d) D  
e) None of the curves represent a car moving in one direction then reversing its direction.
2.7.6. Consider the graph the position versus time graph shown. Which curve on the graph best represents a car that is initially moving in one direction and then reverses directions?

a) A
b) B
c) C
d) D
e) None of the curves represent a car moving in one direction then reversing its direction.
2.9.1. Two identical ping-pong balls are selected for a physics demonstration. A tiny hole is drilled in one of the balls; and the ball is filled with water. The hole is sealed so that no water can escape. The two balls are then dropped from rest at the exact same time from the roof of a building. Assuming there is no wind, which one of the following statements is true?

a) The two balls reach the ground at the same time.

b) The heavier ball reaches the ground a long time before the lighter ball.

c) The heavier ball reaches the ground just before the lighter ball.

d) The heavier ball has a much larger velocity when it strikes the ground than the light ball.

e) The heavier ball has a slightly larger velocity when it strikes the ground than the light ball.
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d) The heavier ball has a much larger velocity when it strikes the ground than the light ball.

e) The heavier ball has a slightly larger velocity when it strikes the ground than the light ball.
2.9.2. A cannon directed straight upward launches a ball with an initial speed \( v \). The ball reaches a maximum height \( h \) in a time \( t \). Then, the same cannon is used to launch a second ball straight upward at a speed \( 2v \). In terms of \( h \) and \( t \), what is the maximum height the second ball reaches and how long does it take to reach that height?

a) \( 2h, t \)

b) \( 4h, 2t \)

c) \( 2h, 4t \)

d) \( 2h, 2t \)

e) \( h, t \)
2.9.2. A cannon directed straight upward launches a ball with an initial speed $v$. The ball reaches a maximum height $h$ in a time $t$. Then, the same cannon is used to launch a second ball straight upward at a speed $2v$. In terms of $h$ and $t$, what is the maximum height the second ball reaches and how long does it take to reach that height?

a) $2h$, $t$

b) $4h$, $2t$

c) $2h$, $4t$

d) $2h$, $2t$

e) $h$, $t$