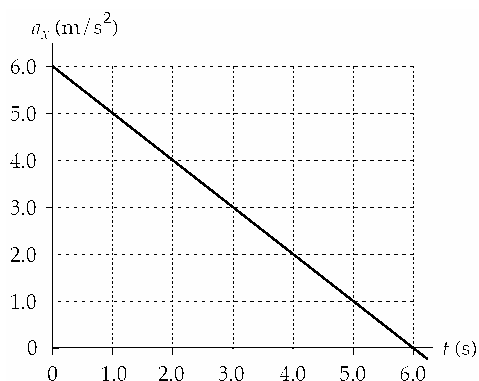


## AP Physics - Kinematics Practice Test

### Multiple Choice

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

- \_\_\_\_\_ 1. The position of a particle moving along the  $x$  axis is given by  $x = (21 + 22t - 6.0t^2)$ m, where  $t$  is in s. What is the average velocity during the time interval  $t = 1.0$  s to  $t = 3.0$  s?
- 6.0 m/s
  - 4.0 m/s
  - 2.0 m/s
  - 8.0 m/s
  - 8.0 m/s
- \_\_\_\_\_ 2. The position of a particle as it moves along the  $x$  axis is given for  $t > 0$  by  $x = (t^3 - 3t^2 + 6t)$  m, where  $t$  is in s. Where is the particle when it achieves its minimum speed (after  $t = 0$ )?
- 3 m
  - 4 m
  - 8 m
  - 2 m
  - 7 m
- \_\_\_\_\_ 3. At  $t = 0$ , a particle is located at  $x = 25$  m and has a velocity of 15 m/s in the positive  $x$  direction. The acceleration of the particle varies with time as shown in the diagram. What is the position of the particle at  $t = 5.0$  s?



- 175 m
  - 125 m
  - 138 m
  - 154 m
  - 165 m
- \_\_\_\_\_ 4. An automobile traveling along a straight road increases its speed from 30.0 m/s to 50.0 m/s in a distance of 180 m. If the acceleration is constant, how much time elapses while the auto moves this distance?
- 6.00 s
  - 4.50 s
  - 3.60 s
  - 4.00 s
  - 9.00 s

- \_\_\_ 5. An object is thrown downward with an initial ( $t = 0$ ) speed of 10 m/s from a height of 60 m above the ground. At the same instant ( $t = 0$ ), a second object is propelled vertically upward from ground level with a speed of 40 m/s. At what height above the ground will the two objects pass each other?
- 53 m
  - 41 m
  - 57 m
  - 46 m
  - 37 m

- \_\_\_ 6. The velocity at the midway point of a ball able to reach a height  $y$  when thrown with velocity  $v_i$  at the origin is:
- $\frac{v_i}{2}$
  - $\sqrt{v_i^2 - 2gy}$
  - $\sqrt{\frac{v_i^2}{2}}$
  - $\sqrt{v_i^2 + 2gy}$
  - $gy$

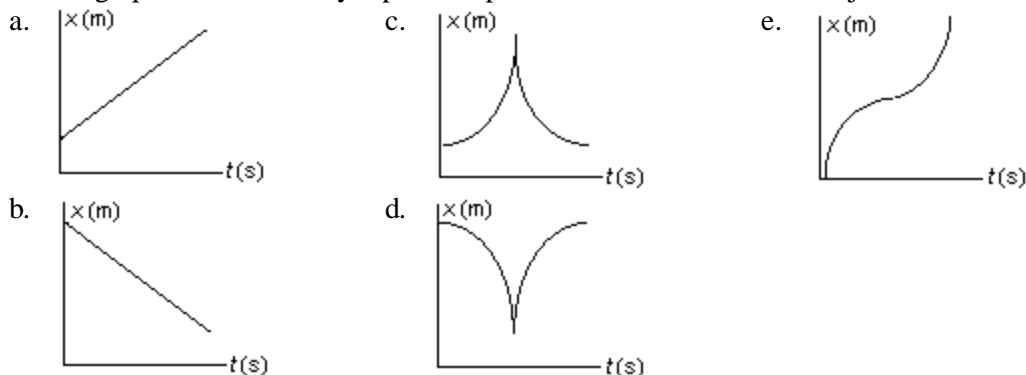
- \_\_\_ 7. The position of a particle moving along the  $y$ -axis has a position given by  $y = 0.20\text{m} + \left(8.0 \frac{\text{m}}{\text{s}}\right)t - \left(10 \frac{\text{m}}{\text{s}^2}\right)t^2$ .

Is there any time interval during which the particle is not moving?

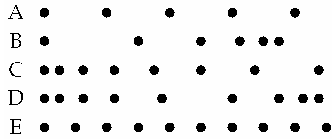
- Yes, from 0.60 s to 1.00 s.
  - Yes, from 0.795 s to 0.805 s.
  - Yes, at the time  $t = 0.80$  s.
  - No, the velocity is never zero.
  - No, an instant is not the same as a time interval.
- \_\_\_ 8. The position of an object at equal time intervals is shown below:



Which graph below correctly represents position versus time for this object?

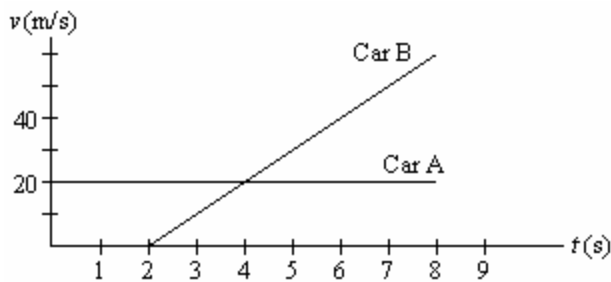


- \_\_\_ 9. Five motion diagrams in which points represent the positions of an object at equal time intervals are shown below. Which statement is correct?



- A has the greatest speed and the greatest acceleration.
- C has decreasing speed.
- D slows down and then speeds up.
- D speeds up and then slows down.
- E has a greater speed than A.

10. Driver A is cruising along enjoying the fall colors. Driver B starts her car at the instant he passes her. Their velocities are shown as functions of time in the graph below. At what instants in time are drivers A and B side by side?



- 0 s, 2 s
  - 0 s, 4 s
  - 2 s, 4 s
  - 2 s, 6 s
  - 4 s, 6 s
11. A particle leaves the origin with a velocity of 7.2 m/s in the positive  $y$  direction and moves in the  $xy$  plane with a constant acceleration of  $(3.0\hat{i} - 2.0\hat{j})$  m/s<sup>2</sup>. At the instant the particle moves back across the  $x$  axis ( $y = 0$ ), what is the value of its  $x$  coordinate?
- 65 m
  - 91 m
  - 54 m
  - 78 m
  - 86 m
12. A particle starts from the origin at  $t = 0$  with a velocity of  $(16\hat{i} - 12\hat{j})$  m/s and moves in the  $xy$  plane with a constant acceleration of  $\vec{a} = (3.0\hat{i} - 6.0\hat{j})$  m/s<sup>2</sup>. What is the speed of the particle at  $t = 2.0$  s?
- 52 m/s
  - 39 m/s
  - 46 m/s
  - 33 m/s
  - 43 m/s
13. A rock is thrown from the edge of the top of a 100-ft tall building at some unknown angle above the horizontal. The rock strikes the ground a horizontal distance of 160 ft from the base of the building 5.0 s after being thrown. Assume that the ground is level and that the side of the building is vertical. Determine the speed with which the rock was thrown.
- 72 ft/s
  - 77 ft/s

- c. 68 ft/s
- d. 82 ft/s
- e. 87 ft/s

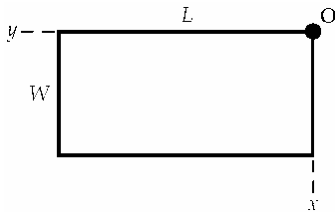
14. The site from which an airplane takes off is the origin. The  $x$ -axis points east; the  $y$ -axis points straight up. The position and velocity vectors of the plane at a later time are given by

$$\vec{r} = (1.61 \times 10^4 \hat{i} + 9.00 \times 10^3 \hat{j}) \text{ m and } \vec{v} = (150 \hat{i} - 21 \hat{j}) \frac{\text{m}}{\text{s}}.$$

The magnitude, in meters, of the plane's displacement from the origin is

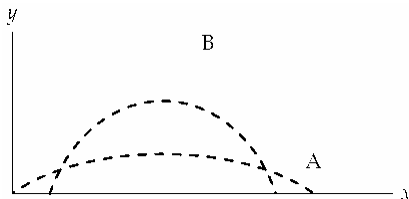
- a.  $9.14 \times 10^3$ .
- b.  $1.61 \times 10^4$ .
- c.  $1.84 \times 10^4$ .
- d.  $9.14 \times 10^3 t$ .
- e.  $1.61 \times 10^4 t$ .

15. A tennis player wants to slam a serve at **O** at height  $h$  above the court so that the ball lands just inside the opposite corner of the court. The court has length  $L$  and width  $W$ . What should the ratio  $\frac{v_{0V}}{v_{0H}}$  be, where  $v_{0V}$  is the vertical component and  $v_{0H}$  the horizontal component of the initial velocity  $\vec{v}_0$ ? The time  $t = 0$  is the time when the ball is hit by the racket.



- a.  $h / \sqrt{L^2 + W^2}$
- b.  $(h - \frac{1}{2}gt^2) / \sqrt{L^2 + W^2}$
- c.  $(h + \frac{1}{2}gt^2) / \sqrt{L^2 + W^2}$
- d.  $\sqrt{L^2 + W^2} / (h - \frac{1}{2}gt^2)$
- e.  $\sqrt{L^2 + W^2} / (h + \frac{1}{2}gt^2)$

16. Two balls, projected at different times so they don't collide, have trajectories A and B, as shown below.



Which statement is correct?

- a.  $v_{0B}$  must be greater than  $v_{0A}$ .

- b. Ball A is in the air for a longer time than ball B.
- c. Ball B is in the air for a longer time than ball A.
- d. Ball B has a greater acceleration than ball A.
- e. Ball A has a greater acceleration than ball B.

**AP Physics - Kinematics Practice Test**  
**Answer Section**

**MULTIPLE CHOICE**

- |     |        |        |
|-----|--------|--------|
| 1.  | ANS: C | PTS: 1 |
| 2.  | ANS: B | PTS: 1 |
| 3.  | ANS: D | PTS: 1 |
| 4.  | ANS: B | PTS: 1 |
| 5.  | ANS: B | PTS: 1 |
| 6.  | ANS: C | PTS: 1 |
| 7.  | ANS: E | PTS: 1 |
| 8.  | ANS: E | PTS: 1 |
| 9.  | ANS: D | PTS: 1 |
| 10. | ANS: D | PTS: 1 |
| 11. | ANS: D | PTS: 1 |
| 12. | ANS: D | PTS: 1 |
| 13. | ANS: C | PTS: 1 |
| 14. | ANS: C | PTS: 1 |
| 15. | ANS: B | PTS: 1 |
| 16. | ANS: C | PTS: 1 |