AP Physics 1– MC Practice – Kinematics 1D

Questions 1 – 3 relate to two objects that start at x = 0 at t = 0 and move in one dimension independently of one another. Graphs, of the velocity of each object versus time are shown below

1. Which object is farthest from the origin at t = 2 seconds.
   (A) A  (B) B  (C) they are in the same location at t = 2 seconds  (D) They are the same distance from the origin, but in opposite directions

2. Which object moves with constant non-zero acceleration?
   (A) A  (B) B  (C) both A and B  (D) neither A nor B

3. Which object is in its initial position at t = 2 seconds?
   (A) A  (B) B  (C) both A and B  (D) neither A nor B

4. The graph above shows the velocity versus time for an object moving in a straight line. At what time after t = 0 does the object again pass through its initial position?
   (A) 1 s  (B) Between 1 and 2 s  (C) 2 s  (D) Between 2 and 3 s

5. A body moving in the positive x direction passes the origin at time t = 0. Between t = 0 and t = 1 second, the body has a constant speed of 24 meters per second. At t = 1 second, the body is given a constant acceleration of 6 meters per second squared in the negative x direction. The position x of the body at t = 11 seconds is
   (A) + 99m  (B) + 36m  (C) − 36 m  (D) − 99 m
Questions 6 – 8

At time $t = 0$, car X traveling with speed $v_0$ passes car Y which is just starting to move. Both cars then travel on two parallel lanes of the same straight road. The graphs of speed $v$ versus time $t$ for both cars are shown above.

6. Which of the following is true at time $t = 20$ seconds?
   
   (A) Car Y is behind car X.   
   (B) Car Y is passing car X.   
   (C) Car Y is in front of car X.   
   (D) Car X is accelerating faster than car Y.

7. From time $t = 0$ to time $t = 40$ seconds, the areas under both curves are equal. Therefore, which of the following is true at time $t = 40$ seconds?
   
   (A) Car Y is behind car X.   
   (B) Car Y is passing car X.   
   (C) Car Y is in front of car X.   
   (D) Car X is accelerating faster than car Y.

8. Which of the following pairs of graphs shows the distance traveled versus time and the speed versus time for an object uniformly accelerated from rest?
9. The graph above shows the velocity \( v \) as a function of time \( t \) for an object moving in a straight line. Which of the following graphs shows the corresponding displacement \( x \) as a function of time \( t \) for the same time interval?

10. The graph above shows velocity \( v \) versus time \( t \) for an object in linear motion. Which of the following is a possible graph of position \( x \) versus time \( t \) for this object?

11. Starting from rest at time \( t = 0 \), a car moves in a straight line with an acceleration given by the accompanying graph. What is the speed of the car at \( t = 3 \) s?

   (A) 1.0 m/s  
   (B) 2.0 m/s  
   (C) 6.0 m/s  
   (D) 10.5 m/s
12. A child left her home and started walking at a constant velocity. After a time she stopped for a while and then continued on with a velocity greater than she originally had. All of a sudden she turned around and walked very quickly back home. Which of the following graphs best represents the distance versus time graph for her walk?

(A) ![Graph A](image)

(B) ![Graph B](image)

(C) ![Graph C](image)

(D) ![Graph D](image)

13. Above is a graph of the distance vs. time for a car moving along a road. According the graph, at which of the following times would the automobile have been accelerating positively?

   (A) 0, 20, 38, & 60 min.  
   (B) 5, 12, 29, & 35 min.  
   (C) 5, 29, & 57 min.  
   (D) 12, 35, & 41 min.

14. The position vs. time graph for an object moving in a straight line is shown below. What is the instantaneous velocity at $t = 2 \text{ s}$?

   (A) $-2 \text{ m/s}$  
   (B) $\frac{1}{2} \text{ m/s}$  
   (C) $0 \text{ m/s}$  
   (D) $2 \text{ m/s}$
15. Shown below is the velocity vs. time graph for a toy car moving along a straight line. What is the maximum displacement from start for the toy car?

![Velocity vs. Time Graph](image)

- (A) 5 m
- (B) 6.5 m
- (C) 7 m
- (D) 7.5 m

16. Given the graph of the velocity vs. time of a duck flying due south for the winter. At what point did the duck stop its forward motion?

![Velocity vs. Time Graph](image)

- (A) A
- (B) B
- (C) C
- (D) D

17. A snail is moving along a straight line. Its initial position is $x_0 = -5$ meters and it is moving away from the origin and slowing down. In this coordinate system, the signs of the initial position, initial velocity and acceleration, respectively, are

<table>
<thead>
<tr>
<th>Choice</th>
<th>$x_0$</th>
<th>$v_0$</th>
<th>$a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>(B)</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>(C)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(D)</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>
Questions 18-20
The following TWO questions refer to the following information. At \( t_0 \) two cars moving along a highway are side-by-side as they pass a third car stopped on the side of the road. At this moment the driver of the first car steps on the brakes while the driver of the stopped car begins to accelerate. The diagrams below show the positions of each car for the next 5 seconds.

18. During which time interval would cars #2 and #3 be moving at the same average speed?
(A) \( t_0 \) to \( t_1 \)  
(B) \( t_1 \) to \( t_2 \)  
(C) \( t_2 \) to \( t_3 \)  
(D) \( t_3 \) to \( t_4 \)

19. Which of the three cars had the greatest average speed during these 5 seconds?
(A) car #2 and car #3 had the same average speed  
(B) car #2  
(C) all three cars had the same average speed  
(D) car #3

20. If car #3 continues to constantly accelerate at the same rate what will be its position at the end of 6 seconds?
(A) 24 m  
(B) 68 m  
(C) 72 m  
(D) 78 m

Questions 21-22

21. The graph represents the relationship between distance and time for an object that is moving along a straight line. What is the instantaneous speed of the object at \( t = 5.0 \) seconds?
(A) 0.0 m/s  
(B) 0.8 m/s  
(C) 2.5 m/s  
(D) 4.0 m/s

22. Between what times did the object have a non-zero acceleration?
(A) 0 s on  
(B) 0 s to 5 s  
(C) the object was not accelerating at any time  
(D) 5 s to 8 s
Questions 23-24
The diagram below represents a toy car starting from rest and uniformly accelerating across the floor. The time and distance traveled from the start are shown in the diagram.

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Distance (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>0.1</td>
<td>24</td>
</tr>
<tr>
<td>0.2</td>
<td>54</td>
</tr>
<tr>
<td>0.3</td>
<td>96</td>
</tr>
</tbody>
</table>

23. What was the acceleration of the cart during the first 0.4 seconds?
(A) 25 m/s²  (B) 9.8 m/s²  (C) 50 m/s²  (D) 12 m/s²

24. What was the instantaneous velocity of the cart at 96 centimeters from the start?
(A) 0.6 m/s  (B) 4.8 m/s  (C) 1.9 m/s  (D) 60 m/s

Questions 25-26
The motion of a circus clown on a unicycle moving in a straight line is shown in the graph below.

25. What would be the acceleration of the clown at 5 s?
(A) 1.6 m/s²  (B) 8.0 m/s²  (C) 2.0 m/s²  (D) 3.4 m/s²

26. After 12 seconds, how far is the clown from her original starting point?
(A) 0 m  (B) 10 m  (C) 47 m  (D) 74 m
Questions 27-29
The accompanying graph describes the motion of a marble on a table top for 10 seconds.

27. For which time interval(s) did the marble have a negative velocity?
   (A) from $t = 8.0$ s to $t = 10.0$ s only
   (B) from $t = 6.9$ s to $t = 10.0$ s only
   (C) from $t = 4.8$ s to $t = 10.0$ s only
   (D) from $t = 4.8$ s to $t = 6.2$ s and from $t = 6.9$ s to $t = 10.0$ s only

28. For which time interval(s) did the marble have a positive acceleration?
   (A) from $t = 0.0$ s to $t = 8.0$ s only
   (B) from $t = 0.0$ s to $t = 3.6$ only
   (C) from $t = 3.8$ s to $t = 4.8$ s and $t = 6.2$ s to $t = 6.8$ s only
   (D) from $t = 2.0$ s to $t = 2.5$ s, from $t = 5.8$ s to $t = 6.2$ s, and from $t = 8.4$ s to $t = 8.8$ s only

29. What is the marbles average acceleration between $t = 3.1$ s and $t = 3.8$ s
   (A) $-2.0$ m/s$^2$
   (B) $0$ m/s$^2$
   (C) $2.0$ m/s$^2$
   (D) $3.0$ m/s$^2$

Questions 30-31
The accompanying graph describes the motion of a toy car across the floor for 10 seconds.

30. What is the acceleration of the toy car at $t = 4$ s?
   (A) $-1$ m/s$^2$
   (B) $0$ m/s$^2$
   (C) $1$ m/s$^2$
   (D) $2$ m/s$^2$

31. What was the total displacement of the toy car for the entire 10 second interval shown?
   (A) 0 meters
   (B) 6.5 meters
   (C) 9 meters
   (D) 10 meters