Solutions

socrative
by MasteryConnect

AP Physics 1 - Test 02 - 1D Constant Acceleration

Score:

1. The position of an object is given as a function of time by $x=7t-3t^2$, where x is in meters and t is in seconds. Its average velocity over the interval from t=0 to t=4 is:

A) 5 m/s

B) -5 m/s

C) 11 m/s

D) -11 m/s

E) -14.5 m/s

$$v = \frac{\Delta x}{t} = \frac{x_4 - x_0}{4} = \frac{-20-0}{4}$$

$$\boxed{v = -5\ m/s}$$

$$x(4) = 7(4) - 3(4)^2 = -20\ m$$

$$x(0) = 7(0) - 3(0)^2 = 0$$

2. Of the following situations, which one is impossible?

A) A body having velocity east and acceleration east. → speeding up

B) A body having velocity east and acceleration west. → slowing down

C) A body having zero velocity and non-zero acceleration. → an object tossed up and is at peak height

D) A body having constant acceleration and a changing velocity. → hopefully that's possible since $a = \frac{\Delta v}{t}$

E) A body having constant velocity and a changing acceleration.

3. A car, initially at rest ($v_i = 0$), travels 20m in 4s along a straight line with constant acceleration. The acceleration of the car is:

A) 0.4 m/s^2

B) 1.3 m/s^2

C) 2.5 m/s^2

D) 4.9 m/s^2

E) 9.8 m/s^2

$v_i = 0$

$\Delta x = 20m$

$t = 4s$

$a = ?$

$$\Delta x = \cancel{v_i t} + \frac{1}{2}at^2$$

$$a = \frac{2\Delta x}{t^2} = \frac{2(20)}{4^2} = \boxed{2.5\ m/s^2}$$

4. A racing car traveling with constant acceleration increases its speed from 10m/s to 50m/s over a distance of 60m. How long does this take?

A) 2.0 s

B) 4.0 s

C) 5.0 s

D) 8.0 s

E) 10.0 s

$v_i = 10\ m/s$

$v_f = 50\ m/s$

$\Delta x = 60m$

$t = ?$

$$\Delta x = \frac{1}{2}(v_i + v_f)t$$

$$t = \frac{2\Delta x}{v_i + v_f} = \frac{2(60)}{10+50} = \boxed{2\ \text{Seconds}}$$

5. A car starts from rest ($v_i = 0$) and goes down a slope with a constant acceleration of 5.0 m/s^2. After 5 s the car reaches the bottome of the hill. Its speed at the bottom of the hill is:

A) 1 m/s

B) 12.5 m/s

$a = 5\ m/s^2$

$v_i = 0$

$t = 5s$

$v_f = ?$

$$v_f = v_i + at$$

$$= 0 + 5(5) = \boxed{25\ m/s}$$

(C) 25 m/s

(D) 50 m/s

(E) 160 m/s

6. A car moving with an initial velocity of 25 m/s north has a constant acceleration of 3 m/s^2 south. After 6 seconds, its velocity will be:

(A) 7 m/s north

(B) 7 m/s south

(C) 43 m/s north

(D) 20 m/s north

(E) 20 m/s south

$a = -3\ m/s^2$

$t = 6\ s$

$V_i = 25\ m/s$

$V_f = ?$

$V_f = V_i + at$

$= 25 + (-3)(6)$

$\boxed{V_f = 7\ m/s}$

Positive, so north

7. The diagram shows a velocity-time graph for a car moving in a straight line. At point Q, the car must be:

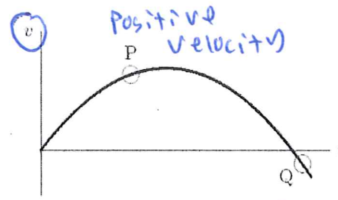
(A) moving with a zero acceleration

(B) traveling downhill

(C) traveling below ground level

(D) reducing speed

(E) traveling in the reverse direction to that at point P



Positive velocity

negative velocity

8. The diagram shows a velocity-time graph for a car moving in a straight line. At point P the car must be:

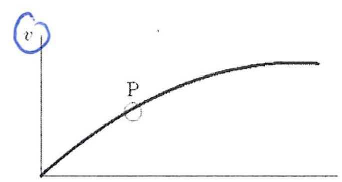
(A) moving with zero acceleration

(B) climbing a hill

(C) accelerating → slope of the graph

(D) stationary

(E) traveling backwards



9. A cart accelerates toward the origin as indicated on the diagram. What would the position vs. time and velocity vs. time graphs look like?

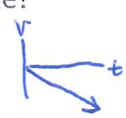
(A) A

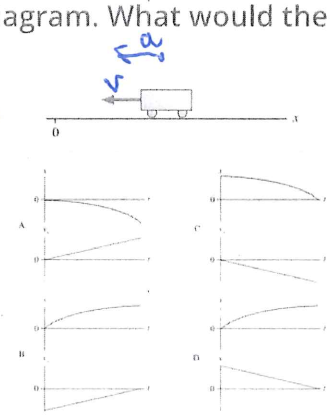
(B) B

(C) C

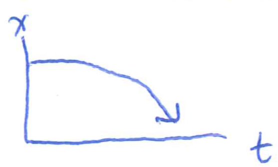
(D) D

moving left, so v must be negative!



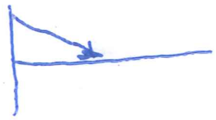


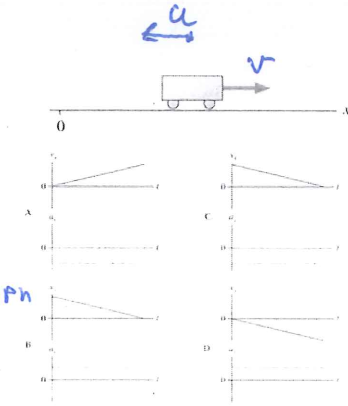
accelerating left, so x must look like a frownie



10. A cart ***slows down*** while moving away from the origin. What do the velocity and acceleration graphs look like?

velocity right, so v must be positive





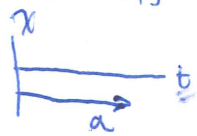
Ⓐ A

Ⓑ B

Ⓒ C

Ⓓ D

acceleration left, so below axis on "a" graph



11. Question 11

Ⓐ A

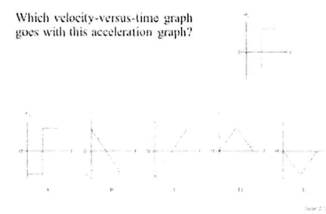
Ⓑ B

Ⓒ C

Ⓓ D

Ⓔ E

Slope should be negative at first, then Positive.



12. A car moves along a straight stretch of road. The following graph shows the car's position as a function of time:

At what point(s) is the displacement zero?

Ⓐ A

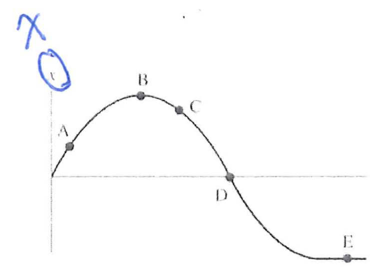
Ⓑ B

Ⓒ C

Ⓓ D

Ⓔ E

returns to zero



13. A car moves along a straight stretch of road. The following graph shows the car's position as a function of time:

At what point(s) is the speed zero?

Ⓐ A

Ⓑ B

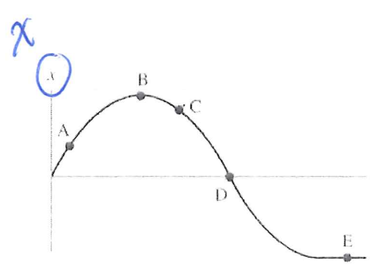
Ⓒ C

Ⓓ D

Ⓔ E

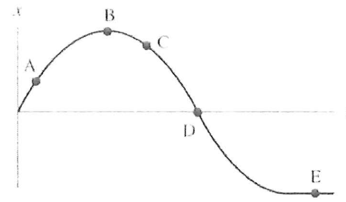
Ⓕ B & E

Slope is zero at these two points



14. A car moves along a straight stretch of road. The following graph shows the car's position as a function of time:

At what point(s) is the speed increasing?

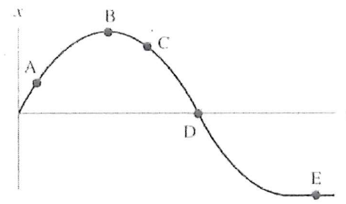


Slope is getting steeper.

- (A) A
- (B) B
- (C) C
- (D) D
- (E) E
- (F) C & D

15. A car moves along a straight stretch of road. The following graph shows the car's position as a function of time:

At what point(s) is the speed decreasing?



Slope is becoming less steep.

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

16. The area of a *velocity vs. time* graph respresents:

- (A) Acceleration
- (B) Displacement
- (C) Average velocity
- (D) Instantaneous velocity
- (E) None of the above

17. The slope of a *velocity vs. time* graph represents:

- (A) Acceleration
- (B) Displacement
- (C) Average velocity
- (D) Instantaneous velocity
- (E) None of the above

18. The slope of an *acceleration vs. time* graph respresents:

- (A) Acceleration
- (B) Displacement
- (C) Average velocity

(D) Instantaneous velocity

(E) None of the above

19. The <u>area</u> of an ***acceleration vs. time*** graph represents:

(A) Acceleration

(B) Displacement

(C) Instantaneous velocity

(D) Change in velocity

(E) None of the above

Just like the area of a velocity vs. time graph can only give us a change of position (displacement), the area of an acceleration vs. time graph can only get us a change of velocity.

20. When ***must*** an object "Slow Down"?

(A) When acceleration and velocity point in opposite directions

(B) When acceleration is negative

(C) When acceleration and velocity point in the same direction

(D) When velocity is negative

(E) When velocity and acceleration are both constant

21. The following graph is a position vs time graph. At which instance of time is the speed the greatest?

(A) A

(B) B

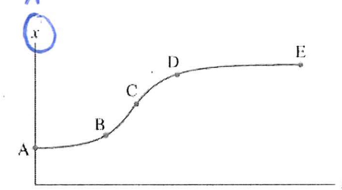
(C) C

(D) D

(E) E

Slope is steepest

x



22. The following graph is a position vs. time graph. The velocity at instant 1 is ____________ while the velocity at instant 2 is ____________

(A) positive, negative

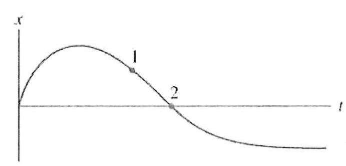
(B) positive, negative

(C) negative, negative

(D) negative, positive

(E) positive, zero

Both negative slope.



23. A car is traveling at v_x=36 m/s. The driver applies the brakes and the car decelerates at 6.0 m/s^2. What is the stopping distance?

(A) 4.0 m

(B) 130 m

(C) 120 m

$V_i = 36\ m/s$

$a = -6\ m/s^2$

$V_f = 0$

$\Delta x = ?$

negative because slowing down means acceleration points in opposite direction of velocity

$V_f^2 = V_i^2 + 2a\Delta x$

$\Delta x = \frac{-V_i^2}{2a} = \frac{-(36)^2}{2(-6)} = \boxed{108\ m}$

110 m

v_i v_f t

24. Car A can go from 0 to 60mph in 16s.

a

Car B is capable of maintaining twice the acceleration of that of Car A, even ar higher speeds. How much time would be required for Car B to go from 0 to120mph?

A 4.0 s

B 12 s

C 16 s

D 8.0 s

$v_f = \cancel{v_i}^{0} + at$ $\quad t = \frac{v_f}{a}$

$t \propto v$ $\quad t \propto \frac{1}{a}$

Looking at the proportionalities: doubling v_f doubles t. doubling "a" halves t. So overall, t does not change

25. Chameleons catch insects with their tongues, which they can rapidly extend to great lengths. In a typical strike, the chameleon's tongue accelerates at a remarkable 260 m/s^2 for 20ms, then travels at a constant velocity for another 30ms.

0.02 seconds 0.03 seconds

During the total time of 50ms, how far does the tongue reach?

A 0.208 m (20.8 cm)

B 1.23 m (123 cm)

C 0.052 (5.2 cm)

D 2.53 m (253 cm)

E 0.156 m (15.6 cm)

1st part

$a = 260\ m/s^2$

$t = 0.02$ sec

$v_i = 0$

$\Delta x = ?$

$\Delta x = \cancel{v_i t}^{0} + \frac{1}{2}at^2$

$\Delta x = \frac{1}{2}(260)(0.02)^2$

$\Delta x = 0.052\ m$

$v_f = v_i + at = 0 + 260(0.02) = 5.2\ m/s$

2nd part

$\Delta x = v \cdot t$

$\Delta x_2 = (5.2)(0.03)$

$\Delta x_2 = 0.156$

$0.052 + 0.156$

$\boxed{\Delta x_{total} = 0.208\ m}$

26. Suppose a racer must finish a race with an average velocity of 150 km/h. If he starts with a velocity of 100 km/h and assuming constant acceleration, what velocity must he finish the race with?

A 150 km/h

B 100 km/h

C 200 km/h

D 273 km/h

E 50 km/h

$\frac{100 + 200}{2} = 150$

27. An object slides down a ramp. Which of the following statements are true?

A Speed increases

B Acceleration increases

C Both Speed and Acceleration Increases

D None of the above

28. Suppose you take a trip that covers 180 km and takes 3 hours to make. Your average velocity it

A 30 km/h

B 60 km/h

C 180 km/h

$v_{avg} = \frac{\Delta x}{t} = \frac{180}{3} = 60$

D) 360 km/h

E) 540 km/h

29. A car accelerates at 2 m/s^2. Assuming the car starts from rest, how much time does it need to accelerate to a velocity of 20 m/s?

$v_i = 0$

A) 2 seconds

B) 10 seconds

C) 20 seconds

D) 40 seconds

E) none of the above

$a = 2\ m/s^2$

$v_i = 0$

$v_f = 20\ m/s$

$t = ?$

$v_f = v_i + at$

$t = \frac{v_f - v_i}{a} = \frac{20 - 0}{2} = \boxed{10 \text{ seconds}}$

30. Suppose an object has an initial velocity of 40 m/s and has an acceleration of -10 m/s^2. How long will it take the object to return to its original position?

$\Delta x = 0$

A) 4 seconds

B) 8 seconds

C) 10 seconds

D) 400 seconds

E) It will never return to its original position

$v_i = 10\ m/s$

$a = -10\ m/s^2$

$\Delta x = 0$

$t = ?$

$\Delta x = v_i t + \frac{1}{2} a t^2$

$0 = t (v_i + \frac{1}{2} a t)$

$0 = v_i + \frac{1}{2} a t$

$t = \frac{-2 v_i}{a} = \frac{-2(40)}{-10}$

$\boxed{t = 8 \text{ seconds}}$

31. A vector quantity is a quantity that has

A) magnitude and time

B) time and direction

C) magnitude and direction

32. Acceleration is defined by a CHANGE in

A) time it takes to move from one place to another place

B) velocity of an object

C) distance divided by the time interval

D) velocity divided by the time interval

E) time it takes to move from one speed to another speed

33. When you look at the speedometer in a moving car, you can see the car's

A) average distance traveled

B) instantaneous acceleration

C) average speed

D) instantaneous speed

E) average acceleration

34. Challenge Question: Suppose you are in a car that is going around a curve. The speedometer reads a constant 30 mph. Which of the following is NOT true.

(A) You and the car are accelerating

(B) Your acceleration is constantly changing

(C) Your velocity is constant → your direction is changing.

(D) Your direction is constantly changing

(E) Your speed is constant

35. It is possible to have a positive acceleration and a negative velocity at the same instant.

(A) True

(B) False

If an object is slowing down, then acceleration must be opposite of velocity

36. If an objects velocity is zero, then its acceleration must also be zero.

(A) True

(B) False

Toss a pen up. At the top, the pen stops but the earth is still pulling down on it.