**Kinematics - Motion Graphs Key Points**

Variables

 Time (t)

Position (x) - \_\_\_\_\_\_\_\_\_\_\_\_ an object is

Speed or velocity (v) - how \_\_\_\_\_\_\_\_\_\_ it is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Acceleration (a) – how \_\_\_\_\_\_\_\_\_\_\_\_ its \_\_\_\_\_\_\_\_\_\_\_\_\_ is changing

 Displacement (Δx)

Distance vs. displacement

 Distance is \_\_\_\_\_\_\_\_\_\_\_\_\_\_ amount an object has traveled

 Displacement is \_\_\_\_\_\_ \_\_\_\_\_\_\_\_ the object ends up from its starting point

Velocity approximation

 A quick approximation to change m/s to mph is to a little more than \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the \_\_\_\_ to get \_\_\_\_\_

Position time graph

* Slope is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Therefore, the steeper the line, the \_\_\_\_\_\_\_\_ the object is moving
* Straight lines mean \_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, curved lines mean \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Velocity Time Graph

* Slope is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Area between the graph and the x-axis is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Area under the x-axis means the object is moving \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the area would be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_ cannot be determined, only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The sign of velocity tells the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Acceleration Time Graph

* Area between the graph and the x-axis is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Acceleration doesn’t say anything about which way an object is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Speeding up and slowing down

* If velocity and acceleration have the **\_\_\_\_\_\_** sign, the object is speeding up. This is seen on a velocity time graph by moving \_\_\_\_\_\_\_\_\_\_\_\_\_ from the x-axis (this is different than \_\_\_\_\_\_\_\_\_\_\_\_\_ the x-axis)
* If velocity and acceleration have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_signs, the object is slowing down. This is seen on a velocity time graph by moving \_\_\_\_\_\_\_\_\_\_\_\_\_ the x-axis (this is different than \_\_\_\_\_\_\_\_\_\_\_\_ the x-axis)

|  |  |
| --- | --- |
|  |  *V E L O C I T Y* |
|  *ACCELERATION* |  | **+** | **-** |
| **+** |  |  |
|  **-** |  |  |

AP Physics C

* Velocity is the \_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Acceleration is the \_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Velocity is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Position is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* This means that in addition to a \_\_\_\_\_\_\_\_\_\_\_\_\_\_, I can give you an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and ask you to find position, velocity, and acceleration

Example

The position of an object moving along a straight line is given by  where x is in meters and t in seconds.

a) Derive the expressions for the velocity and acceleration of the object as a function of time.

b) Find the position of the object at t = 0, t = 2s, t = 4s.

c) Find the displacement or the object between t = 2s and t = 4s; between t = 0s and t = 4s.

d) Find the average velocity between t = 2s and t = 4s

e) What is the instantaneous velocity at t = 2s?

f) At what time(s) is/are the instantaneous velocities zero?

g) When does the instantaneous velocity have a maximum or a minimum value?

h) When is the instantaneous acceleration of the object zero?

Examples









