Motion on a Position vs Time Graph

Name:

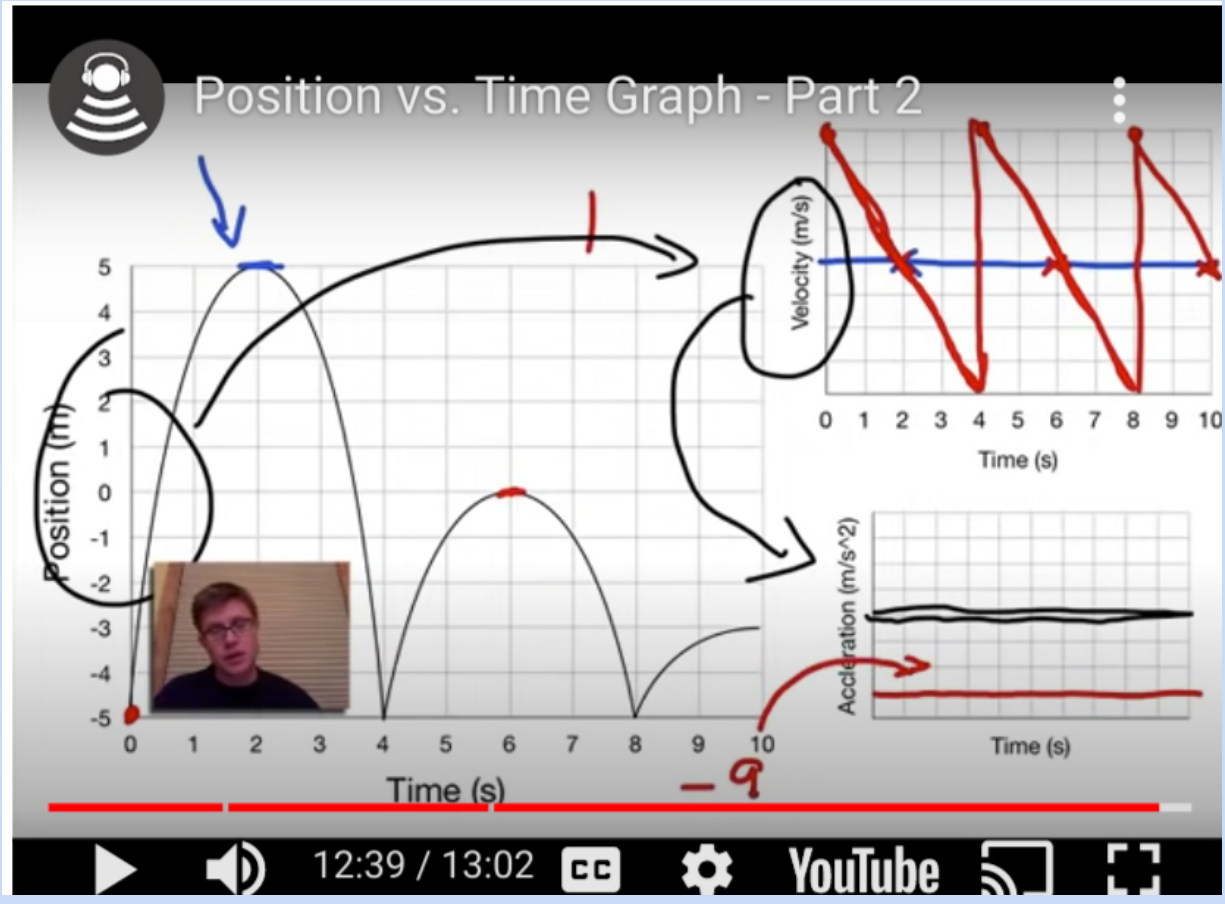
INTRODUCTION:

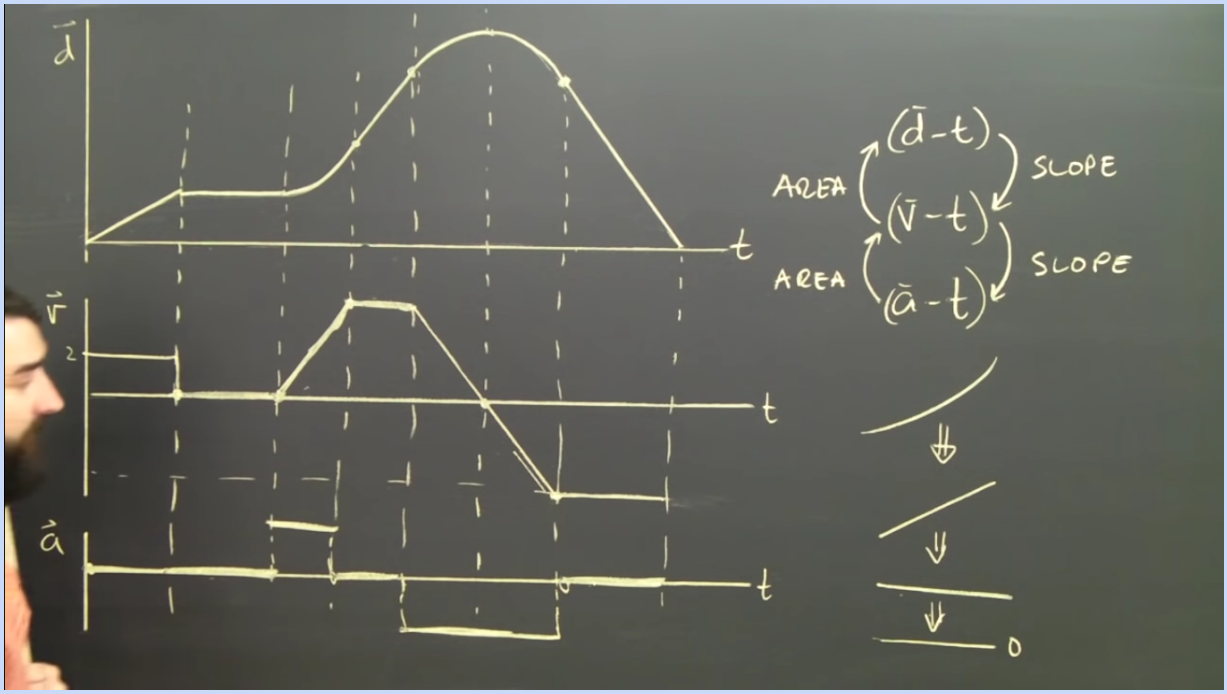
In this activity you will read about and then explore how to describe motion on a position vs time graph. Remember the slope of a Position vs Time graph is the Velocity. ***Velocity* is the rate of speed in which something happens in a particular direction.**

BACKGROUND INFORMATION:

Complete this reading: Position vs Time Graphs (ck-12). Then summarize your learning (2pts)

1) The slope of a position v time graph equals velocity.
2) The slope of the velocity v time graph equals acceleration
3) When plotting the slope, identify the places where the slope equals zero.
4) The slope of a curve like x^2 line is a straight line with constant slope (2).
5) The slope of the inclined line is a horizontal line.
6) The slope of the horizontal line is zero.
7) (I think the graph below is a little inaccurate: it could better show that the slope of the position-time curve is decreasing with each bump).



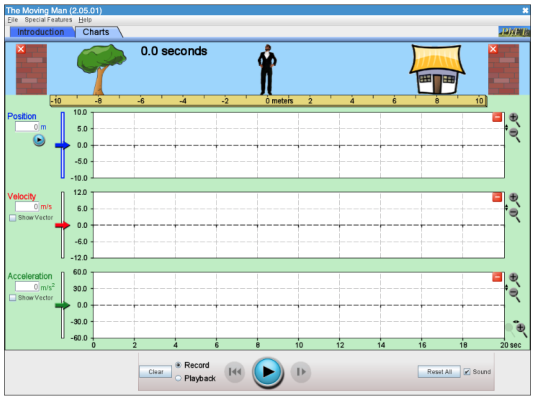


https://www.youtube.com/watch?v=EZXLkAYjmR0

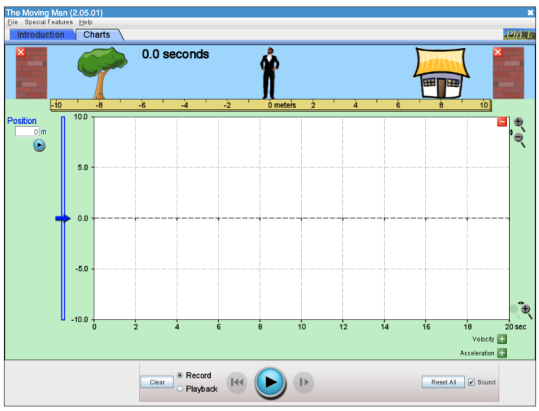
Note:You may find it helpful to review the Live Class recording from 10/10 if you missed class.

SIMULATION SET UP:

1. Open the Moving Man Phet Simulation. It will take a second to load.
2. Click on “Charts” found on the top left next to “Introduction”
3. You will get this image:



3. Click on the red square with the white dash in “velocity” then the red square in acceleration to make your The Moving Man look like this:



4. You should now only have the Position vs Time graph showing.

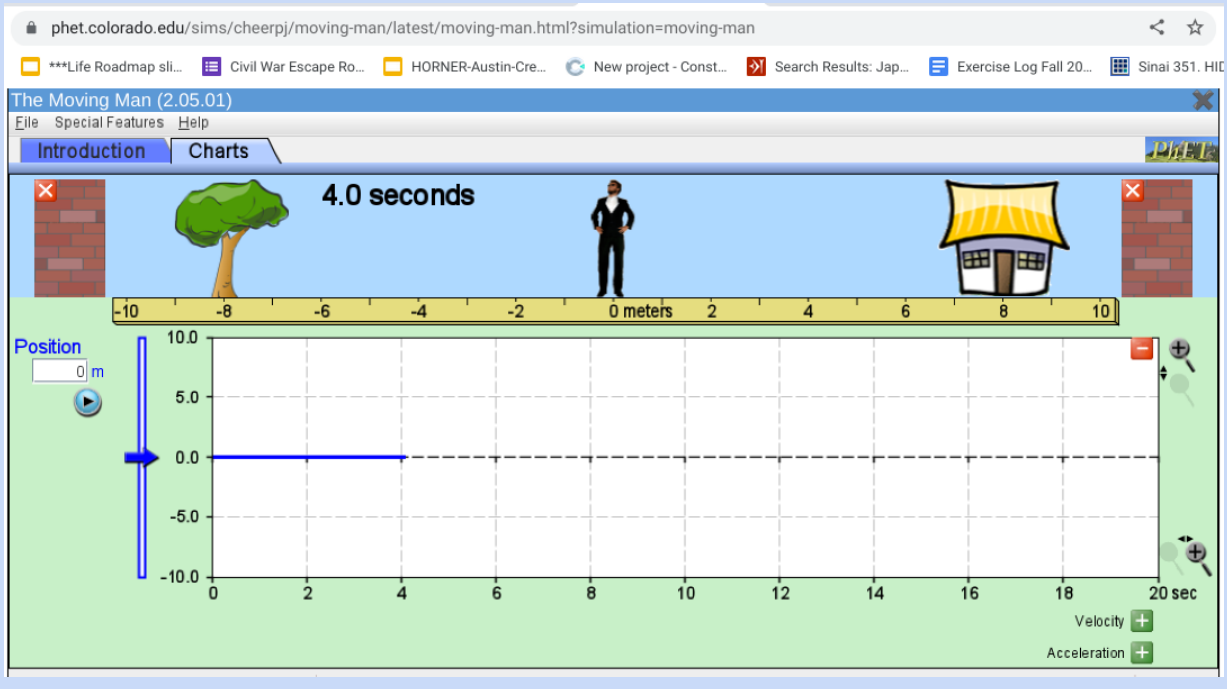
EXPLORE

1. Start your simulation by clicking on the play button at the bottom. If you don't click the play button your graph will not work.

Clear your graph and start at the origin, Zero:

2. Start your sim and don't move your man.
   a. Take a screenshot and enter it in the box below.
   b. Answer in the box: What do you notice about the slope? What does that tell you?

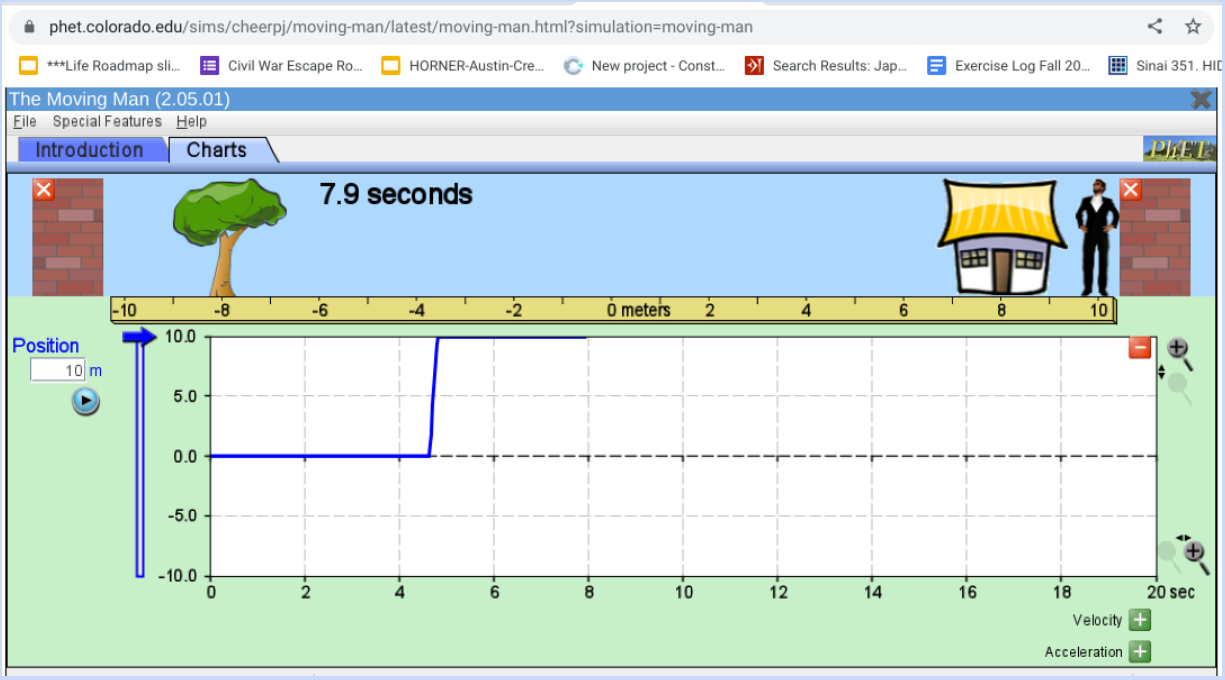
The flat slope indicates that the man is not moving



Clear your graph and start at the origin, Zero:

3. Move your man quickly to the right, positive velocity, and then stop him.
    a. Take a screenshot and enter it in the box below.
    b. Answer in the box: What do you notice about the slope? What does that tell you?

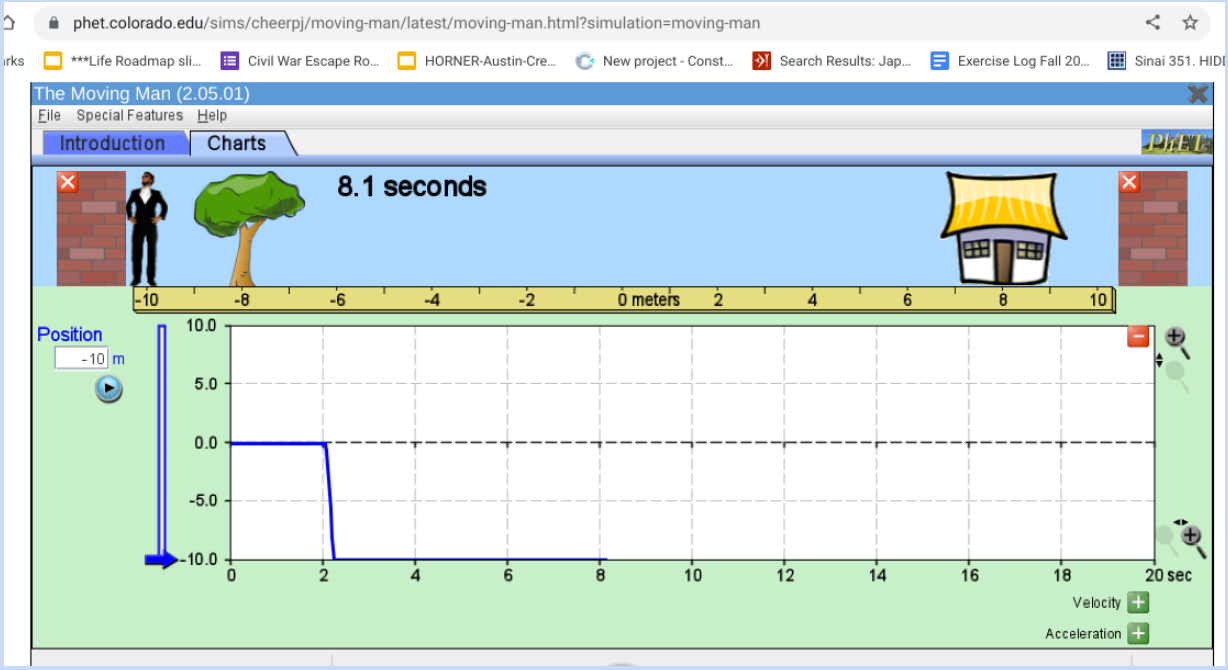
Sudden motion to the right makes a steep positive slope. The slope is flat when the man stops.



Clear your graph and start at the origin, Zero:

4. Move your man quickly to the left, negative velocity, and then stop him.
    a. Take a screenshot and enter it in the box below.
    b. Answer in the box: What do you notice about the slope? What does that tell you?

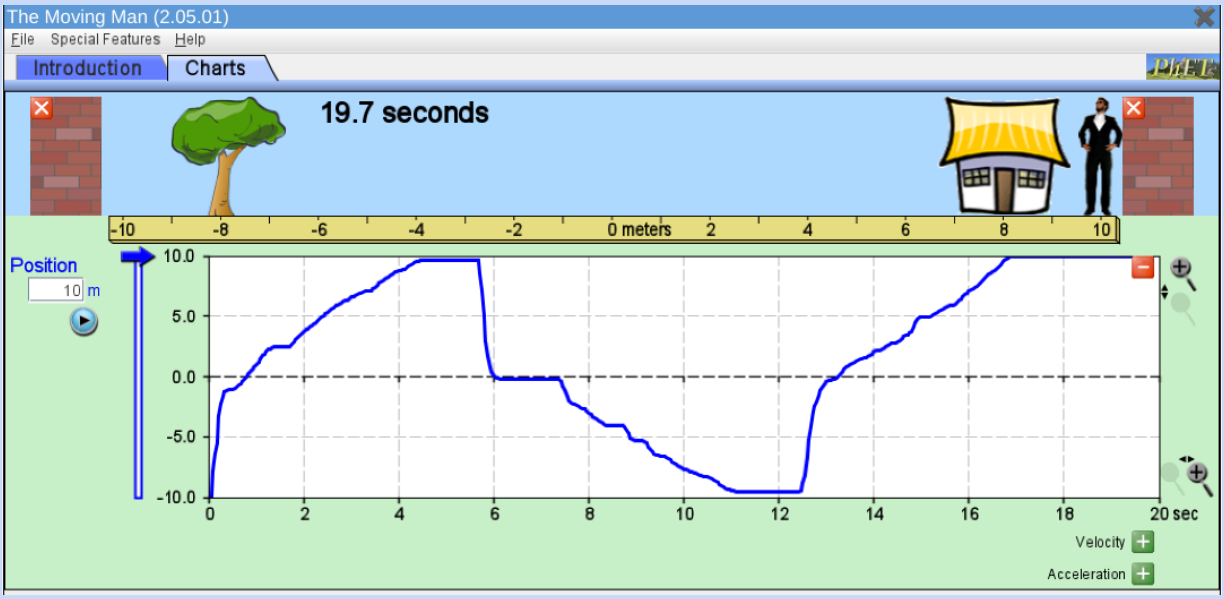
When the man was still at the origin, the position for flat at the zero level. When the man was moved quickly to the left, the position fell steeply from 0 to -10 and then flat-lined.



Clear your graph and start at the origin, Zero:

5. Move your man quickly at first (either direction) and then slow to a stop. Then move your man in the opposite direction quickly and then slow to a stop. positive velocity quickly at first then slow to a stop.
    a. Take a screenshot and enter it in the box below.
    b. Answer in the box: What do you notice about the slope? What does that tell you?

Moving quickly right (t =0, t =1) make a steep slope upward. As the man slows (t=2 to t=4.5) there is a gentle slope upward. When he, stops (t=5) the slope is flat. When he goes quickly left (t=5.5 to t=6) the slope is steep downward. When he stops at the origin at t =6, the slope is flat. When he continues to the left slowly, there is a downward slope until t=12. Then he suddenly moves right making a steep upward slope until t-13. He slows and stope at t=17.



Clear your graph and start at the origin, Zero:

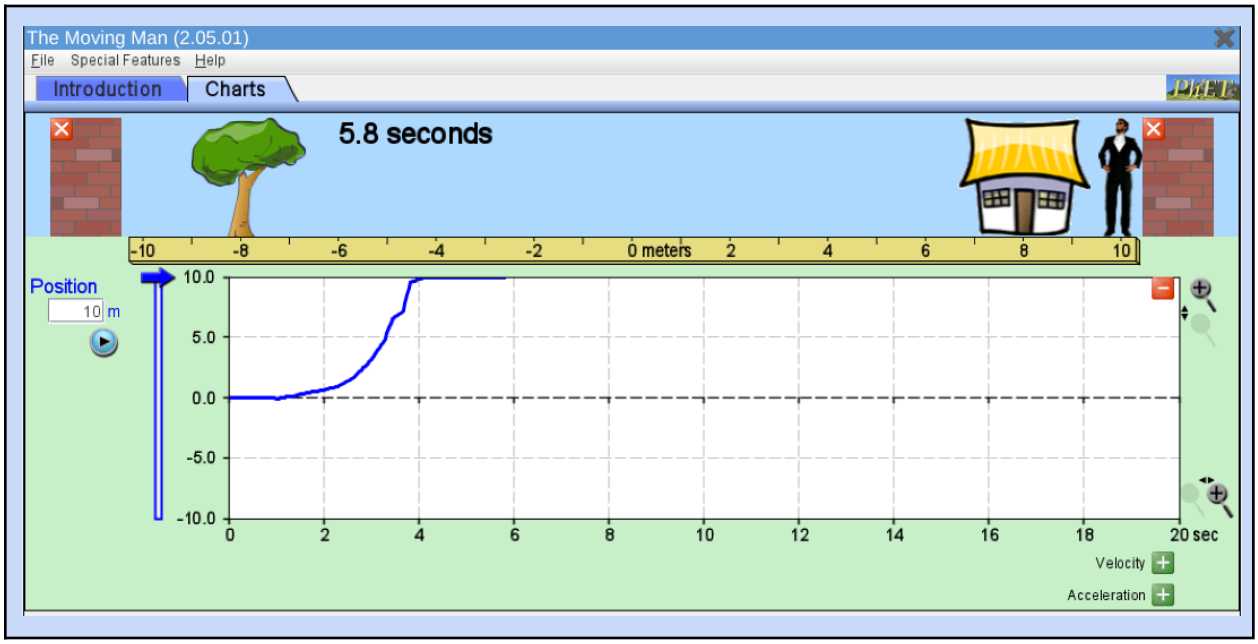
6. Move your man to the right, positive velocity, then to the left, negative velocity, crossing the origin. Do this 10 times.
    a. Take a screenshot and enter it in the box below.
    b. Answer in the box: What do you notice about the slope? What does that tell you?

The slope made a steep positive for motion to the right, and a steep negative for motion to the left. The wave crossed the zero point.

Clear your graph and start at the origin, Zero:

7. Move your man slowly at first then speed up.
    a. Take a screenshot and enter it in the box below.
    b. Answer in the box: What do you notice about the slope? What does that tell you?

Moving slowly to right makes slight upward curve, speeding up makes a much more steep upward curve.



ANALYZE:

1. What does the slope on the position vs time chart or graph mean? How do you know?

The slope on a position vs time chart indicates the velocity. Velocity is the change in position over the change in time, the rise over the run, or the slope of the position vs time curve.

2. What does velocity describe? Use evidence from the blue charts to support your answer.

Velocity describes the slope of the position vs time graph. Graph 7 shows show the slope increases with increasing velocity. Chart 6 shows a deep narrow wave in the position vs time, and the slope changes from steep positive to steep negative as the velocity changes from positive to negative rapidly.

3. Compare and contrast position and velocity. How are they related?

The velocity is based on the change of position per unit time. The velocity is the slope of the position vs. time slope.

a) If the velocity is zero, the position vs time graph will be flat.
b) If the velocity curve is flat but non-zero, the velocity is constant and the position vs time curve will change at a constant rate. It will be a straight rising line if the velocity is a positive constant, and a straight negative line if the velocity is a constant negative.
c) If the velocity is increasing linearly, then the position vs time graph will be curved.
d) When there is a flat tangent point on the position vs time curve, the velocity is zero.