

Section B: Kinematic Graphs 1

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Unit: One-Dimensional Kinematics

Level: 1

Prerequisites: None

Points to:

Goals:

- to be able to recognize the position-time, velocity-time and acceleration-time graphs of each of these main types of motion:

1. constant velocity motion
2. not moving
3. positive acceleration motion (speeding up)
4. negative acceleration motion (slowing down)

Questions on this quiz are entirely *multiple choice*.

Section B: Kinematic Graphs 1

Part C: Position-Time Graphs

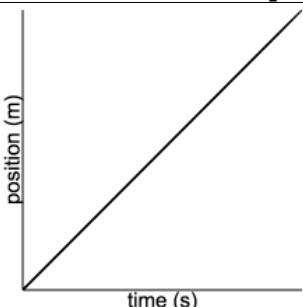
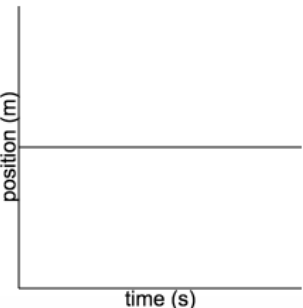
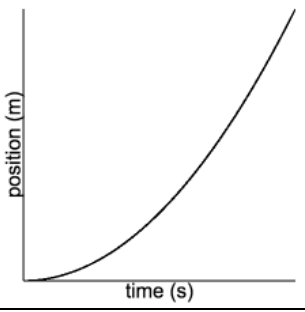
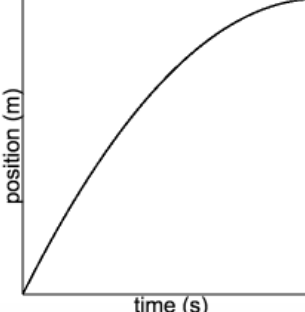
Position-Time Graph

A position-time graph shows *where an object is*.

Whenever the position is changing, that means an object is moving.

The faster position changes, the faster something is moving

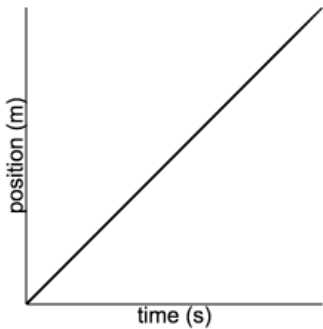
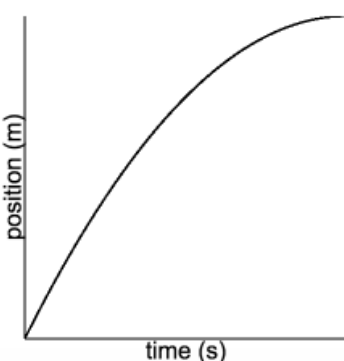
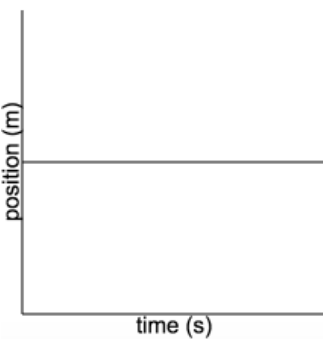
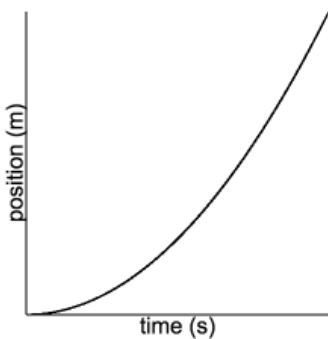
Important position-time graphs;

Type of Motion	Position-Time Graph	Discussion
Constant Velocity Motion	 A position-time graph with 'position (m)' on the vertical axis and 'time (s)' on the horizontal axis. A straight line starts at the origin (0,0) and extends upwards and to the right at a constant slope.	A straight line upward. Position is changing at a constant rate.
Not Moving	 A position-time graph with 'position (m)' on the vertical axis and 'time (s)' on the horizontal axis. A horizontal line is drawn at a constant position value on the vertical axis.	A horizontal line. Position is not changing.
Positive Acceleration	 A position-time graph with 'position (m)' on the vertical axis and 'time (s)' on the horizontal axis. A curve starts at the origin (0,0) and curves upwards, becoming steeper as time increases.	- Curves upward. - The curve shows velocity getting higher and higher. - This shape is called a <i>parabola</i> .
Negative Acceleration (Deceleration)	 A position-time graph with 'position (m)' on the vertical axis and 'time (s)' on the horizontal axis. A curve starts at the origin (0,0) and curves upwards, but its slope decreases as time increases, eventually leveling off.	- This is the <i>most challenging graph</i> . See more explanation below. - This shape is called an <i>upside down parabola</i> .

Section B: Kinematic Graphs 1

Matching Activity

For each of the choices 1, 2, 3, and 4 chose which position-time graph shows it:

1. A runner with a constant velocity. 2. An accelerating car. 3. A person sitting on the couch. 4. A decelerating bicycle.	Graph A 	Graph B 
	Graph C 	Graph D 

The Most Challenging Kinematic Graph

The most *challenging* of the graphs is the position-time graph for something with a *negative acceleration*.

Even though the *speed* is decreasing, the object is still moving forward, so the position-time graph goes *up*, not down.

5a. Imagine you are driving and you hit your brake. Does your car continue to move forward?

5b. How is this fact shown in the kinematic graph?

Section B: Kinematic Graphs 1

Drawing Activity

Draw a kinematic graph for each of the following situations.

Whenever you draw a graph, you MUST label both of the two axes of the graph.

6. A person is walking down the hallway at a constant velocity.

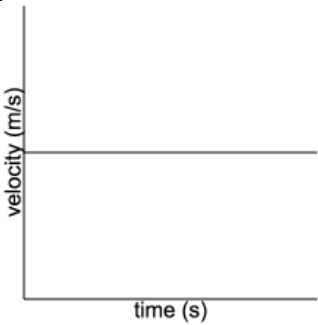
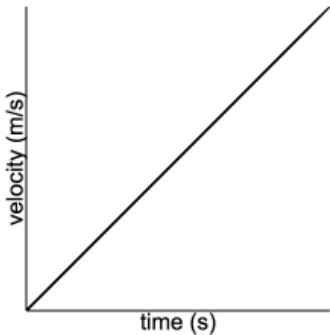
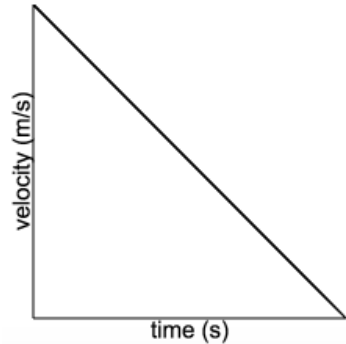
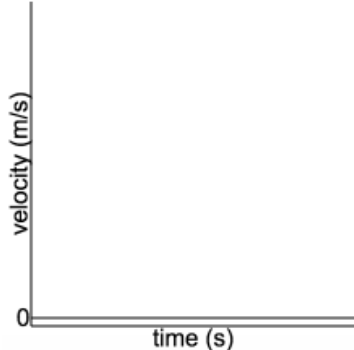
7. A car at a stop sign starts driving very fast.

8. A lazy dude does nothing all day.

9. A light ahead of a car turns red and the car slows down to a stop.

Section B: Kinematic Graphs 1

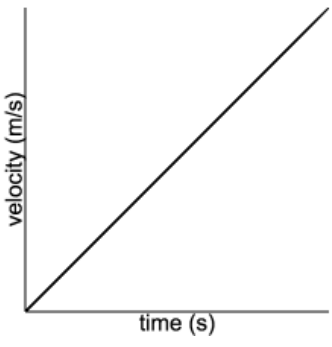
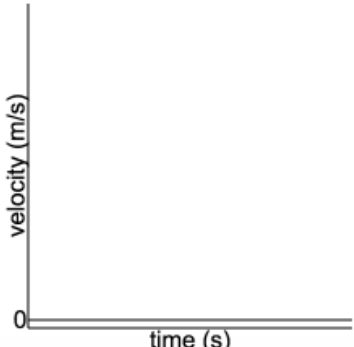
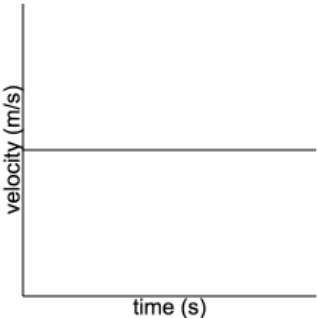
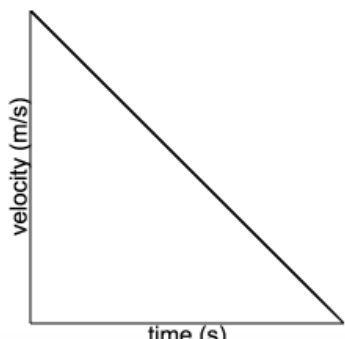
Part 3: Velocity-Time Graphs:

Type of Motion	Velocity-Time Graph	Explanation
Constant Velocity		- If velocity is constant, it is represented by a horizontal line.
Positive Acceleration		- When something is accelerating, velocity is increasing.
Negative Acceleration (Deceleration)		- When something is decelerating, velocity is decreasing.
Not Moving		-Whenever something is not moving, velocity is zero.

Section B: Kinematic Graphs 1

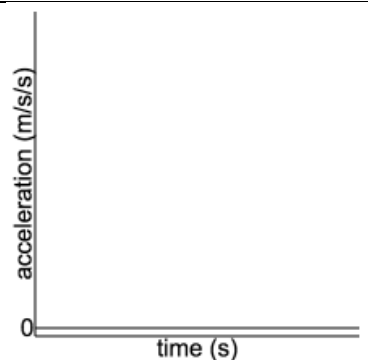
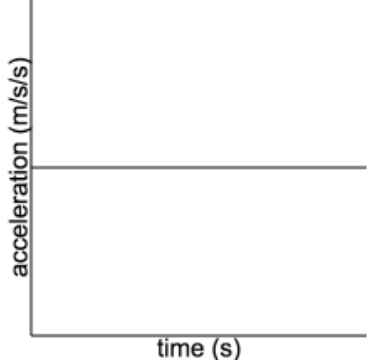
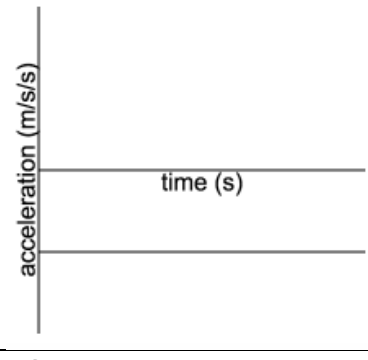
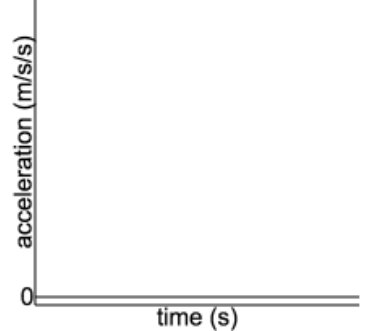
Matching Activity

For each of the choices 1, 2, 3, and 4 chose which velocity-time graph shows it:

<p>1. A runner with a constant velocity.</p> <p>2. An accelerating car.</p>	<p>Graph A</p> 	<p>Graph B</p> 
<p>3. A person sitting on the couch.</p> <p>4. A decelerating bicycle.</p>	<p>Graph C</p> 	<p>Graph D</p> 

Section B: Kinematic Graphs 1

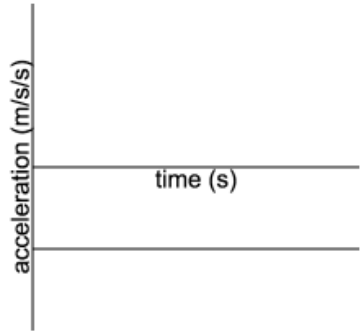
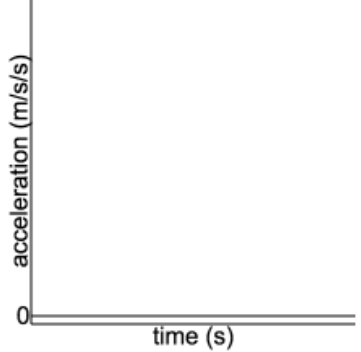
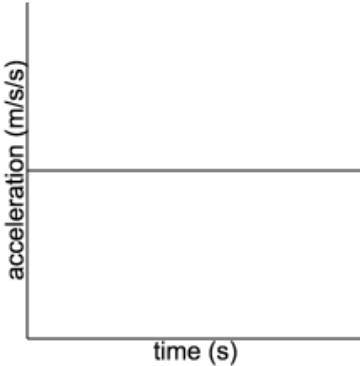
Part 4: Acceleration-Time Graphs

Type of Motion	Acceleration-Time Graph	Explanation
Constant Velocity	 <p>The graph shows a horizontal line at zero acceleration on the y-axis, labeled 'acceleration (m/s/s)', against time on the x-axis, labeled 'time (s)'. The origin is marked with '0'.</p>	<ul style="list-style-type: none"> - If velocity is constant, acceleration is zero. - This graph represents an object whose acceleration is always zero.
Positive Acceleration	 <p>The graph shows a horizontal line at a positive value on the y-axis, labeled 'acceleration (m/s/s)', against time on the x-axis, labeled 'time (s)'.</p>	<ul style="list-style-type: none"> - Acceleration is positive. - The line <i>above</i> the x-axis represents this.
Negative Acceleration (Deceleration)	 <p>The graph shows a horizontal line at a negative value on the y-axis, labeled 'acceleration (m/s/s)', against time on the x-axis, labeled 'time (s)'.</p>	<ul style="list-style-type: none"> - Acceleration is negative. - The line <i>below</i> the x-axis represents this.
Not Moving	 <p>The graph shows a horizontal line at zero acceleration on the y-axis, labeled 'acceleration (m/s/s)', against time on the x-axis, labeled 'time (s)'. The origin is marked with '0'.</p>	<ul style="list-style-type: none"> - If something is not moving, acceleration is clearly zero.

Section B: Kinematic Graphs 1

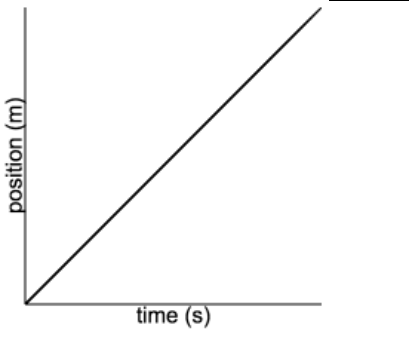
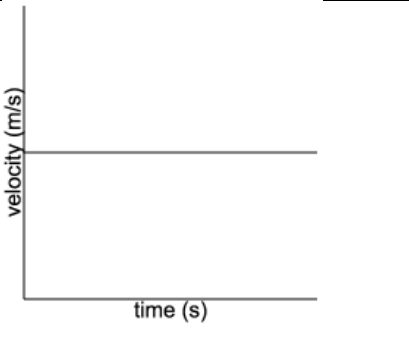
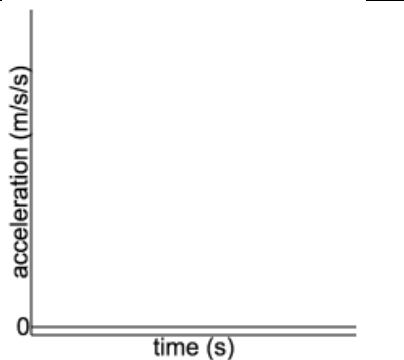
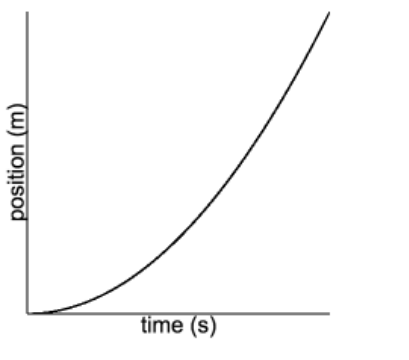
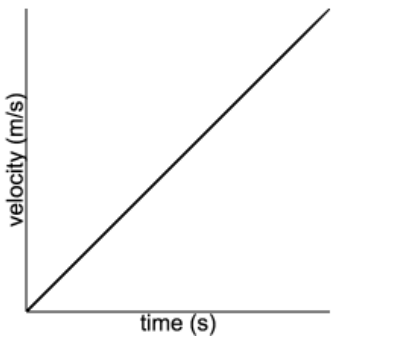
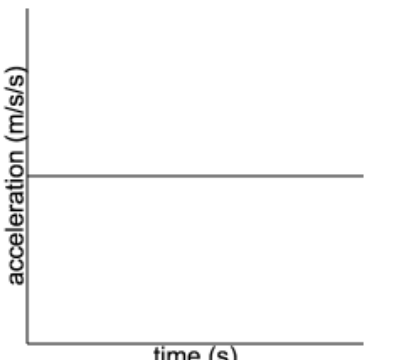
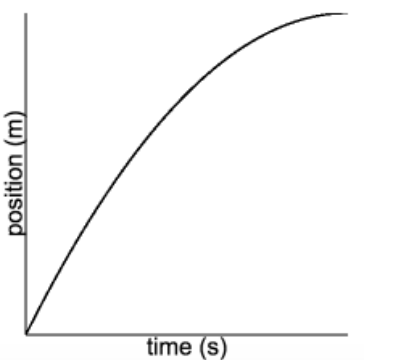
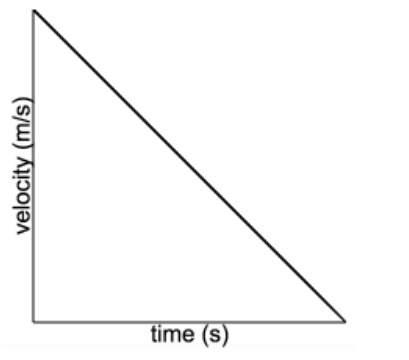
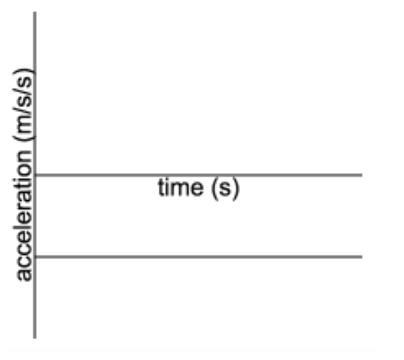
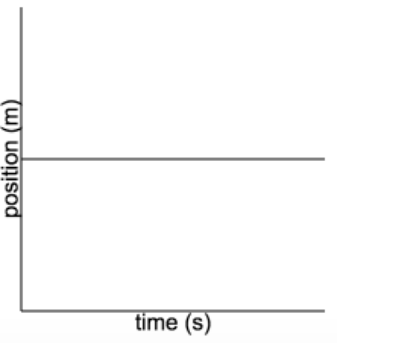
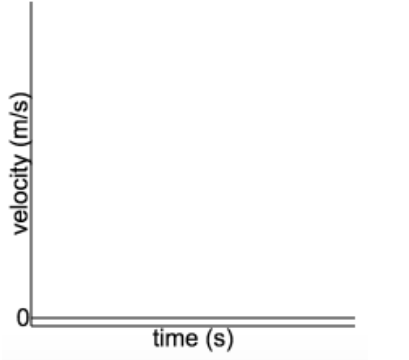
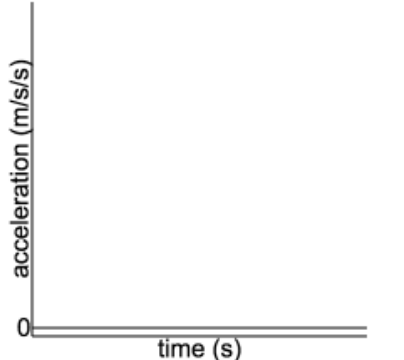
1. Which two types of motion have identical acceleration-time graphs? Why?

For questions 2, 3, and 4, choose an acceleration graph that represents the motion.

2. No Acceleration	3. Positive Acceleration	4. Negative Acceleration
<p>Graph A</p> 	<p>Graph B</p> 	<p>Graph C</p> 

Section B: Kinematic Graphs 1

Part 5: A reference of all graphs you must memorize:

CONSTANT VELOCITY		
		
POSITIVE ACCELERATION		
		
NEGATIVE ACCELERATION		
		
NOT MOVING		
		

Section B: Kinematic Graphs 1