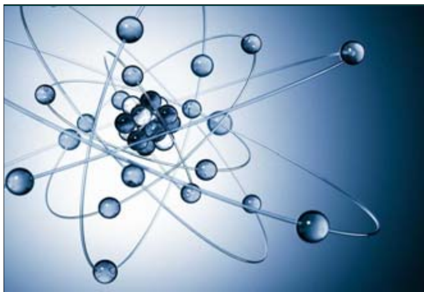
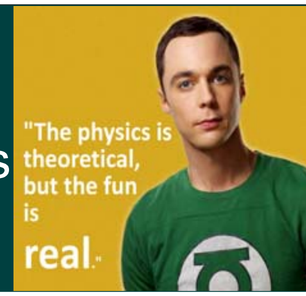


Unit 1: Kinematics

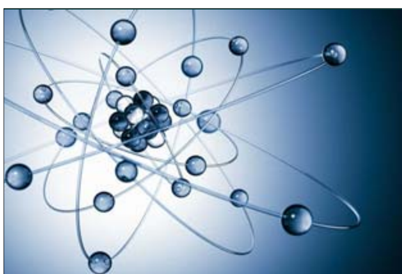


1.4 Analyzing Graphs

We have studies three types of graphs in Kinematics:

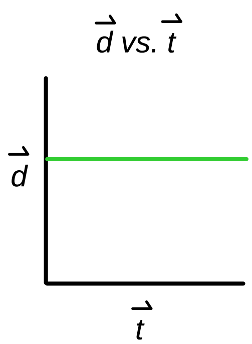
- distance-time
- velocity-time
- acceleration-time

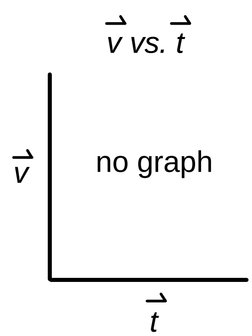
Each graph we look at tells us a story about the movement of an object.

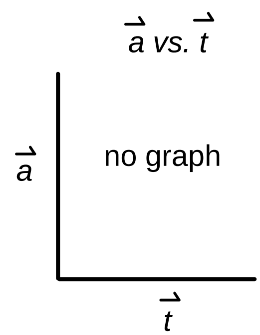


Case 1: No Movement

- uniform motion
- zero velocity, zero acceleration
- distance does not change with respect to time

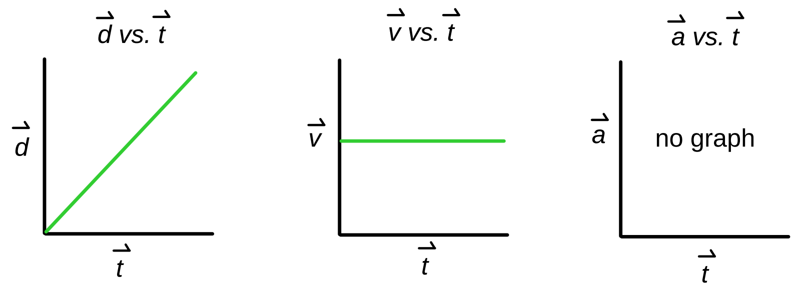






Case 2: Constant Velocity (positive)

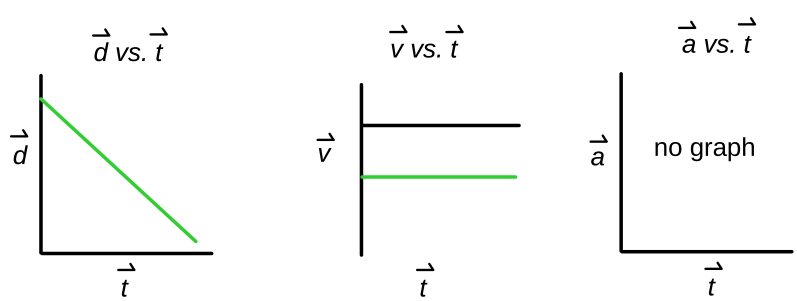
- uniform motion, positive direction (up, right, east, north)
- can use $\vec{v} = \vec{d}/t$
- zero acceleration



slope of distance vs. time graph gives velocity

Case 3: Constant Velocity (negative)

- uniform motion, negative direction (down, left, west, south)
- can use $\vec{v} = \vec{d}/t$
- zero acceleration

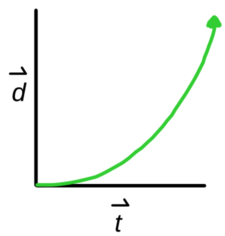


slope of distance vs. time graph gives velocity

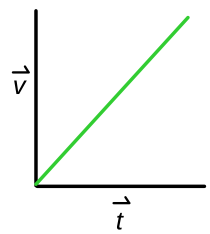
Case 4: Constant Acceleration (positive)

- changing velocity
- must use kinematics equations
- positive acceleration ($\vec{a}$ in same direction as $\vec{v}$)

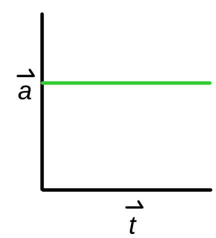
$\vec{d}$ vs. $\vec{t}$



$\vec{v}$ vs. $\vec{t}$



$\vec{a}$ vs. $\vec{t}$

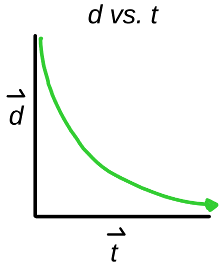


slope of velocity vs. time graph gives acceleration

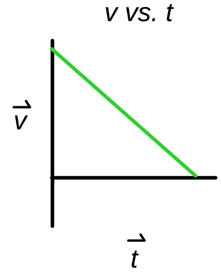
Case 5: Constant Acceleration (negative)

- changing velocity
- must use kinematics equations
- negative acceleration ($\vec{a}$ in opposite direction as $\vec{v}$)

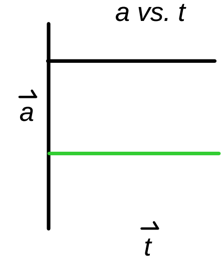
$\vec{d}$ vs. $\vec{t}$



$\vec{v}$ vs. $\vec{t}$



$\vec{a}$ vs. $\vec{t}$



slope of velocity vs. time graph gives acceleration

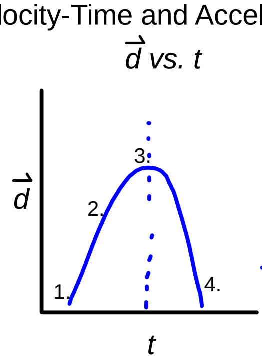
Summary

- slope of $\vec{d}$ *vs. t* gives $\vec{v}$
- slope of $\vec{v}$ *vs. t* gives $\vec{a}$
- area under $\vec{v}$ *vs. t* gives $\vec{d}$

} Unit Analysis

Throwing an Object Into the Air

We look at Displacement-Time Graphs of objects thrown into the air in Math 20-1. Now we need to think about how we can transfer the information we know from these graphs onto Velocity-Time and Acceleration time graphs.



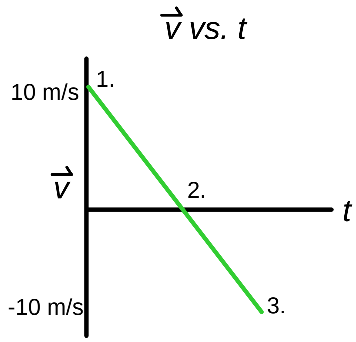
1. Starts at (0,0). Time zero and height zero.

2. As time increases, objects distance away from us increases (gravity pulls on the object resulting in the curve of the graph).

3. Object reaches max. height with a veolicty of zero but acceleration is still -9.81 m/s².

4. Object return to starting point in same amount of time it took to reach max. height(symmetry).

Now think about how the velocity-time graph would look for the same scenario.

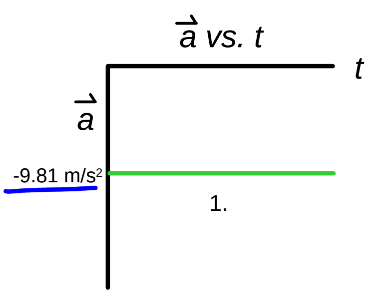


1. Assume we throw the object at 10 m/s. As it rises, it slows down due to gravity's deceleration.

2. The *t-int* indicates a velocity of zero or the moment when the object reaches max. height/the vertex.

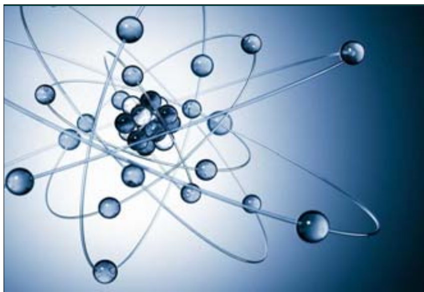
3. The object then travels downward (negative velocity) until it is caught here.

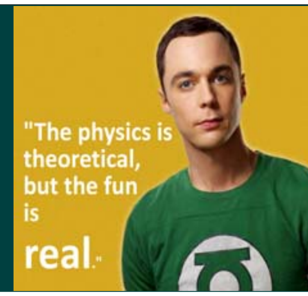
What about the acceleration-time graph?



1. Acceleration due to gravity is always -9.81 m/s^2.

*We only deal with constant acceleration in this course. This means all acceleration graphs will be horizontal lines.





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