Kinematics Quantity Dictionary Assignment
First Draft Due 12-11
Final Draft Due 12-21 [before Christmas break]

Create a *dictionary* of quantities within kinematics.

They are divided into four families, based on the units of that particular quantity.

Meters family
Distance
Displacement
Position
Initial Position
Final Position

Meters per second family
Instantaneous velocity
Average Velocity
Instantaneous Speed
Average Speed
Final Velocity
Initial Velocity
Change in Velocity

Meters per second squared family
Acceleration

Seconds Family
Time
Change in Time

For each of the 15 quantities listed, you must write a dictionary entry. The entry must include lements listed in the table below:

Meters Family (How Far?)

Quantity	**Written Definition**	**Equation Definition**	**Algebraic Symbol**	**Vector or Scalar?**	**Useful Application**	**How to Calculate**	**Why is it a vector?**
Distance	x		x	x	x	x	
Displacement	x	x	x	x	x	x	x
Position	x		x	x	x	x	x
Initial Position	x		x	x			
Final Position	x		x	x			

Meters Per Second Family (How fast?)

Quantity	**Written Definition**	**Equation Definition**	**Algebraic Symbol**	**Vector or Scalar?**	**Useful Application**	**How to Calculate**	**Why is it a vector?**
Velocity (instantaneous)	x	x (if taking calculus)	x	x	x	x	x
Speed (instantaneous)	x	x (if taking calculus)	x	x	x	x	
Average Velocity		x	x	x		x	x
Average Speed		x	x	x		x	
Initial Velocity	x		x	x			
Final Velocity	x		x	x			
Change in Velocity		x	x	x		x	x

Meters Per Second Squared Family (How much faster?)

Quantity	**Written Definition**	**Equation Definition**	**Algebraic Symbol**	**Vector or Scalar?**	**Useful Application**	**How to Calculate**	**Why is it a vector?**
Acceleration	x	x	x	x	x	x	x

Seconds Family (How long?)

Quantity	**Written Definition**	**Equation Definition**	**Algebraic Symbol**	**Vector or Scalar?**	**Useful Application**	**How to Calculate**	**Why is it a vector?**
Time			x	x	x		
Change in Time			x	x	x		

[For extra credit, try to define "time".]

There are 15 quantities in total included in your dictionary.
For each quantity, you need to include the pieces indicated by an x.
For example, for **distance** you need to include A written definition, an algebraic symbol, vector or scalar, a useful application, and how to calculate it. You don't need to include an equation definition or "Why is it a vector?"

For **time** you need to include an algebraic symbol, vector or scalar, and a useful application. You don't need to include anything else.

Guidelines for each section:

Written Definition

You need to define the argument.

If you use a definition taken from a resource, you need to cite the resource.

Equation Definition

Write an equation which defined the quantity.

If the equation defines quantity X, it must be in the form:

x = …

If it is in a different form, it is not acceptable.

For example, if you were defining x which is equal to the sum of a and b, then

$$x = a + b$$

would be acceptable but

$$a = x - b$$

Would not be acceptable.

Algebraic Symbol

Write the algebraic symbol for a particular quantity. Make sure you look up a proper algebraic symbol in a resource.

For some quantities, more than one algebraic symbol is used.

Vector or Scalar:

Write if the quantity is a vector or a scalar.

Useful Application:
To describe a useful application, you need to write a time that *this quantity is useful* but *the other quantities of that family are not useful*.

Examples:
In a running race in which the starting lien is also the finish line. You need to know the *distance* of the race, but the *displacement* of the race is zero, and there certainly isn't a need to determine the origin and set the *position*.

In baseball, they use a radar gun to measure the *instantaneous speed* of a pitch. Obviously, the direction is towards home plate, so *instantaneous velocity* isn't very helpful, and the pitch happens so quickly that *average speed,* which involves averaging over time of the whole pitch, isn't helpful.

Mile markers on a highway are examples of *position*, they measure how far you are from a particular point (typically the southern or western end of the highway), which would be equivalent to the origin. If you need to know where an exit is located or where an accident occurred, you need to use the mile markers.

When you want to know how long it is until the end of school, you are trying to find the *change in time* between now and the end, not the simply the *time*.

Do not use any of these examples.
Do not use exactly the same examples one of your friends uses.
Also, do not use any examples that are given in textbooks or on the internet unless you adapt them to make them more personal. If you adapt an example taken from a resource, you must cite that resource.

How to Calculate:
Give an example of a time you need to calculate this quantity, and calculate it. You should make up numbers and use them to calculate the quantity.

Make sure that you calculate the quantity *directly from the definition*.
For example, if you calculated acceleration from the formula:

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

This would not be *directly* from the definition of acceleration, but using a derived mathematical formula. That's okay in most physics problems, but in this assignment we are focusing on using the *definitions*.
So instead, use the definition to explain how to calculate acceleration. The definition of acceleration is:

$$a = \frac{\Delta v}{\Delta t}$$

Why is it a vector?
Explain why the quantity is a vector and not a scalar.

The most surefire way to complete this is to give an example of different instances of this quantity that have different *directions*.
For example:
Force is a vector. Pushing a shopping cart is an example of a force. If you push the cart one way up the aisle, and then turn around and push it back the other way, you have created two different forces with two different *directions*, and thus force must be a vector.

Example of a "Dictionary Entry"

Electric Current

Written Definition

Electric current represents the amount of charge that passes a point on an electric circuit in a unit time.

Equation Definition:

$$I = \frac{\Delta q}{\Delta t}$$

Current is change in charge divided by change in time.

Algebraic Symbol:

The algebraic symbol for current is I.

Vector or scalar:

Current is a scalar

Useful Application:

You need to know the current in a circuit because certain electric devices are a risk to catch fire if the current is too high. No other quantity than current serves this purpose.

How to calculate it from the definition:

If 0.002 Coulombs of charge pass a point in a time of two seconds, then the current is:

$$I = \frac{\Delta q}{\Delta t} = \frac{0.002}{2} = 0.001 \text{ A} = 1 \text{ mA}$$

Recommended Resources to Help you Complete this Project

"The Physics Classroom" – website that covers most topics in high school physics.
https://www.physicsclassroom.com

"Open Stax" – Website containing many college science textbooks, including physics textbooks.
https://openstax.org

"Flipping Phyiscs" – videos covering a typical high school physics curriculum
https://www.flippingphysics.com

"Kahn Aacdemy Physics" – videos covering a typical phyiscs curriculum
https://www.khanacademy.org/science/physics

There are also physics textbooks available in Mr. Kuncik's classroom where you can look up this material.

Please don't use Wikipedia for this assignment.

Guidelines For Turning it in:

Please have the dictionary printed and ready to turn in on December 11th.
Please type this assignment.
Please do not ask to go to the library to print at the beginning of class on the day it is due.
Please do no use my stapler to staple your assignment.
(This rule exists because with past homework assignments, almost the whole class made a line to use my stapler at the start of class. That shouldn't happen in a high school class, so bring it already stapled.)

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