Science 20F
In Motion
Introduction
Lesson #1

Date: _____

S2-3-01 Analyze the relationship among displacement, time, and velocity for an object in uniform motion. Include: visual, numeric, graphical, symbolic (velocity = Δd/Δt).

Uniform Motion

In Physics we study motion, which can be broken down into two categories:

1) **Kinematics**
2) **Dynamics**

Kinematics is the study of **motion**. We will look at **how far** and **how fast** an object moves. The two terms in science are called: **displacement** and **acceleration**.

Dynamics is the study of **what causes motion** such as **forces**, **momentum** and **impulse**.

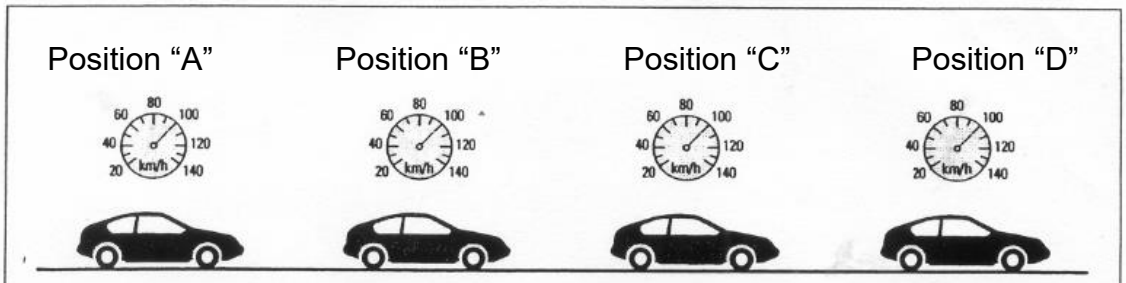
Uniform motion is motion where an object is displaced (changes position) at a constant velocity and in a straight line.

Motion describes the change of an objects position. It is usually measured in distances (how far it moved) and measured over a period of time (how long it took to move from point "A" to point "B".

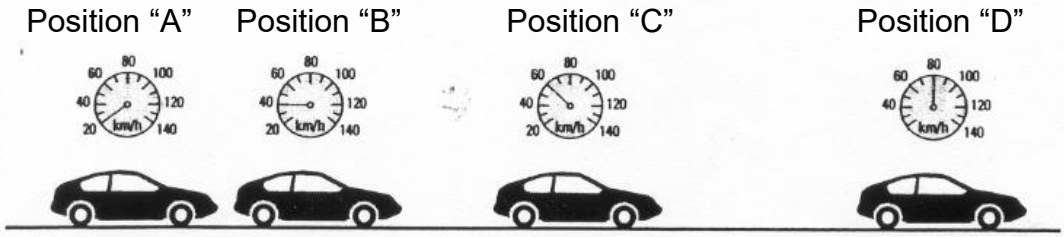
Distance over Time

Describe the motion of these vehicles. Draw a dot under the front tire of each vehicle. The dot will represent oil drops. Then measure the distance between each "dot" under the front tires.

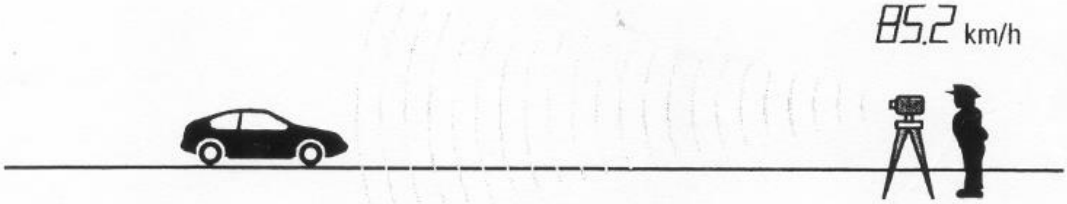
Sample "1"



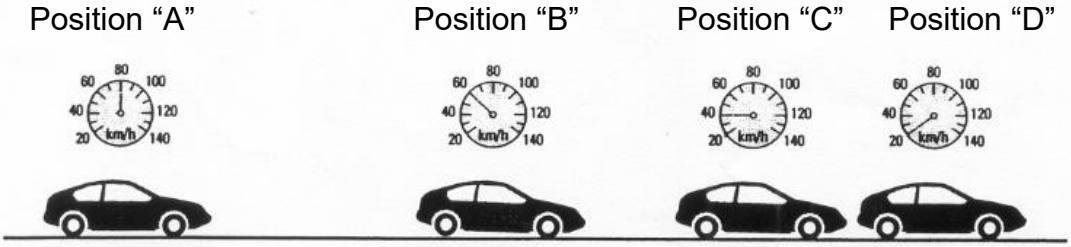
Sample "2"



Sample "C"



Sample "D"



Use the information on the next page to make more sense of this activity.

Motion and the Car
Displacement, time, and velocity!

Look to the previous page "distance over time".

Describe the motion of these vehicles.

If the "dots" under the front tires of the vehicle were caused by a pin hole leak in the oil-pan under the car, then the droplets of oil would be falling out at precisely 1 drop per second. If an oil drop falls every second but the car is moving, the drops will fall on different places along the road, making a mark on the road where the car was at that exact moment in time. Each second there is a record of where the car was. The speedometer indicates the speed the car is moving in Km/h.

So, lets look at your measurements.

Looking at **Sample "1"** You should notice that the distance between the dots is pretty much the same each time, (for each position, A, B, C, and D), w**hether or not each of your measurements are exact or not**. If the speed is not changing, (100km/h) each second, the car moves the same distance each second. That is **proof** that the car is moving at the same speed. **Constant Speed**, = **Constant Motion**!

Looking at **Sample "2"** You should notice that the distance between the dots is not the same each time, (for each position, A, B, C, and D). The distance between each dot is "Increasing" each second (each position). If the distance is changing between each dot, but the dots appear on the road each "second" then the speed **is** changing. Increased distance traveled per second, means increased speed over time. We call this **"acceleration"** (increasing speed). The speedometer also shows that. This is **proof** that the car is **accelerating**!

Looking at **Sample "3"**, … **Oh on!** The car was clocked at 85.2 km/h in a 60 km/h zone, … the cop motions to the driver to pull over.

Looking at **Sample "4"** You should notice that the distance between the dots is again not the same each time, (for each position, A, B, C, and D). This time the distance between each dot is less each second, (distance is decreasing). If the distance between each dot is decreasing for each "second" that passed that would show that the speed is changing. This time the car is slowing down. Less distance is traveled each second; thus, we call it **"deceleration"**. (decreasing speed). The speedometer also shows that. This is **proof** that the car is **decelerating**!

Motion Vocabulary

There are two kinds of numbers:

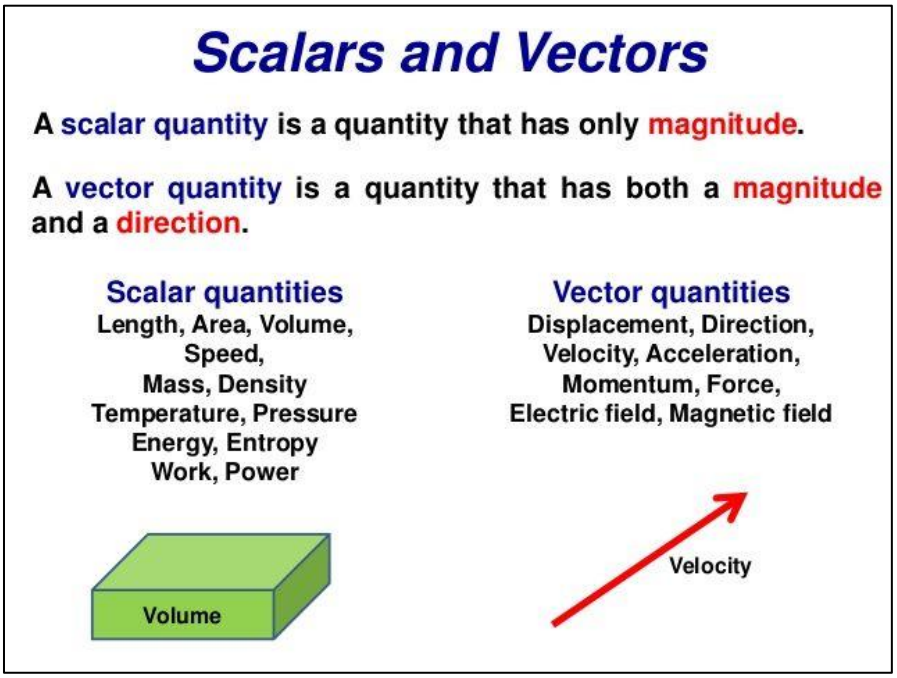
1. Scalar Measurement with only Magnitude (size).

Ex. 10 kg - mass
10.5 cm - length
50km/hr - speed
time, volume,

2. Vector Measurement with both Magnitude (size) and direction.

Ex. I'm traveling 10km/h north

- I'm in front of the school.



I go by the name of *Vector*. It's a mathematical term, represented by an arrow with both direction and magnitude. *Vector*!

Motion Language

Fill in the blanks

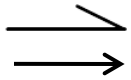
Symbol	Quantity	Scalar/ Vector	Description	Question	Example
			When something Occurs	When?	The train leaves @ 3:30pm
			How long something takes. It means the duration of the event	How Long	It lasted one minute
			How far two objects are apart	How far?	I travelled 13 km
			Where the object is!	Where is the object?	The car is 2 km north of the school.
			Change in position.	Where is the object Now?	The car is now 3km north. It was “displaced” 1km to the north.
			The distance covered in a specific period of time	How fast?	The car is travelling 110km/hr.
			Speed and direction of motion	How fast and in what direction?	The boat is traveling 20km/h west.
			Change in velocity in a certain time or direction	Is the object changing velocity?	The driver is moving from 50km/hr to 100km/hr

Symbol	Quantity	Scalar/ Vector	Description	Question	Example
t	time	S	When something Occurs	When?	The train leaves @ 3:30pm
▲t	time interval	S	How long something takes. It means the duration of the event	How Long	It lasted one minute
d	distance	S	How far two objects are apart	How far?	I travelled 13 km
$\vec{d}$	position	V	Where the object is!	Where is the object?	The car is 2 km north of the school.
$\vec{\blacktriangle d}$	displacement	V	Change in position.	Where is the object Now?	The car is now 3km north. It was “displaced” 1km to the north.
v	speed	S	The distance covered in a specific period of time	How fast?	The car is travelling 110km/hr.
$\vec{v}$	velocity	V	Speed and direction of motion	How fast and in what direction?	The boat is traveling 20km/h west.
$\vec{a}$	acceleration	V	Change in velocity in a certain time or direction	Is the object changing velocity?	The driver is moving from 50km/hr to 100km/hr

Motion
Vocabulary Review
Lesson 1B

Date: _____

Motion Vocabulary

 means "Vector"

 called "Delta" means that there is a "Change" involved

Time Symbol = **t** **Standard unit: seconds** (s)

Time: is when an event occurs. It is a **scalar** quantity.

Time interval Symbol = **Δt** **Standard unit: seconds** (s)

Time interval: describes the duration of an event. It is a **scalar** quantity.

Distance Symbol = **d** **Standard unit: meters** (m)

Distance: is a **scalar** quantity, so it has magnitude (size) but no direction.

Position Symbol = **$\vec{d}$** **Standard unit: meters** (m)

Position: describes an objects location. It is a **vector** quantity, so it has magnitude (size) and it has direction. (*Both must be identified.*)

(The arrow over the letter "d" means "vector")

Displacement Symbol = **$\Delta\vec{d}$** **Standard unit: meters** (m)

Displacement: describes how much an objects position has changed. It is a **vector**.

(Even if you run around a circular track and stop running where you started your displacement is "Zero"!)

Speed Symbol = **v** **Standard unit: meters per second** (m/s)

Speed: describes how fast something is moving. It is a **scalar** quantity, it does not indicate direction.

Velocity Symbol = $\vec{v}$ **Standard unit: meters per second** (m/s)

Velocity: describes the speed and direction of motion. It is a **vector**.

(how fast an objects position is changing)

Acceleration Symbol = $\vec{a}$ **Standard unit: meters per second each second**

Acceleration: describes how much an objects velocity changes in a certain amount of time. It is a **vector**.

(Whether you speed up or slow down or even changing direction is a change in velocity and therefore termed **acceleration**.)

Additional Vocabulary

Distance interval Symbol = Δd
initial distance Symbol = d_i
final distance Symbol = d_f
Calculation: $\Delta d = d_f - d_i$

Time interval Symbol = Δt
initial time Symbol = t_i
final time Symbol = t_f
Calculation: $\Delta t = t_f - t_i$

Displacement Symbol = $\vec{\Delta d}$
Calculation: $\vec{\Delta d} = \vec{d}_f - \vec{d}_i$

Velocity Symbol = $\vec{\Delta v}$
Calculation: $\vec{\Delta v} = \vec{v}_f - \vec{v}_i$

Velocity interval Symbol = $\vec{\Delta v}$
initial velocity Symbol = v_i
final velocity Symbol = v_f