Let's Review…

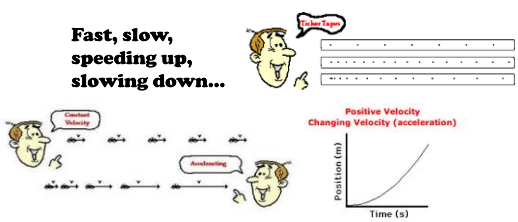
- Uniform motion is…
- Non-uniform motion occurs when…

Let's Review…

- Uniform motion is… motion at a <u>constant speed</u> in a <u>straight line.</u>
- Non-uniform motion occurs when… there is a <u>change in speed AND / OR direction</u>.

Describing Motion

- The motion of an object is often described using words, equations, diagrams, and graphs.



Describing Motion

- Words and phrases such as *going fast*, *stopped*, *slowing down*, *speeding up*, and *turning* are a good start...
- But in physics, we need to also use words like *distance*, *displacement*, *speed*, *velocity*, and *acceleration*. Each of these has a math quantity associated with it.

Describing Motion

- The math quantities that are used to describe motion can be divided into two categories: <u>scalar</u> and <u>vector</u>.
- Scalars are quantities that are fully described by a <u>magnitude</u> (or number) alone.
- Vectors are quantities that are fully described by both a <u>magnitude</u> and a <u>direction</u>.

Scalars & Vectors

Scalars	Vectors
measurement has size but no direction	measurement involves both size and direction
E.g. 15 m, 30 s	E.g.10 km N, 1 m/s W

Check your understanding…

- Which measurements are scalar? Which are vector?

a) 15 hm NE
b) 12 s
c) 19 m/s S
d) 1.8 cm

Check your understanding…

- Which measurements are scalar? Which are vector?

a) 15 hm NE Vector
b) 12 s
c) 19 m/s S
d) 1.8 cm

Check your understanding…

- Which measurements are scalar? Which are vector?

a) 15 hm NE Vector
b) 12 s Scalar
c) 19 m/s S
d) 1.8 cm

Check your understanding…

- Which measurements are scalar? Which are vector?

a) 15 hm NE Vector
b) 12 s Scalar
c) 19 m/s S Vector
d) 1.8 cm

Check your understanding…

- Which measurements are scalar? Which are vector?

a) 15 hm NE Vector
b) 12 s Scalar
c) 19 m/s S Vector
d) 1.8 cm Scalar

Distance & Displacement

Distance, d

- refers to "how much ground an object has covered"
- scalar

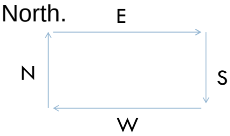
Displacement, $\vec{d}$

- refers to "how far out of place an object is"; it is the object's change in position
- vector

Note: the arrow over the letter 'd' means "vector"

Check your understanding…

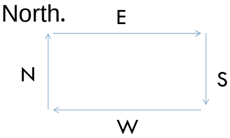
- A physics teacher walks 4 meters East, 2 meters South, 4 meters West, and finally 2 meters North.



1. What distance has she traveled? _____
2. What was her displacement? _____

Check your understanding…

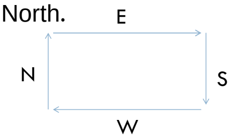
- A physics teacher walks 4 meters East, 2 meters South, 4 meters West, and finally 2 meters North.



1. What distance has she traveled? 12 m
2. What was her displacement? _____

Check your understanding…

- A physics teacher walks 4 meters East, 2 meters South, 4 meters West, and finally 2 meters North.



1. What distance has she traveled? 12 m
2. What was her displacement? 0 m

Distance & Displacement

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- General calculation is:

$$\Delta d = d_f - d_i$$

or

$$\Delta \vec{d} = \vec{d}_f - \vec{d}_i$$

where:
- the symbol Δ means "change in"
- f stands for final
- i stands for initial

Time & Time Interval

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Time	Time Interval
describes when an event occurs	describes the duration of an event
scalar	scalar

Time Interval

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- General calculation is:

$$\Delta t = t_f - t_i$$

where:
- the symbol Δ means "change in"
- f stands for final
- i stands for initial

Speed & Velocity

Speed, v	Velocity, $\vec{v}$
refers to "how fast an object is moving"	refers to "the rate at which an object changes its position"
scalar	vector

Speed

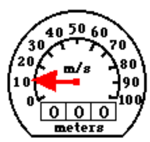
- is the rate at which an object covers distance.
- A fast speed means a large distance is covered in a short amount of time.
- An object with no movement at all has a zero speed.

Velocity

- is speed with a direction!
- Speed is 55 km/hr while velocity is 55 km/hr E.
- Speed is a scalar quantity and does not keep track of direction; velocity is a vector quantity and is direction aware.

Average Vs Instantaneous Speed

Instantaneous Speed, v_{inst}	Average Speed, v_{ave}
the speed at any given instant in time	the average of all instantaneous speeds



Instantaneous speed is the speed on the speedometer at any given time.

Average speed is the average of all the speedometer readings during the course of the trip.

Acceleration, $\vec{a}$

- the rate at which an object changes its velocity (vector)
- An object is accelerating if it is changing its velocity (speeding up or slowing down and/or changing direction).

Any Questions?

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