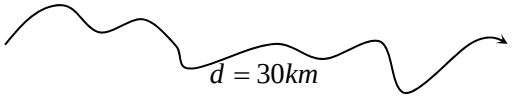
The language of physics

As with every other discipline, physics has its own terms. It is important to realize that many terms that you know in everyday language may have a slightly different meaning than what you expect.

Distance:

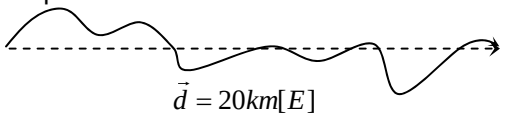
- Defined as the length of the **path** taken by a moving object.
- Example, a car drives 30 km down a winding road.
- Distance is a **scalar**.



Symbols		
d_i or d_1	means **initial distance**	**Ex**: The car was 500m away when the engine blew.
d_f or d_2	means **final distance**	**Ex**: The car final stopped 100m away after blowing the engine.
Δd	(pronounced "delta") means the ***change in distance***	**Ex:** the car drove 400m with the blown engine.
Formula	$\Delta d = d_f - d_i$ or $\Delta d = d_2 - d_1$	**Ex:** $\Delta d = d_f - d_i$ $\Delta d = 100m - 500m$ $\Delta d = -400m$
Units	***meters (m)***	

Displacement:

- Defined as the straight-line distance between an object's starting position and its final position,
- INDEPENDENT of the path taken.
- Displacement also has a direction too.
- Displacement is a **vector**.



Symbols		
$\vec{d}_i$ or $\vec{d}_1$	means **initial position**, meaning that both the proximity and position must be recorded from the viewpoint of the observer.	**Ex**: The car was at a position 500m [S] when the engine blew.
$\vec{d}_f$ or $\vec{d}_2$	means **final position**	**Ex**: The car final stopped at a position of 100m [S] after blowing the engine.
$\Delta\vec{d}$	(pronounced "delta") means the ***displacement***.	**Ex:** The car's displacement was 400m [N]
Formula	$\Delta\vec{d} = \vec{d}_f - \vec{d}_i$ or $\Delta\vec{d} = \vec{d}_2 - \vec{d}_1$	**Ex:** let north be positive and let south be negative. $\Delta\vec{d} = \vec{d}_f - \vec{d}_i$ $\Delta\vec{d} = (-100m) - (-500m)$ $\Delta\vec{d} = -100m + 500m$ $\Delta\vec{d} = 400m$ $\Delta\vec{d} = 400m[N]$
Units	***meters (m)***	

Time:

- is defined as the duration for which an event occurs.
- Time is a **scalar** because it has no direction.

Symbols	
t_i or t_1	means the ***initial time***
t_2 or t_2	means the ***final time***
Δt	means the **time interval**
Formula	$\Delta t = t_f - t_i$ or $\Delta t = t_2 - t_1$
Units	***seconds (s)***

Speed:

- Speed, in lay terms, means how fast something in moving.
- In physics it means the same thing but its definition is more specific.
- Speed is a **scalar**.
- **Def:** Speed is the change in distance over time.

  Ex: 100km/h means that an object moves 100km every hour.

Symbols		
v_i or v_1	means the **initial speed**	**Ex**: the train's initial speed was 100km/h
v_f or v_2	means the **final speed**	**Ex**: the car's final speed was 20 m/s
Formula		
Speed	$v = \frac{\Delta d}{\Delta t}$ Where v is in m/s, Δd is in m, and Δt is in s	**Ex:** Find the speed of a car that travels 200m in 40s $v = \frac{\Delta d}{\Delta t}$ $v = \frac{200}{40}$ $v = 5m/s$
Change in speed	$\Delta v = v_f - v_i$ or $\Delta v = v_2 - v_1$	**Ex:** what's the change in speed of a car, initially traveling at 82km/h, if it slows to 60km/h? $\Delta v = v_2 - v_1$ $\Delta v = (60) - (82)$ $\Delta v = -22km/h$
Units	***Meters (m/s)***	

Velocity:

- Velocity is similar to speed but is a **vector**, meaning that it has a direction and a magnitude
- **Def:** Velocity is the change in position over time or displacement over time
  Ex: 100km/h [N] means that an object changes its position 100km [N] every hour.

Symbols		
$\vec{v}_i$ or $\vec{v}_1$	means the **initial velocity**	**Ex**: the train's initial velocity was 100km/h[W]
$\vec{v}_f$ or $\vec{v}_2$	means the **final velocity**	**Ex**: the car's final velocity was 20 m/s [N30°W]
Formula		
Velocity	$\vec{v} = \frac{\Delta \vec{d}}{\Delta t}$ Where $\vec{v}$ is in m/s, $\Delta \vec{d}$ is in m, and Δt is in s	**Ex:** Find the speed of a car that travels 200m[N] in 40s $\vec{v} = \frac{\Delta \vec{d}}{\Delta t}$ $\vec{v} = \frac{200}{40}$ $\vec{v} = 5m/s[N]$
Change in velocity	$\Delta \vec{v} = \vec{v}_f - \vec{v}_i$ or $\Delta \vec{v} = \vec{v}_2 - \vec{v}_1$	**Ex:** what's the change in speed of a car, initially traveling at 82km/h[E], if it slows to 60km/h[E]? $\Delta \vec{v} = \vec{v}_2 - \vec{v}_1$ $\Delta \vec{v} = (60) - (82)$ $\Delta \vec{v} = -22km/h[E]$ $\Delta \vec{v} = 22km/h[W]$
Units	***Meters (m/s)***	

Assignment

1) Which is it? Speed, position, distance, velocity, displacement, acceleration (linear or vector)

a) A car is parked 1.0 km away north _____
b) A car accelerates from 20km/h to 50 km/h _____
c) A car moved a total of 30m _____
d) A roller-blader is traveling at 5.0m/s [R] _____
e) John walked 15m south _____
f) A car decelerates from 30m/s [W] to 15 m/s [W] _____
g) Jane rode 20km [W] _____
h) The ball rolls along the floor at 3.0 m/s _____
i) A car drives at 100k/h [W]

2) Measure the following lines using the maximum precision of your ruler.

_____ smallest unit on your ruler _____ precision of your ruler.

_____

_____

3) Draw a scale diagram of the following vectors. Find the total distance and displacement for each.

a) A mouse moves 30cm [U], then 20cm [L]
b) A car drives 50km [S], then 100km [E]
c) A person walks 20m [N], then 30m [W], then 15m [S]