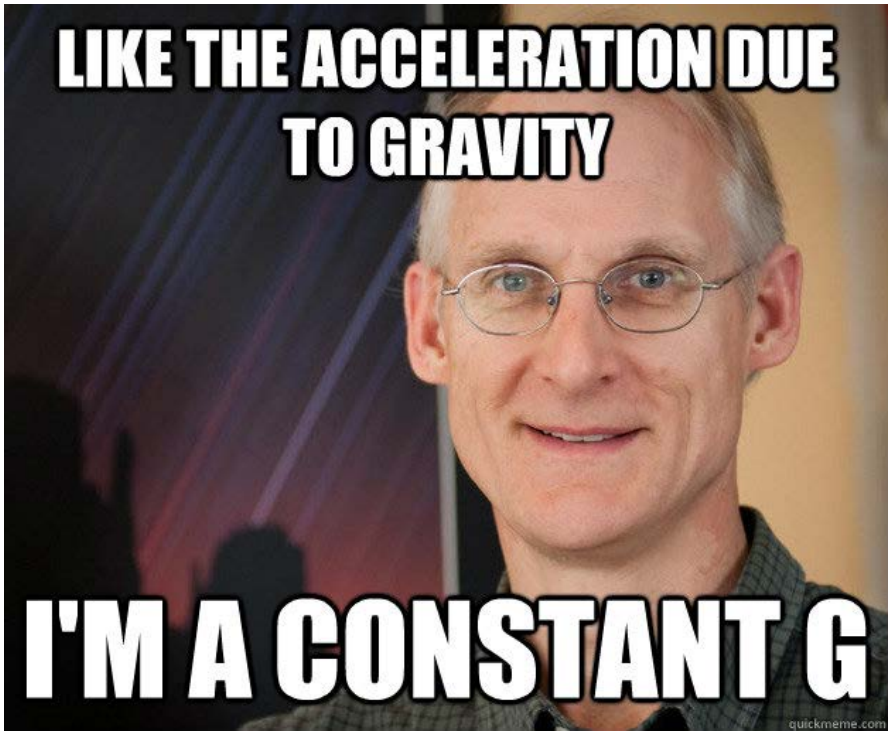
Velocity-Time Graphs for Acceleration



Outcomes:

S2-3-02 Collect displacement data to calculate & graph velocity vs. time for an object accelerating at a constant rate.

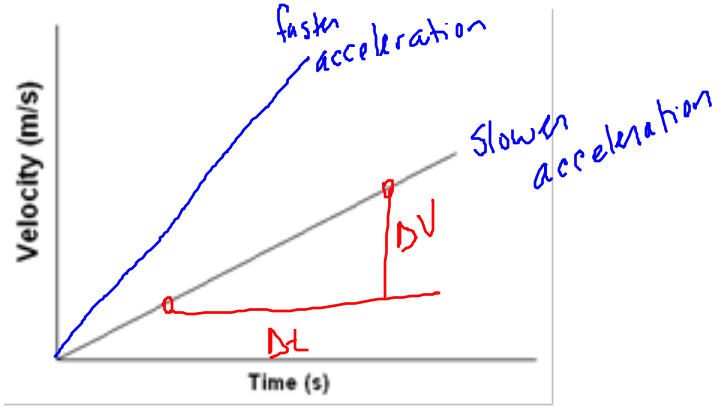
S2-3-03 Analyze the relationships among velocity, time and acceleration for an object accelerating at a constant rate.

V-T Graphs…

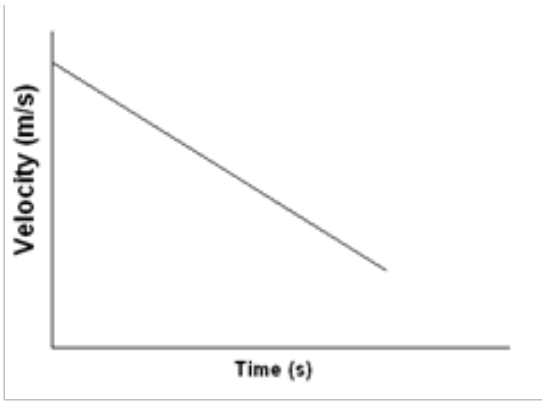
Recall:

- The **SLOPE** of a **DISTANCE**-time graph tells us the **SPEED** of an object!
- The **SLOPE** of a **DISPLACEMENT**-time graph tells us the **VELOCITY** of an object!

We can apply a similar relationship to velocity and acceleration, since acceleration is **HOW MUCH THE VELOCITY CHANGES OVER TIME**.



- ***Velocity is increasing over time → Positive Acceleration***



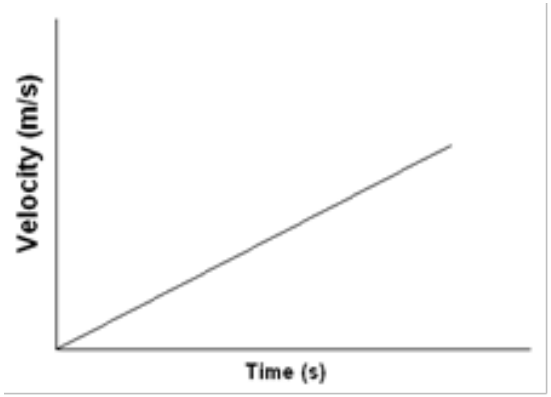
- ***Velocity is decreasing over time → Negative Acceleration***

$$a = \frac{\Delta v}{\Delta t} = \frac{v_2 - v_1}{t_2 - t_1} = \frac{\Delta y}{\Delta x} = \frac{rise}{run} = slope!$$

V-T Graphs…

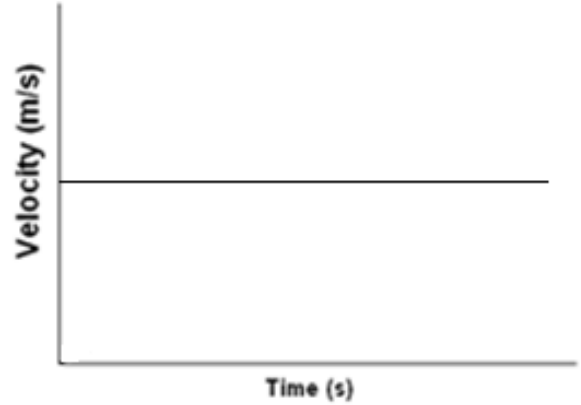
Remember:

A **STRAIGHT LINE** on a velocity-time graph shows that the object is **SPEEDING** up at a **CONSTANT** rate



→ **CONSTANT ACCELERATION**!

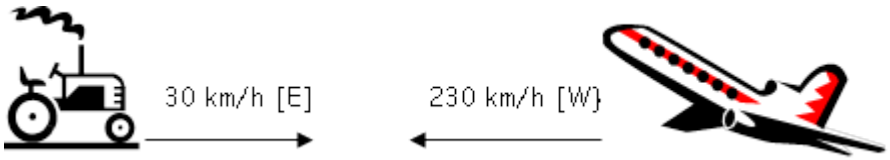
A **STRAIGHT HORIZONTAL** line on a velocity-time graph means that there would be **NO ACCELERATION**



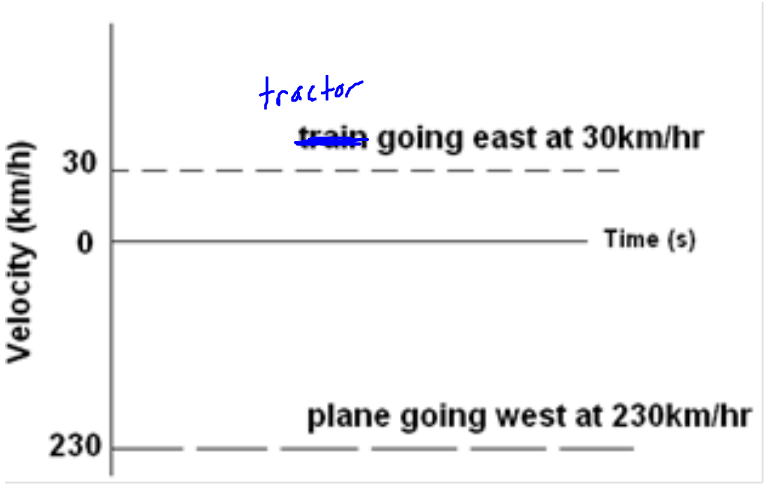
→ **CONSTANT VELOCITY, NO ACCELERATION**

V-T Graphs…

Example:



A graph showing the motion of these objects would look like:



Since the objects are travelling in **OPPOSITE** directions, one velocity will be **POSITIVE**, and the other will be **NEGATIVE**.

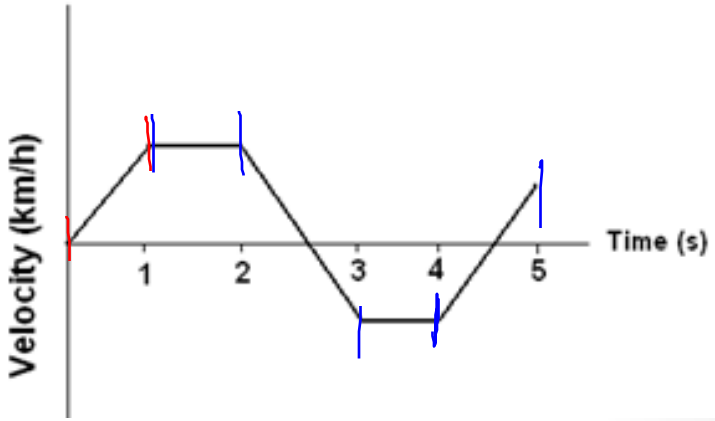
V-T Graphs…

Notes on v-t graphs:

- If velocity is zero, the object is **STOPPED**.
- Straight horizontal line = **CONSTANT VELOCITY**
- Sloping straight line = **CONSTANT ACCELERATION (+ OR -)**
- Curved line = **NON-UNIFORM ACCELERATION**
- Slope of the line = **ACCELERATION**

V-T Graphs…

Describe the motion in the following graph during each time interval:



a) From time 0 to time 1

accelerating in the positive direction
speeding up

b) From time 1 to time 2

Constant speed positive direction

c) From time 2 to time 3

slowing down (+ve), stops, speeds up in -ve direction

d) From time 3 to time 4

Constant speed, -ve direction

e) From time 4 to time 5

slowing down in -ve direction, stops, speeds up in +ve direction