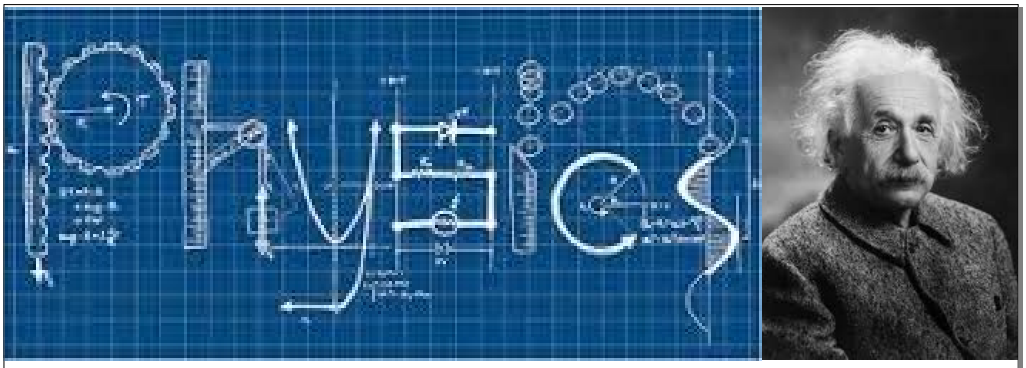


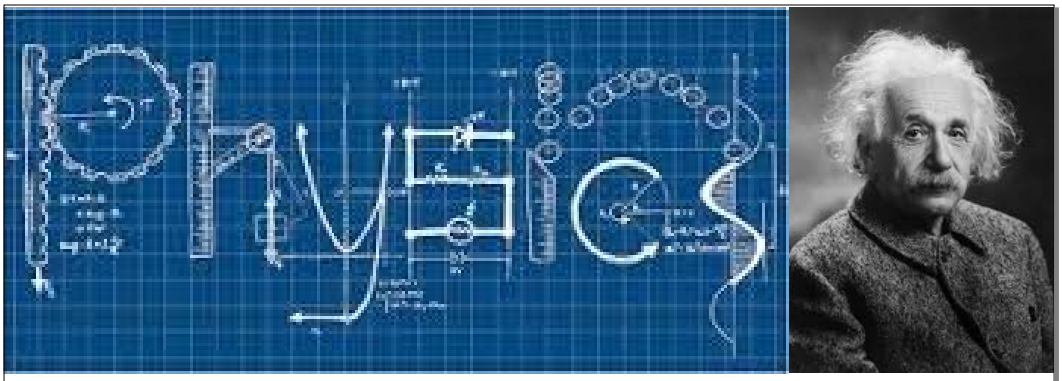
2.4 V_f Formulas

$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$$

$\vec{a}$ = acceleration
$\vec{v}_f$ = final velocity
$\vec{v}_i$ = initial velocity
t = time

This is the formula given on the formula sheet. We commonly use the following rearranged form of this:

$$\vec{v}_f = \vec{a}t + \vec{v}_i$$



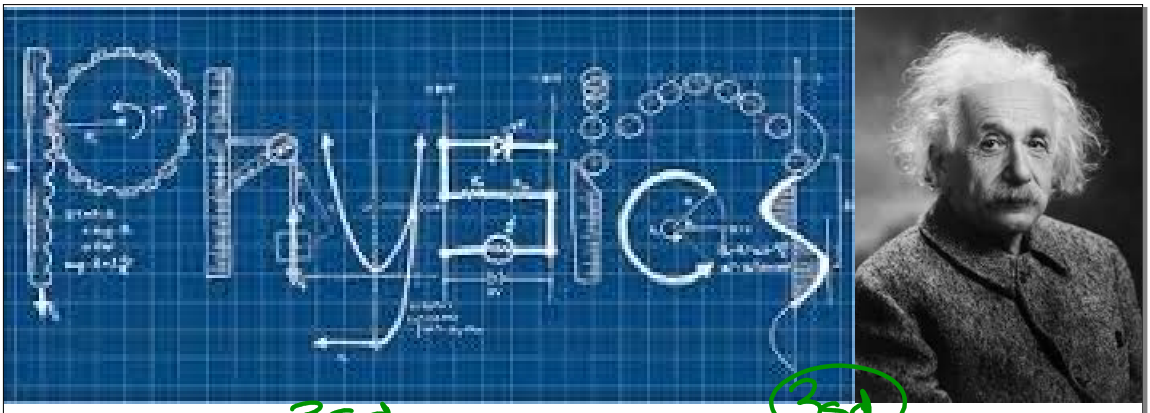
We use algebra to obtain the second form:

$$t \cdot \vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t} \cdot t$$

$$\vec{a}t = \vec{v}_f - \vec{v}_i$$

$$+\vec{v}_i \qquad +\vec{v}_i$$

$$\vec{a}t + \vec{v}_i = \vec{v}_f$$



3sd

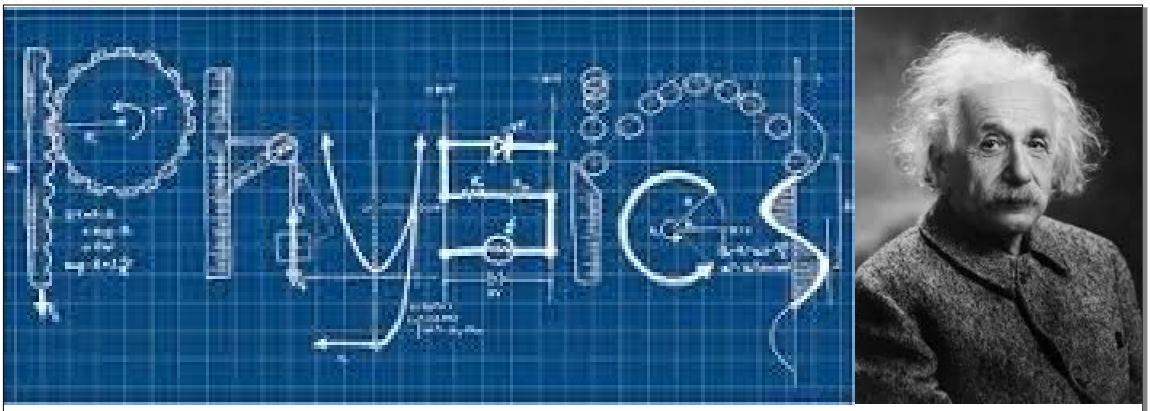
3sd

Ex.) A car is stopped at a red light. The light turns green and the car accelerates. After 6.00 s the car is travelling at a rate of 4.25 m/s. Determine the acceleration of the car.

$\vec{v}_i = 0\ m/s$
$t = 6.00\ s$
$\vec{v}_f = 4.25\ m/s$
$\vec{a} = ?$
list all variables

$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$
formula

$\vec{a} = \frac{(4.25 - 0)}{6.00}$
$\vec{a} = 0.7083 = 0.708\ m/s^2$
substitute (with units) and solve



Ex.) A golf ball is sitting on a tee. At a time 0.53 s after the ball is hit it is travelling with a speed of 65.0 km/h. What is the acceleration of the ball during that period?

3

2

✓

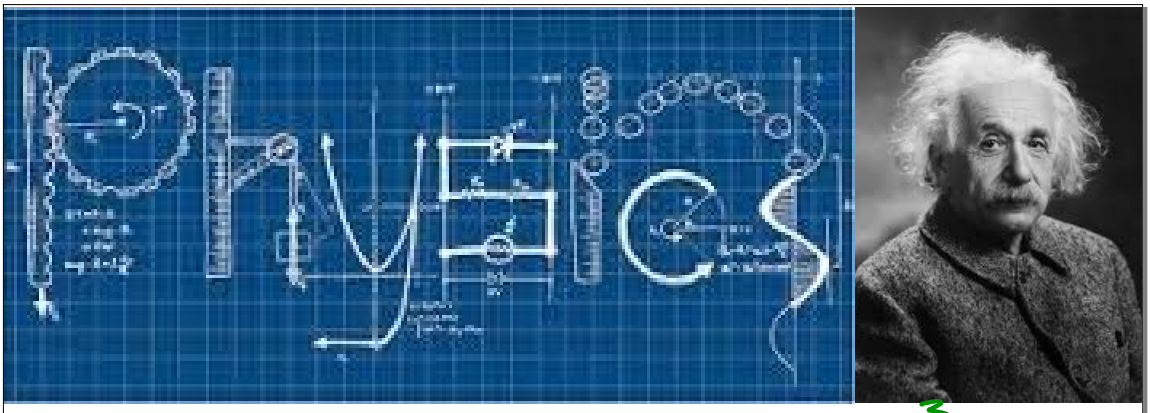
$t = 0.53\ s$
$\vec{v}_i = 0\ m/s$
$\vec{v}_f = 18.05\ m/s$
$\vec{a} = ?$
list all variables

✓

$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$
formula

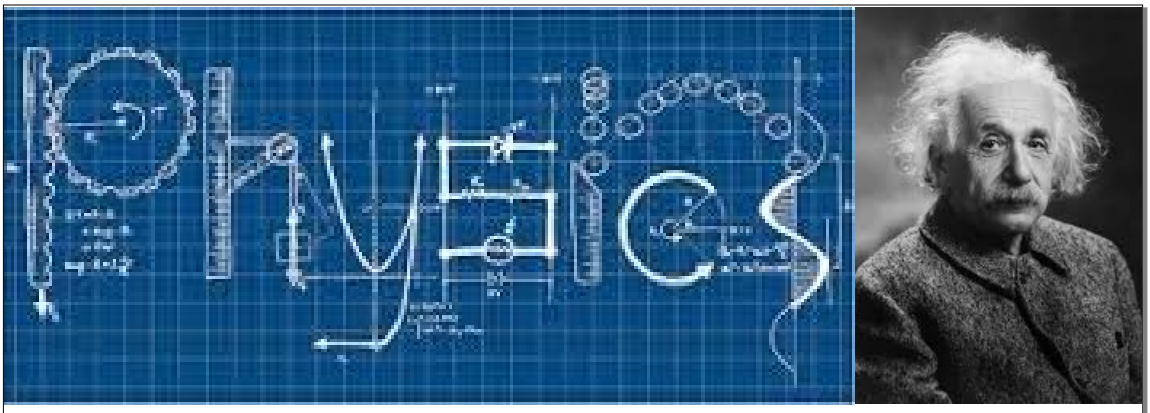
✓

$\vec{a} = \frac{(18.05 - 0)}{0.53} = 34\ m/s^2$
substitute (with units) and solve



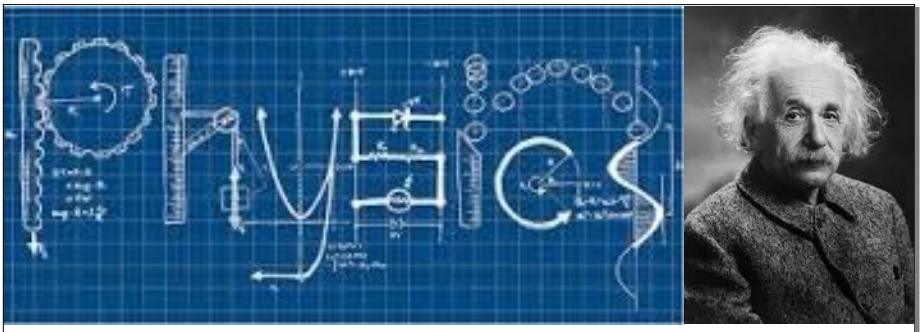
Ex.) A cannonball is fired from a cannon with an initial velocity of 150 m/s. It has an acceleration of -2.50 m/s^2 due to air resistance. Determine the final velocity of the ball after 60 s of movement.

list all variables	formula	substitute (with units) and solve
$\vec{V}_i = 150 m/s$ $\vec{a} = -2.50 m/s^2$ $t = 60 s$ $\vec{V}_f = ?$	$\vec{V}_f = \vec{a}t + \vec{V}_i$	$\vec{V}_f = (-2.50)(60) + 150$ $\vec{V}_f = 0.0 m/s$



Ex.) An object starts from rest and accelerates 1.30 m/s^2 [N] for 6.00 s. What is the final velocity of the object?

list all variables	formula	substitute (with units) and solve
$\vec{V}_i = 0 m/s$ $\vec{a} = +1.30 m/s^2$ $t = 6.00 s$ $\vec{V}_f = ?$	$\vec{V}_f = \vec{a}t + \vec{V}_i$	$\vec{V}_f = (+1.30)(6.00) + 0$ $\vec{V}_f = +7.80 m/s = 7.80 m/s [N]$

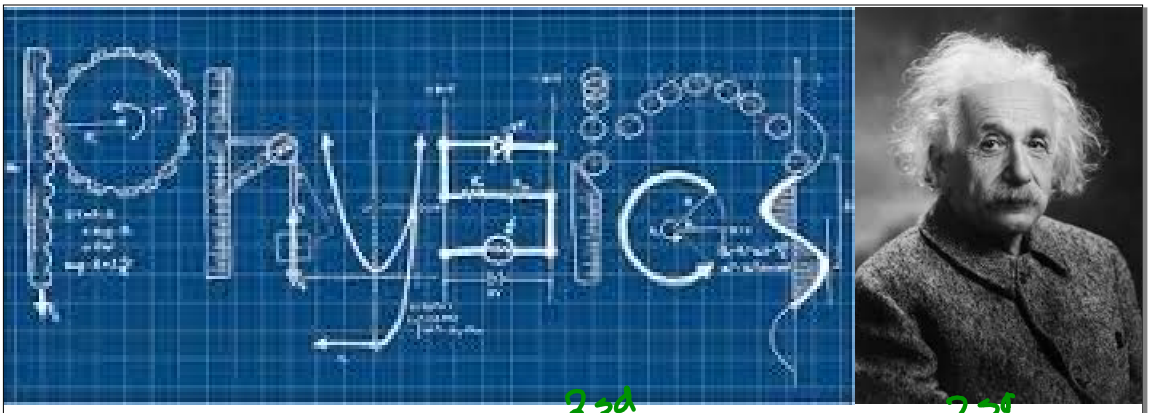


What if we were asked for time?

$$t \cdot \vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t} \cdot t$$

Rearrange for t: $\frac{\vec{a}t}{\vec{a}} = \frac{\vec{V}_f - \vec{V}_i}{\vec{a}}$

$$t = \frac{\vec{V}_f - \vec{V}_i}{\vec{a}}$$



Ex.) A track athlete runs at a velocity of 8.1 m/s, then slows down to 4.1 m/s. Her acceleration is at a rate of -0.62 m/s^2. How long did this change in velocity take?

2 sd 2 sd t

$\vec{V}_i = 8.1 m/s$
$\vec{V}_f = 4.1 m/s$
$\vec{a} = -0.62 m/s^2$
$t = ?$
list all variables

$t = \frac{\vec{V}_f - \vec{V}_i}{\vec{a}}$
formula

$t = \frac{(4.1 - 8.1)}{-0.62}$ $t = 6.5 s$
substitute (with units) and solve