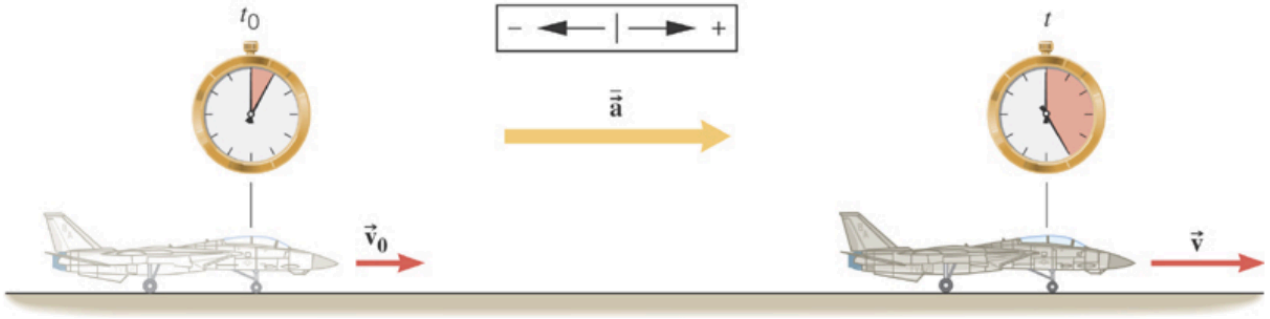
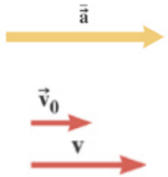


Average Acceleration Definition

$$\vec{a} = \frac{\vec{v} - \vec{v}_o}{t - t_o} = \frac{\Delta \vec{v}}{\Delta t}$$

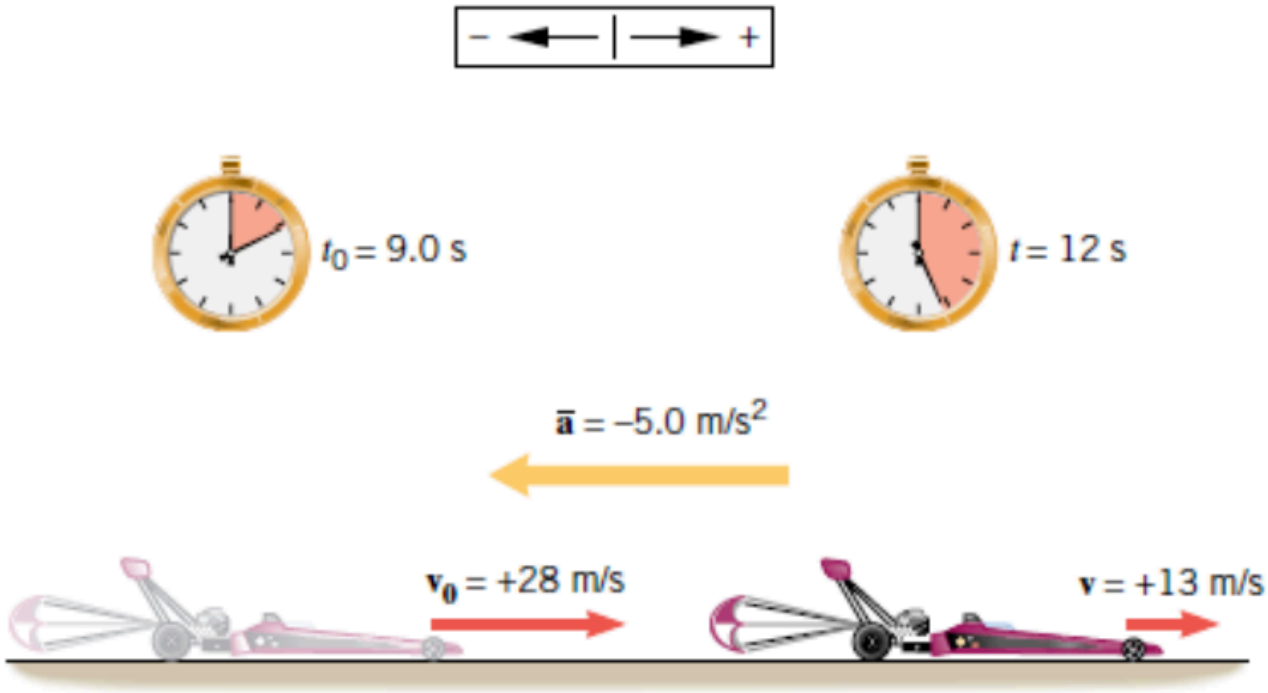


Acceleration (a) = Change in velocity/ Elapsed time = Final velocity - Initial velocity/ final time - initial time.

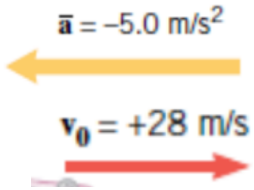
Acceleration = 400 m/s - 100 m/s / 10 s = 300 **m/s** /10 **s** = 30 **m/s²**

$$\frac{m}{S} : S = \frac{m}{S^2}$$

$$\frac{m}{S} \times S = \frac{m}{}$$


−
+
$t_0 = 9.0$ s
$t = 12$ s
$\bar{\mathbf{a}} = -5.0$ m/s^2
$\mathbf{v_0} = +28$ m/s
$\mathbf{v} = +13$ m/s

(*b*)


$\bar{\mathbf{a}} = -5.0$ m/s^2
$\mathbf{v_0} = +28$ m/s

1) A car accelerates at a constant rate from 40 km/h [E] to 90 km/h [E] in 5.0 s. What is its acceleration?

Initial velocity (from) = 40 km/h [E]

Final velocity (to) = 90 km/h [E]

time = 5.0 s

Acceleration = final velocity - initial velocity / time = 90 km/h - 40 km/h / 5.0 s = 10 km/h/s [E]

2) A cyclist accelerate from 5.0 m/s [S] to 15 m/s [S] in 4.0 s. What is his acceleration?

Initial velocity (from) = 5.0 m/s [S]
Final velocity (to) = 15 m/s [S]
time = 4.0 s

Acceleration = final velocity - initial velocity / time = 15 m/s - 5 m/s / 4s =10 m/s /4 s = 2.5 m/s^2

3) A jet plane accelerates from rest to 750 km/h in 2.2 min. What is is average acceleration?

Initial velocity (from) = Rest 0 km/h
final velocity (to) = 750 km/h
time = 2.2 min.

Acceleration = final velocity - initial velocity / time = 750 km/h / 2.2 min = 340.9 (km/h)/min

4) A runner accelerates from 0.52 m/s to 0.78 m/s in 0.5 s. What is her acceleration?

Initial velocity (from) = 0.52 m/s
Final velocity (to) = 0.78 m/s
Time: 0.5 s

$$\text{Acceleration} = \frac{\text{Final velocity - Initial velocity}}{\text{Time}}$$

$$\text{Acceleration} = \frac{\text{Final velocity - Initial velocity}}{\text{Time}} = \frac{0.78 - 0.52}{0.5\ \text{s}} = \frac{0.26\ (\text{m/s})}{0.5\ \text{s}}$$

$$\frac{0.26\ (\text{m/s})}{0.5\ \text{s}} = \frac{0.26}{0.5}\ \frac{(\text{m/s})}{\text{S}} = 0.52\ (\text{m/s})/\text{s} = 0.52\ \text{m/s}^2$$

5) A driver entering the outskirts of a city takes her foot off the accelerator so that her car slows down from 90 km/h to 50 km/ h in 10 s. Find the car's average acceleration.

Initial velocity (from): 90 km/h
Final velocity (to): 50 km/ h
Time: 10 s

$$\text{Acceleration} = \frac{\text{Final velocity - Initial velocity}}{\text{Time}} =$$

$$\text{Acceleration} = \frac{\text{Final velocity - Initial velocity}}{\text{Time}} = \frac{50 \text{ km/h} - 90 \text{ km/h}}{10 \text{s}} = \frac{-40 \text{ km/h}}{10 \text{ s}}$$

$$-4 \left(\frac{\text{km/h}}{\text{s}}\right) = -4 \text{ (km/h)/s}$$

Acceleration = - 4km/h in every S
by 10 s, it is pushing it -4 x 10 = -40 km/h
starting at 90 km/h - 40 km/s = 50 km/h

6. A boy rolls a ball up a hill giving it a velocity of 4.5 m/s[N]. Five second later, the ball is rolling down the hill with a velocity of 1.5 m/s [S]. What is the ball's acceleration?
Make both velocity in the same direction; **Both South or Both North**

Option 1
Initial velocity: **4.5 m/s [N]**

Final velocity : 1.5 m/s [S] = **- 1.5 m/s [N]**

Time: 5 s

Option 2
Initial velocity: + 4.5 m/s[N] = **- 4.5 m/s [S]**
Final velocity : +**1.5 m/s [S]**
Time: 5 s

$$\text{Acceleration} = \frac{\text{Final velocity - Initial velocity}}{\text{Time}} = \frac{1.5 \text{ m/s } \cancel{[S]} - 4.5 \text{ m/s } \cancel{[N]}}{5 \text{ s}}$$

$$\text{Acceleration} = \frac{1.5 \text{ m/s } \mathbf{[S]} - 4.5 \text{ m/s } \mathbf{[N]}}{5 \text{ s}} =$$

Option 2

Initial velocity: + 4.5 m/s[N] = **- 4.5 m/s [S]**

Final velocity : **1.5 m/s [S]**

Time: 5 s

$$\frac{1.5 \text{ m/s [S]} - (-4.5 \text{ m/s [S]})}{5 \text{ s}} = \frac{1.5 + 4.5}{5 \text{ s}} = \frac{6 \text{ m/s [S]}}{5 \text{ s}} = 1.2 \text{ m/s/s} = 1.2 \text{ m/s}^2 \text{ [S]}$$

Option 1

Initial velocity: **4.5 m/s [N]**

Final velocity : 1.5 m/s [S] = **- 1.5 m/s [N]**

Time: 5 s

$$\frac{\text{-1.5 m/s [N] - (4.5 m/s [N])}}{\text{5 s}} = \frac{\text{-1.5 - 4.5}}{\text{5 s}} = \frac{\text{-6 m/s [N]}}{\text{5 s}} = \text{-1.2 m /s}^2\text{ [N]}$$

Examples of vector quantity:
Displacement: 5 m [E]
Velocity: 3 m/s [N]
Acceleration: 8 m/s^2 [S]

Which one is not a vector?

Vector (velocity):
1) Direction
2) Unit
3) **quantity or magnitude (size, number)**

Acceleration is a change in Velocity. Acceleration is a vector

Three situations when an object accelerates
1) speeding (**5** m/s [N] to **10** m/s [N])
2) slowing (**25** m/s [E] to **0** m/s [E])
3) change of direction (25 m/s **[N]** to 25 m/s **[E]**

15 m/s [N] to 15 m/s [N] = no acceleration

Vector quantity should have 3 characters (things);
Example : Velocity = **2** m/s **[N]**
Displacement = **2** m **[S]**
Acceleration = **2.2** m/s^2 **[E]**

1) Direction

2) Units

3) **Magnitude** (numbers, size) (slowing down or speeding)

Acceleration: Change in velocity;
An object accelerate with the velocity changes.

Acceleration:
1) slowing down (**5** m/s [N] to **3** m/s [N]
2) speeding (**7** m/s [S] to **15** m/s [S])
3) Direction (+ 15 m/s **[E]** to - 15 m/s **[W]**)
What else could be a change in velocity?