

An Introduction to Acceleration

SPH4C

Acceleration is defined as the change in the velocity of an object per interval of time, or:

$$\vec{a} =$$

where $\vec{v}_2 =$ _____ and $\vec{v}_1 =$ _____

Acceleration will have units of _____ or _____.

(Notice also that acceleration is a _____.)

Example 1: Jake increases his velocity from 13 m/s [E] to 25 m/s [E] in 5.0 s. What is his acceleration?

Givens:

Select:

Unknown:

Solve:

Example 2: Richard reduces his velocity from 15 m/s [forward] to 12 m/s [forward] in 4.0 s. What is his acceleration?

Givens:

Select:

Unknown:

Solve:

If an object is slowing down, acceleration is opposite the direction of motion.

The equation that represents the definition of acceleration may be rearranged to solve for any of the other variables, e.g. (solving for v_2)

$$a = \frac{v_2 - v_1}{\Delta t}$$

$$a \square = \left(\frac{v_2 - v_1}{\square} \right) \square$$

$$a \square = v_2 - v_1$$

$$a \square + \square = v_2 - v_1 + \square$$

$$a \square + \square = v_2$$

$$\text{or } v_2 = \square$$

Example 3: A ball is travelling at 12 m/s [up] and being accelerated at 9.8 m/s² [down].
What is its velocity after 2.0 s?

Givens:

Select:

Unknown:

Solve:

Playing with the Ticker Timers and Acceleration

Take a ticker timer and ticker tape. Place the ticker tape in the timer and turn the timer on. Pull the tape speeding up and then slowing down. (You may find it easiest to attach a car to the tape and give the car a push for “speeding up” and then just let friction slow the car for “slowing down.”)

As the tape is speeding up, the dots get _____.

As the tape is slowing down, the dots get _____.

Sketch what you think the distance-time graph would look like for an object that is:

slowing down?

speeding up?

More Practice

1. An object accelerates from rest (a speed of zero) to 1.0 m/s [East] in 0.5 s.
The magnitude of its acceleration is:
A. 0 m/s² B. 2 m/s² C. 4 m/s² D. impossible to determine
2. An object accelerates from rest (a speed of zero) to 1.0 m/s [East] in 0.5 s.
The direction of its acceleration is:
A. East B. West C. 0 D. impossible to determine
3. A car travelling at an initial speed of 30 m/s [North] brakes to a stop in 3 s.
The magnitude of its acceleration is:
A. 0 m/s² B. 0.1 m/s² C. 10 m/s² D. impossible to determine
4. A car travelling at an initial speed of 30 m/s [North] brakes to a stop in 3 s.
The direction of its acceleration is:
A. North B. South C. 0 D. impossible to determine
- 5.(a) If Donovan Bailey reaches a top speed from rest of 10.2 m/s in 2.5 s, what was the magnitude of his acceleration? (Show a GUSS solution.)

Givens:

Select:

Unknown:

Solve:

- 5.(b) What was his speed after 1.0 s? (Show a GUSS solution.)

Givens:

Select:

Unknown:

Solve: