PHYSICS

ACCELERATION

Acceleration - As a scalar - The rate of change in ***Speed***
- As a vector - The rate of change in ***Velocity***

$$\text{ACCELERATION} = \frac{\text{Change in SPEED}}{\text{TIME}}$$

$$\text{ACCELERATION} = \frac{\text{Change in VELOCITY}}{\text{TIME}}$$

Δv is the change of speed/velocity and can be written as $v_2 - v_1$

(Where v_2 is final speed and v_1 is initial speed)

Additional Formulae

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Acceleration Units

The units for acceleration are slightly complex. Refering to the formula it is a ***SPEED*** (distance per time) divided by a ***TIME***. This means that an acceleration unit will be a ***distance per time per time***.

For example, a car that accelerates 10 **km/h** every **second** would be said to be accelerating at 10 **km/h/s.**

There will be times where the time units are the same. For example, a car that accelerates at 5 **m/s** every **second** would be said to be accelerating at 5 **m/s/s** or 5 **m/s²**.

Ex: *Calculate the acceleration of a plane that speeds up from 10 m/s to 60 m/s in 5.0 seconds.*

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Ex: *An airplane lands on a runway travelling 250 km/h and slows down at a rate of 20 km/h/s. How fast will the plane be going after 8.5 seconds?*

Ex: *In order to make an upcoming turn, a car needs to be traveling a speed of 12 m/s. If the car is originally travelling at 90 km/h and the breaks can decelerate the car at 3 m/s/s. How long in advance should the driver initiate breaking in order to safely take the turn?*

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1. A roller coaster car rapidly picks up speed as it rolls down a slope. As it starts down the slope, its speed is 4 m/s. But 3 seconds later, at the bottom of the slope, its speed is 22 m/s. What is its average acceleration?

2. A cyclist accelerates from 0 m/s to 8 m/s in 3 seconds. What is his acceleration ? Is this acceleration higher than that of a car which accelerates from 0 to 30 m/s in 8 seconds?

3. A car advertisement states that a certain car can accelerate from rest to 70 km/h in 7 seconds. Find the car's average acceleration.

4. A lizard accelerates from 2 m/s to 10 m/s in 4 seconds. What is the lizard's average acceleration?

5. If a Ferrari, with an initial velocity of 10 m/s, accelerates at a rate of 50 m/s/s for 3 seconds, what will its final velocity be?

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6. A car traveling at a speed of 30.0 m/s encounters an emergency and comes to a complete stop. How much time will it take for the car to stop if it decelerates at -4.0 m/s^2?

7. If a car can go from 0 to 100 km/hr in 8.0 seconds, what would be its final speed after 5.0 seconds if its starting speed were 80 km/hr?

8. A cart rolling down an incline for 5.0 seconds has an acceleration of 4.0 m/s^2. If the cart has a beginning speed of 2.0 m/s, what is its final speed?

9. A helicopter's speed increases from 25 m/s to 60 m/s in 5 seconds. What is the acceleration of this helicopter?

10. As she climbs a hill, a cyclist slows down from 25 mi/hr to 6 mi/hr in 10 seconds. What is her deceleration?

11. A motorcycle traveling at 25 m/s accelerates at a rate of 7.0 m/s^2 for 6.0 seconds. What is the final speed of the motorcycle?

12. A car starting from rest accelerates at a rate of 8.0 m/s/s. What is its final speed at the end of 4.0 seconds?

13. After traveling for 6.0 seconds, a runner reaches a speed of 10 m/s. What is the runner's acceleration?

14. A cyclist accelerates at a rate of 7.0 m/s^2. How long will it take the cyclist to reach a speed of 18 m/s?

15. A skateboarder traveling at 7.0 meters per second rolls to a stop at the top of a ramp in 3.0 seconds. What is the skateboarder's acceleration?