

Accelerating Objects

Acceleration (a vector quantity) is defined as _____

It has units of _____

A batter changes the velocity of a baseball by 55 m/s during 0.003 seconds the bat is in contact with the ball. The acceleration is:

Acceleration can be calculated using the equation:

A car maker advertises that its car can go from zero to 100 km/h in 3.2 seconds. This a description of acceleration.

Acceleration as a Vector

Since acceleration is a vector quantity, uniform motion means _____

If either the _____,
the object is accelerating.

E.g. Objects moving at constant speed in a circle (merry-go-round, planets) are constantly accelerating

Acceleration can be _____

_____ – increasing velocity, same direction as the moving object

_____ - uniform motion (velocity stays constant).

_____ - decreasing velocity, opposite direction of moving object

Equations of Motion

Study Notes/Questions

A car is initially traveling at a velocity of 52 km/h [W]. During a time interval of 15s, it increases its velocity to 76 km/h [W]. What is the average acceleration of the car?

A cheetah is waiting in the bushes for its prey. At just the right moment, it suddenly begins racing across the field. Within moments, it has reached its maximum velocity of 26 m/s [N]. If its acceleration was 3.1 m/s^2 [N], how long did the cheetah take to reach its maximum velocity?

A bicycle is moving east along a straight sidewalk. During the 1.7 s interval, the bicycle accelerates at 1.2 m/s^2 [E]. After the time interval, the bicycle's velocity is 4.3 m/s [E]. What was the bicycle's velocity at the beginning of that time interval?

Equations of Motion Practice

1. What happens to the velocity of an object as it falls if the only force acting on the object is gravity? What happens to the acceleration of the object?
2. A cyclist starts from rest and reaches a velocity of 18 m/s [SW] in 3.8 s. What was the cyclist's acceleration?
3. A UFO is flying at a velocity of 45 m/s [E]. If 5.9 s later its velocity was 35 m/s [W], what was its acceleration? What assumption did you make?
4. A motorcycle and rider start from rest and reach a velocity of 52 km/h [E] in 2.7 s. What was the acceleration of the motorcycle in m/s^2 ?
5. A sprinter finishes a race with a velocity of +8.9 m/s. The sprinter accelerated to a stop at a rate of -2.7 m/s^2 . How long did it take the sprinter to come to a stop?

Solutions:

1. The velocity increases. The acceleration is always 9.8 m/s^2
2. 4.7 m/s^2 [SW]
3. -14 m/s^2 [W]. East is positive, and the change in velocity was instantaneous
4. 5.3 m/s^2
5. 3.3 s

Equations of Motion

Study Notes/Questions

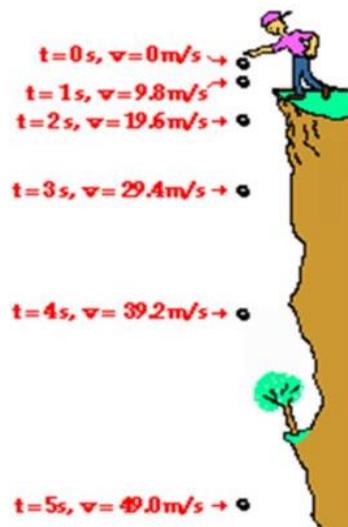
Falling Objects

Objects fall because the force of gravity

When air resistance is negligible, motion is called _____

Since the force of gravity is constant, the acceleration due to gravity is also _____

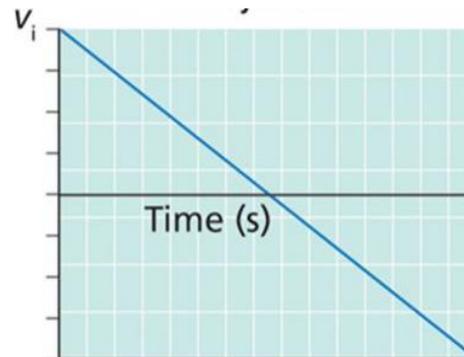
The acceleration of gravity near Earth's surface is about _____



Velocity of a Vertical Projectile

If an object is thrown upward with an initial velocity of v_i , the force of gravity will cause it to slow down, stop briefly, then fall back to the Earth.

A _____
is acting on the object



Vertical Projectiles

A baseball is thrown with a velocity of 15 m/s upward. What will be the baseball's velocity after 2 seconds?

A person standing on a bridge drops a rock down toward the water below. The rock strikes the water 5.2 s later. Assuming no air resistance, what is the velocity of the rock when it hits the water?