Regents Physics

Kinematic Equations

APlusPhysics

Objectives

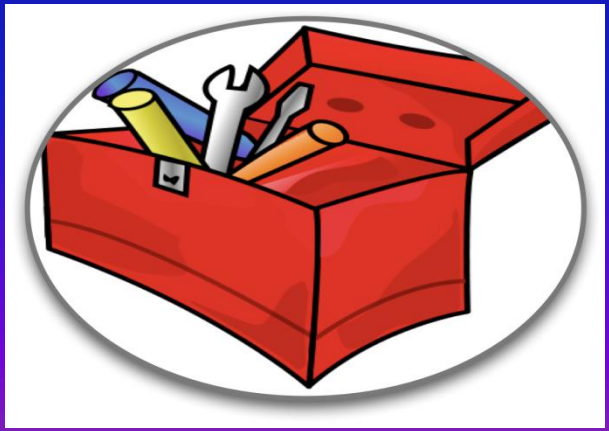
- Use kinematic equations to solve problems for objects moving at a constant acceleration in a straight line.

Problem-Solving Toolbox

- Graphs are not always the most effective way of understanding motion.

Variable	Value
v_i	Initial velocity
v_f	Final velocity
d	Displacement
a	Acceleration
t	Time

- Kinematic equations help us solve for five key variables describing the motion of an object in a single dimension.



Kinematic Equations

$$v_f = v_i + at$$

$$d = v_i t + \frac{1}{2} a t^2$$

$$v_f^{\,2} = v_i^{\,2} + 2ad$$

Problem Solving Steps

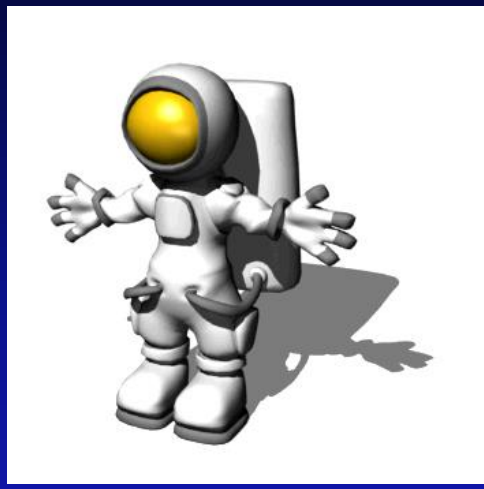
1. Label your analysis for horizontal (x-axis) or vertical (y-axis) motion.
2. Choose a direction as positive (typically the direction of initial motion).
3. Create a motion analysis table.
4. Fill in your givens.
5. Once you know three items in the table, solve for unknowns.
6. Verify that your solution makes sense.

Sample Problem - Horizontal

A race car starting from rest accelerates uniformly at a rate of 4.9 meters per second^2. What is the car's speed after it has traveled 200 meters?

Sample Problem - Vertical

An astronaut standing on a platform on the Moon drops a hammer. If the hammer falls 6.0 meters vertically in 2.7 seconds, what is its acceleration?



Sample Problem – 2 Steps

A car traveling on a straight road at 15 m/s accelerates uniformly to a speed of 21 m/s in 12 seconds. Find the total distance traveled by the car in this 12-second time interval.

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$v_i =$

$v_f =$

$d = FIND$

$a =$

$t =$

Can't find "d" directly, find "a" first.

$$v_f = v_i + at$$

$$a = \frac{v_f - v_i}{t} =$$

$$d = v_i t + \frac{1}{2} a t^2 =$$