Motion During Constant Acceleration

Pre-Class Questions:

Problem Set (due next time)
Ch 2 - 27, 31,33, 40

Lecture Outline

1. The Equations of Motion
2. Hints for Problem Solving
3. Lots of Examples

Kinematic equation	Missing variable
$v = v_o + at$	$x - x_o$
$x = x_o + v_o t + \frac{1}{2} a t^2$	v
$v^2 = v_o^2 + 2a(x - x_o)$	t

Example 1: A car accelerating at a constant rate goes from zero to 60mph (26.8m/s) in 6.00s. Find (a)the acceleration and (b)the distance traveled during this time.

Hints for Problem Solving

- A sketch of the important features of the problem.
- A clearly identified coordinate system, if needed.
- A list of known quantities.
- A list of the quantities you intend to find.
- The names of the relevant definitions, laws, and useful relationships you use.
- A written explanation of the reasoning required for the key steps.
- The algebra done first, then the numbers plugged in.
- A clear indication of the final answer (such as a box around it)
- A final written comment about the result.

1. A runner stealing second base is running at 8.00m/s. Second base is 2.00m away when she begins her slide into the base. Assume during the slide she is decelerating at a constant rate and her speed reaches zero just as she touches second base. Find (a)the time for her to get to second base and (b)her acceleration during the slide.

2. A drag racer starting from rest can cover the quarter mile in 4.572s. Find (a)his acceleration in m/s^2 (assumed constant) and (b)his final speed in m/s and mph. Here's a video of a top fuel dragster in competition (http://www.youtube.com/watch?v=LNszt39F3ns).

3. According to the White Tip Reef Shark Project of Hawaii (http://www.whitetip.org/accelerometry.htm) a shark has a maximum sustained acceleration of 1.3g or $13m/s^2$. Suppose a shark starting at rest can reach a top speed of 30m/s. Find (a) the distance the shark covers and (b)the time it takes to reach this speed.

4. A wildly erratic driver traveling at highway speeds has only 100m to pass a slower car. Making a bad decision, he accelerates at a constant rate for 3.20s to pass the car and notices he reaches a speed of 150km/h (95mph). Find (a)the initial velocity and the (b) acceleration of the car.

Lecture 03 - Summary

Kinematic equation	Missing variable
$v = v_o + at$	$x - x_o$
$x = x_o + v_o t + \frac{1}{2}at^2$	v
$v^2 = v_o^2 + 2a(x - x_o)$	t

Warning: They work only for constant acceleration!

A proper problem solution includes:
•A sketch of the important features of the problem.
•A clearly identified coordinate system, if needed.
•A list of known quantities.
•A list of the quantities you intend to find.
•The names of the relevant definitions, laws, and useful relationships you use.
•A written explanation of the reasoning required for the key steps.
•The algebra done first, then the numbers plugged in.
•A clear indication of the final answer (such as a box around it)
•A final written comment about the result.