Kinematics

Kinematics is the collective name for the unit that covers acceleration, velocity, displacement, and time and how they relate to each other. It's important to understand the formulas in this unit because they will come back in later units, such as force and work.

Measurement Review

Acceleration	a	m/s^2
Velocity	V^F or V^I	m/s
Displacement	Δx	m
Time	t	s

Speed, Velocity and Acceleration

Speed, measured in meters/second, can be found with the formula:
distance / time
Velocity, also measured in meters/second, can be found with the formula:
displacement / time, or $\Delta x / \Delta t$.
Acceleration, measured in meters/second^2, can be found with the formula:
(final velocity - initial velocity) / (final time - initial time), or $(V^F - V^I) / (T^F - T^I)$
Time, measured in seconds, is generally given to you.

T^I is usually, but not always, zero.

The Four Formulas

Formula:	Missing:
$\Delta x = V^I t + \frac{1}{2} at^2$	V^F
$V^F = V^I + at$	Δx
$\Delta x = (V^F + V^I / 2) \times t$	a
$\Delta x = (V^{F2} - V^{I2}) / 2a)$	t

Every kinematics problem will give you 3 of the 5 variables and ask you to solve for 1 variable. The fifth variable doesn't matter - use the formula **without** that variable (if the problem doesn't mention a, use the formula without a in it.)

Example Problem

A worker drops a wrench from the top of a tower 80 m tall. What is the velocity when the wrench hits the ground?
In the context of this problem, we are told that *$\Delta x = 80$ m*. We know that *$V^I = 0$ m/s* because at the beginning of the problem, the wrench wasn't moving (the worker was holding it. And we can assume that *acceleration is 9.8 m/s^2* because **gravity** is taking effect.
This leaves us with **V^F** and **t**. Since the question is asking us for final velocity, we know that **t** isn't important to this problem - therefore, choose the kinematic equation without the **t** in it to solve the problem.

The equation without **t** in it is **$\Delta x = (V^{F2} + V^{I2}) / 2a$.** Then, all that's left to do is to plug in all the variables and solve for V^F!

The answer to this problem should be *39.60 m/s.*