# The Physics of Particle Settling Velocity
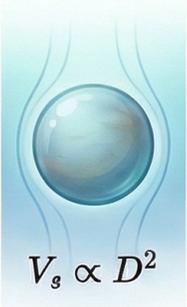
Stokes' Law for Fine Particles

For small particles (Re < 1), settling velocity is proportional to the diameter squared.

$$V_s \propto D^2$$

Impact of Particle Shape

Angular or irregular natural sediments settle more slowly than perfectly smooth spheres.

Faster Settling

Slower Settling

Terminal Velocity is a State of Equilibrium:

Reached when drag force (F_D) exactly balances the particle's submerged weight.
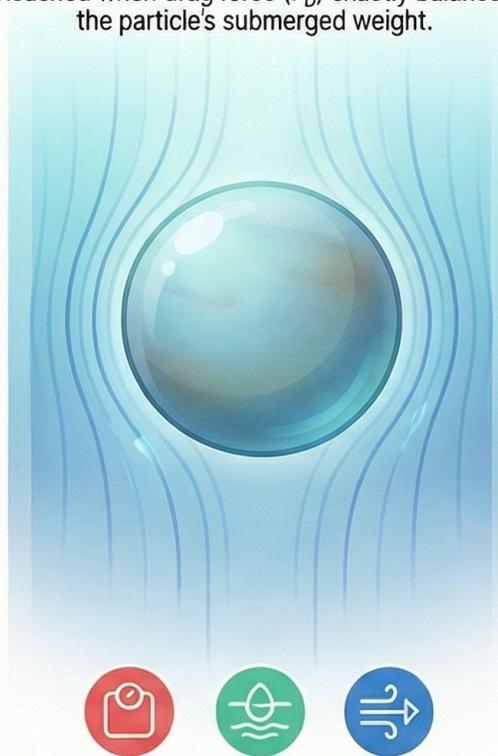
The Three Primary Vertical Forces

Settling is governed by the interaction of **Particle Weight**, **Buoyant Force**, and **Drag**.

The Iterative Calculation Paradox

Velocity depends on drag, but drag depends on velocity, requiring an iterative solving process.

Velocity

Drag Force

Drag Coefficient
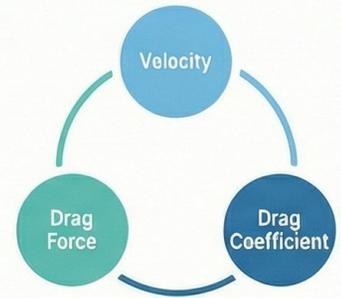
Regime-Dependent Behavior & Flow Dynamics

The Reynolds Number determines if drag is dominated by fluid friction or pressure.
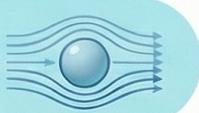
Hydrodynamic Regime	Reynolds Number (Re)	Dominant Physics
Stokes (Viscous)	$Re \leq 1$	Fully laminar flow; drag is dominated by viscous shear.
Transitional	$1 < Re < 10^2$	Flow separation begins, drag transitions from viscous to pressure-dominated.
Inertial	$Re \geq 10^3$	Pressure drag dominates, a turbulent wake forms behind the particle.