

Drag force equation

Fluid Dynamics: Drag Force

- Equation: $F_{\text{drag}} = \frac{1}{2} \rho C_d A v^2$
- Units: N
- ρ = Fluid density
 - Mass per unit volume
 - Air: 1.2754 kg/m^3
 - Water: 997 kg/m^3
- v = velocity of fluid moving relative to object
 - Units: m/s
- C_d = Coefficient of drag
 - Based upon surface characteristics and shape of object
 - Unitless
- A = Frontal area (units: m^2)

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 - A function of skin and form drag
 - Based upon surface characteristics and shape of object
 - Unitless
 - A = Frontal area (units: m²)
- Common to combine $C_d A$ as a single term

Drag force

- Resistance force
 - Running/Cycling into a head wind
 - Swimming resistive force
- Propulsive force
 - Tail wind running/cycling
 - Swimming propulsive force



$$F_{\text{drag}} = \frac{1}{2} \rho C_d A v^2$$

- How to reduce drag resistance force during cycling?
 - Density of air
 - Tight clothing
 - Aero position
- How to reduce drag resistance force during swimming?
 - Density of fluid
 - Swim suit material
 - Horizontal position in water
- How to increase drag propulsion force during swimming?
 - Hand area
 - Swim technique