1 F5: Terminal velocity, drag forces

$$\frac{F}{A} = \eta \frac{dv}{dy} \tag{1}$$

$$F_{viscous} = 6\pi\eta R v \tag{2}$$

$$F_{inertia} = \frac{1}{2} C_D \rho \left(\pi R^2\right) v^2 \tag{3}$$

- C_D drag coefficient
- ρ density of fluid
- R radius of sphere
- η is the dynamic viscosity

$$\sum F_y = mg - B - 6\pi\eta R v - \frac{1}{2} C_D \rho \left(\pi R^2\right) v^2 \tag{4}$$

- If laminal flow (v is small): $F_{inertia} < F_{viscosity}$
- If turbulant (v is big) : you may drop $F_{viscosity}$ term

$$Re = \frac{\rho v D}{\eta} \quad D \text{ is diameter} \tag{5}$$

1.1 Specific Gravity

$$\text{specific gravity} = \frac{\rho_{object}}{\rho_{water}} \tag{6}$$

$$\sum F_y = mg - B - F_{drag} = m(0) \tag{7}$$

$$F_{drag} = mg - B \tag{8}$$

1.2 Deriving Slope Equation

$$\Delta \mathbf{y} = \mathbf{v}_{o_y} - \frac{1}{2} g t^2$$

$$y = \left(\frac{1}{2} g\right) t^2$$

$$\ln(y) = \ln\left(\frac{g}{2}\right) + 2\ln(t)$$

$$F_{drag} = E v_t^k$$