# 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
- $\rho$ density of fluid
- $R$ radius of sphere
- $\eta$ 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

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

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

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