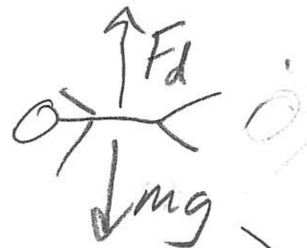
Physics 200 (Stapleton) Name: Key

Ch. 5.1: Drag and Terminal Velocity

Drag Force (friction when moving through a fluid) → $F_d = \frac{1}{2} A C_d \rho v^2$

(A: Cross-sectional Area; C_d: Drag Coefficient; ρ: Density of Air; v: Velocity)

10. Draw a *Free Body Diagram* (diagram showing forces) showing all of the forces acting on a falling skydiver.



$\Sigma F = F_d - mg$

11. For a skydiver at terminal velocity (falling at constant velocity),

$\Sigma F =$ zero

12. Derive an equation for the terminal velocity of a falling object.

$$\Sigma F_{\text{Term Vel}} = 0 = F_d - mg$$

$$\Downarrow$$

$$mg = F_d \Rightarrow mg = \frac{1}{2} A C_d \rho v_{term}^2$$

$$\sqrt{\frac{2mg}{A C_d \rho}} = v_t$$

13. Under what circumstances is a skydiver's acceleration…

…positive? When drag > weight (Parachute opens / Landing)

…negative? weight > drag (before reaching T.V.)

…zero? @ terminal velocity

14. The table below describes the experience of a skydiver who steps out of a stationary helicopter. Create a reasonable acceleration graph portraying this sequence of events. Note the skydiver's velocities at various points.

Sequence	Event
1	Skydiver steps off of helicopter
2	Skydiver reaches a **terminal velocity of -40m/s**
3	Skydiver pulls chute cord. Parachute deploys.
4	Skydiver reaches a new **terminal velocity of -4m/s**
5	Skydiver feet touch down
6	Skydiver comes to rest