

# Physics 1



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# Buoyancy and Drift Forces

## Drag Force

### Questions:

**1) Skydiver.**

A skydiver is jumping off a plane and opens parachute.

Given: the friction force with the air is:  $\vec{F} = -k\vec{v}$ .

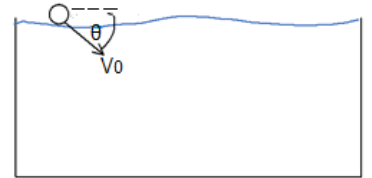
- Find the equation of motion.
- Find the terminal velocity.
- Find the velocity as a function of time if the skydiver starts at rest.



**2) Ball is thrown in to a Pool.**

A ball is thrown into a pool with an initial velocity of  $v_0$  at an angle of  $\theta$  relative to the water's surface.

You are given: Water Viscosity –  $\eta$ .



Ball Radius –  $R$ , Water Density –  $\rho_w$  and Ball Density –  $\rho_b$ ,  $v_0$  and  $\theta$ .

- Write out the Equation of Motion for the ball.
- Find the terminal velocity.
- Find the maximal depth reached by the ball, if  $\rho_b > \rho_w$ .

### Answer Key:

1) a.  $\sum F_y = mg - K_{vy} = ma_y$       b.  $v_{y_{final}} = \frac{mg}{k}$       c.  $v(t) = \frac{mg}{k} \left( 1 - e^{-\frac{k}{m}t} \right)$

2) a.  $c - kv_y = ma_y$ ,  $\sum F_x = -kv_x = ma_x$       b.  $v_{y_{final}} = \frac{mg - F_b}{6\pi\eta R}$

c.  $y_{max} = \frac{cm}{k^2} \ln \frac{k(c - v_0 \sin \theta)}{c} + \frac{m}{k} (c - v_0 \sin \theta) \left[ \frac{c}{k(c - v_0 \sin \theta)} - 1 \right]$