proprep™

Workbook

Table of Contents

Buoyancy and Drift Forces 2
Drag Force 2

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Drag Force

Questions

1) Skydiver.

A skydiver is jumping off a plan and opens a parachute.

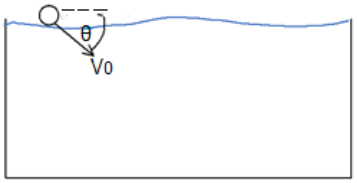
Given: the friction force with the air is: $\vec{F} = -k\vec{v}$.

a. Find the equation of motion.
b. Find the terminal velocity.
c. 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 θ relative to the water's surface.

You are given: Water Viscosity – η.



Ball Radius – R, Water Density – ρ_w and Ball Density – ρ_b, v_o and θ.

a. Write out the Equation of Motion for the ball.
b. Find the terminal velocity.
c. 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. $y_{\max} = \frac{cm}{k^2}\ln\frac{k(c - v_0\sin\theta)}{c} + \frac{m}{k}(c - v_0\sin\theta)\left[\frac{c}{k(c - v_0\sin\theta)} - 1\right]$