

## Problem Set 10b

Assigned: Tuesday 11/22/11

Due: Tuesday 12/06/11

### Question 2:

A thin square plate (density  $\rho_s = 2\rho$ ) of dimension  $1\text{cm} \times 1\text{cm}$  and thickness  $1\text{mm}$  is released in water from rest. If the plate falls parallel to the square side (figure (a) below), its terminal velocity is

$U_p =$  \_\_\_\_\_ (use friction coefficient  $C_f = 1.328 R_L^{-1/2}$  for laminar, and  $C_f = 0.0725 R_L^{-1/5}$  for turbulent boundary layer).

A teardrop-shaped streamlined body has the same length ( $1\text{cm}$ ) and total wetted area ( $S=2\text{cm}^2$ ) as the flat plate above, and has a weight in water (weight minus buoyancy)  $W=1.5 \cdot 10^{-3}\text{N}$ . When dropped from rest vertically (figure (b) below), the terminal velocity of this body is found to be  $U_b = 0.25\text{m/s}$ . Based on this information, the form drag (total drag minus friction drag) of the teardrop-shaped body can be estimated to be  $D =$  \_\_\_\_\_.

