

Problem 1.C2

When a person ice-skates, the ice surface actually melts beneath the blades, so that he or she skates on a thin film of water between the blade and the ice.

(a) Find an expression for total friction force F on the bottom of the blade as a function of skater velocity V , blade length L , water film thickness h , water viscosity μ , and blade width W .

(b) Suppose an ice skater of total mass m is skating along at a constant speed of V_0 when she suddenly stands stiff with her skates pointed directly forward, allowing herself to coast to a stop. Neglecting friction due to air resistance, how far will she travel before she comes to a stop? (Remember, she is coasting on *two* skate blades.) Give your answer for the total distance traveled, x , as a function of (V_0, m, L, h, μ, W) .

(c) Compute x for the case $V_0 = 4$ m/s, $m = 100$ kg, $L = 30$ cm, $W = 5.0$ mm, and $h = 0.10$ mm. Do you think our assumption of negligible air resistance is a good one?