Problem 9.2

A small channel is h = 5 cm deep and b = 10 cm wide. It carries flow at U = 10 cms^{-1}. The stream-wise coordinate is x. The vertical coordinate is z, with z = 0 at the bed and positive upward. A continuous source of dye is injected at a rate of $\dot{m}$ =1 gs^{-1} at mid-depth and mid-width, and at x = 0. Assume that the channel has no dye upstream of the injection point. The bed of the channel is a perfect absorber for the dye**,** such that the concentration of dye in equilibrium with the bed is zero, and thus C(z=0) = 0. The molecular diffusivity for the dye is D = 10^{-5} cm^2s^{-1}. What is the maximum concentration in the channel 20 m downstream of the source?