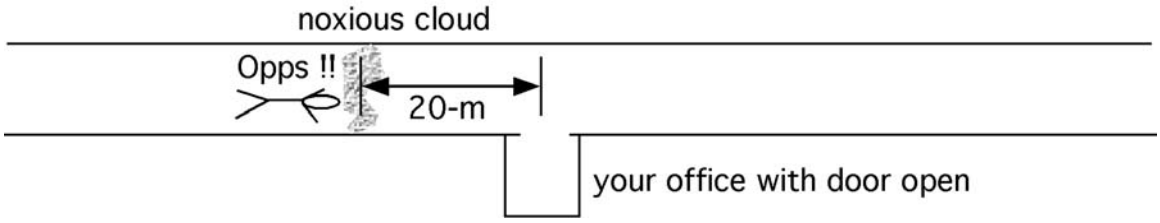
Problem 3.2

A friend of yours is coming to meet you at your office, which is located mid-way along a very long (100-m) hallway. In preparation for a small prank, he is carrying a vial containing 10-g of a noxious smelling gas. He trips 20-m before reaching your office door, and the vial breaks. The gas rapidly mixes vertically and horizontally within the hallway, which is 2-m wide and 3-m high. The human nose will detect the gas at concentrations greater than 10-µg/l. Assume an isotropic diffusion, D = 0.05 m^2/s.



What governing equation describes the evolution of the gas concentration in the hall?
At what time after the spill do you smell the gas?
When does the smell, as perceived by humans, disappear from the hallway?