A chemical reaction (A-> B) is occurring while the reactant diffuses down a rectangular channel.

y

z

Ca(x,0)=C1

x=x1

x=0

Prior to t=0 the reactant concentration in the channel is uniform at Ca(x,0)=Co. At t=0, at x=0, the end concentration is raised to C(0,0)=C1 and held there. Develop a finite difference model for Ca(x,t).

The reactant moves down the channel by diffusion, i.e. flux = -*D*\*(area)\*(dCa(x,t)/dx) and reacts in a 1st order reaction, i.e. r = -k\*Ca.

Notes:

Flux has dimensions of mass/time

*D* has dimensions of L2/time.

k has dimensions of 1/time.

r has dimensions of mass/L3-t.

Suggestion: Use a component mass balance on A for a differential element of size x.

