

### Problem 112A

Consider the flow of a fluid in which the fluid elements are travelling with velocity,  $u$ , in the  $x$  direction (this is the only non-zero velocity of the fluid which it is necessary to consider in this problem). A succession of fluid elements travel through the Eulerian point,  $x = x_o$  with a velocity  $u = u_o$  and subsequently accelerate according to

$$u = (u_o/x_o)x$$

However the flow is **steady**. Chemical constituents within the fluid are reacting in such a way that the concentration,  $c$ , of one of the constituents is increasing with time at a rate denoted by  $\alpha$  (a constant). If the concentration at the point  $x = x_o$  has a known and constant value denoted by  $c_o$  find an expression for the concentration elsewhere as a function of  $x$ ,  $x_o$ ,  $u_o$ ,  $c_o$  and  $\alpha$ .