The cessation of a stream (less precise). A 30 liter well-mixed tank at 20°C is available to dilute 5.0 kg/min of a 5% (by mass) ethanol solution to 3%. We will assume that the diluted ethanol flows out over the rim of the tank, so that the volume of the liquid in the tank is always 30 liters.

Find:

i)   What steady-state flowrate of water is needed to achieve this dilution?
ii)   After steady-state has been achieved, the water flow suddenly is halted. How much time elapses before the effluent ethanol concentration surpasses 4%?

Additional Information:

ρ(3% ethanol) = 0.9927 g/mL
ρ(4% ethanol) = 0.9911 g/mL
ρ(5% ethanol) = 0.9894 g/mL

Pre-problem Thoughts:

1.   What are the components?

2.   What are the subsystems?

3.   What are the streams?

4.   What type of balance should be performed?

5.   Steady-state vs. unsteady-state and reactive vs unreactive.

6.   What is going on in this problem?