M2E03 - Introduction to Modelling –Practice Problems

Solution will be given in the class as well as posted on the web

10. Two large tanks, each holding 24 liters of a brine solution, are interconnected by pipes. Fresh water flows into tank A at a rate of $6L/min$, and fluid is drained out of tank B at the same rate: also $8L/min$ of fluid are pumped from tank A to tank B, and $2L/min$ from tank B to tank A. The liquids inside each tank are kept weel stirred, so that each mixture is homogenous. If initially, the brine solution in tank A contains $x_0 kg$ of salt and that in tank B initially contains $y_0 kg$ of salt, determine the mass of salt in each tank.

11. Two large tanks, each holding $100L$ of liquid, are interconnected by pipes, with the liquid flowing from tank A into tank B at a rate $3L/min$ and from B into A at a rate of $1L/min$. The liquid inside each tank is kept well stirred. A brine solution with a concentration of $2kg/L$ of salt flows into tank A at a rate of $6L/min$. The solution flows out of the system from tank A at $4L/min$ and from tank B at $2L/min$. If, initially, tank A contains pure water and tank B contains $200kg$ of salt, set up the initial value problem for this model.

12. A rock contains two radioactive isotopes, RA_1 and RA_2, that belongs to the same radioactive series; that is, RA_1 decays into RA_2, which then decays into stable atoms. Assume that the rate at which RA_1 decays into RA_2 is $50e^{-10t}kg/sec$. Given information $k = 2/sec$ is the decay constant and $y(0) = 40kg$, find the mass $y(t)$ of RA_2.