Problem 3

Biological cells (spheres with a diameter of 10 um) that are contaminated with a chemical X at a concentration of 1 (relative units) are washed for 1, 2 or 5 minutes with clean water. Will this procedure be sufficient to clean the cells i.e. reduce the relative amount of the chemical in the cell to 2% of the starting value? You will have to make a number of assumptions that may not be simple to get at. Play around with various assumptions if you are uncertain.

Answer: Use link http://www.physics.gla.ac.uk/~awatt/Projects/DiffJK/Java/DiffKJ1.html or the excel sheet Diffusion.xls, "Spherical diffusion". For meaningful calculations the diffusion coefficient in the cell must be known as well as the partition coefficient of chemical X between the cell and water. These values may not be easy to obtain and in fact it is questionable whether there are meaningful values because biological cells are quite heterogeneous. Nevertheless it can be instructive to play around with some rough numbers to get a feeling for results that should at least be in the ball park.