Answers Tut 4:

4.1

a) $k_c = 2.783 \times 10^{-3}$ m.s^{-1}

b) x = 0.912

4.2

a) Ccat = 5.23 kg.m^{-3} ($Ca_s = 0.427$ mol.m^{-3})

b) Ccat = 4.54 kg.m^{-3} ($Ca_s = 0.458$ mol.m^{-3})

Hints:

If the outlet concentration, reactor volume and volumetric feed rate remain the same, it implies that the volumetric rate in the reactor must remain constant for each scenario.

The "overall external mass transfer coefficient" = $k_c a_c$

This is NOT a first order reaction …..Think in terms of unknowns and no of equations

Will k_i' (the mass based rate constant) remain constant if the particle diameter is changed?

4.3

a) $x_{\text{reaction controlled}} = 0.961$

b) $k_c = 6.0 \times 10^{-5}$ m.s^{-1}

c) $k_i' = 8.33 \times 10^{-4}$ m^3.(kg.s)$^{-1}$ (note – function of particle diameter and loading density)

d) $D_2 = 2 \times D_1$