***Preliminary Exam I***

**PROBLEM I**

Four elementary steps:

Kinetic limit of transcription:

Proposed elementary steps and the RNAP balance:

1. Show that:

where,

Saturation constant:

Time constant:

Material balances around the closed and open complex for gene *j* are given by:

At steady state, revised balance equations:

In regards to the steady-state case, only the open complex will be taken into consideration:

Solve for the free RNAP concentration, RX:

Let and solve it for the open complex equation:

1. Conditions under which would be approximately equivalent to the 1-gene system:

The gene system would be equivalent under elongation limited circumstances as , can degrade down to 1 eliminating the summation, thus resulting into the same 1-gene system. However, the values of i and j are relative therefore it can depend on those values.

**PROBLEM II**

