Problem 6

You conduct three steady-state experiments with ^{13}C-labeled glucose, and you assume that flux ends at pyruvate. One experiment will use glucose enriched at C-1, the second experiment will use glucose enriched at C-2, and the third will use glucose enriched at C-3.

Fraction of carbon labeled:

Experiment #1:

C-1: 0.825
C-2: 0.0224
C-3: 0.0134
C-4: 0.0139
C-5: 0.0122
C-6: 0.0228

Experiment #2:

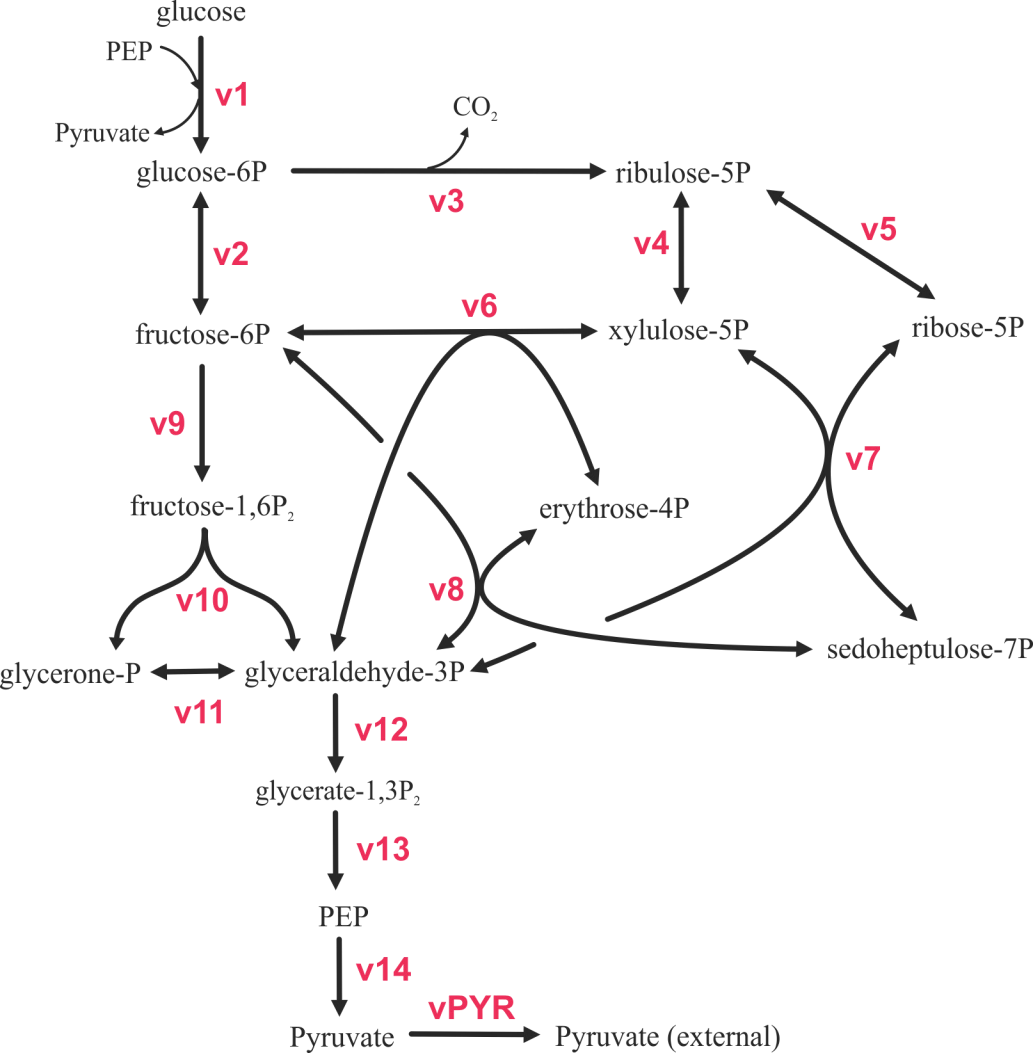
C-1: 0.0224
C-2: 0.825
C-3: 0.0134
C-4: 0.0139
C-5: 0.0122
C-6: 0.0228

Experiment #2:

C-1: 0.0224
C-2: 0.0134
C-3: 0.825
C-4: 0.0139
C-5: 0.0122
C-6: 0.0228

Assume that
1) the molar glucose consumption rate is 100 units.
2) no biomass is formed.
3) all the fluxes are unidirectional. (there is no exchange)

Vary the fraction of glucose-6P entering the pentose phosphate pathway from 0% to 100% in 5% increments. For each fraction, calculate the molar rate of pyruvate formation, and the fractional enrichment at each of the three carbon positions in pyruvate. Make plots of these four variables as a function of pentose phosphate pathway fraction.


glucose
PEP
v1
Pyruvate
CO2
glucose-6P
v3
ribulose-5P
v2
v4
v5
fructose-6P
v6
xylulose-5P
ribose-5P
v9
v7
fructose-1,6P2
erythrose-4P
v10
v8
glycerone-P
glyceraldehyde-3P
sedoheptulose-7P
v11
v12
glycerate-1,3P2
v13
PEP
v14
vPYR
Pyruvate
Pyruvate (external)