

Sandra Vadhin
CHEME 7770 S19
March 12, 2019

Problem Set 3

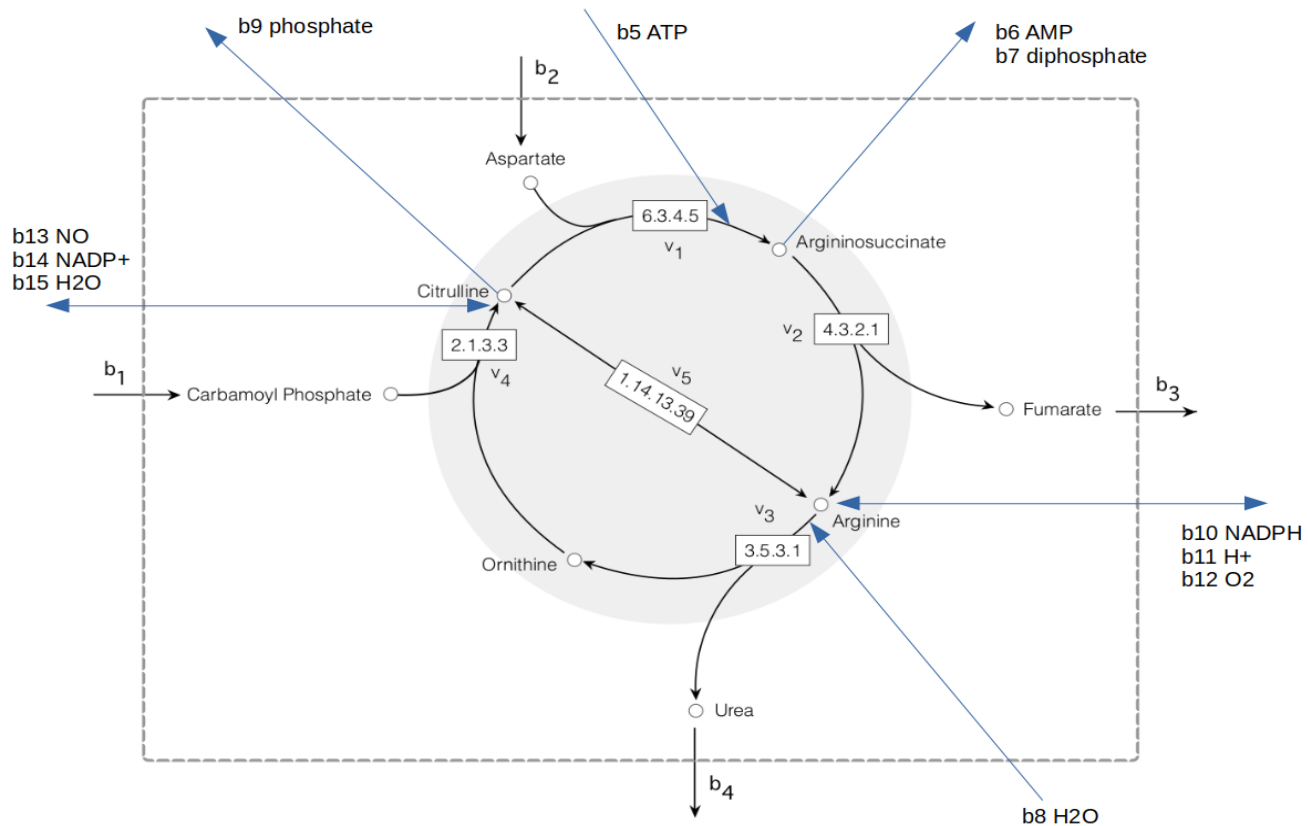


Figure 1. Urea cycle for the purpose of this assignment

V1 catalyzed by EC 6.3.4.5

ATP + L-citrulline + L-aspartate = AMP + diphosphate + 2-(Nomega-L-arginino)succinate

		Chemical formula
Substrates	ATP	C10H16N5O13P3
	Citrulline	C6H13N3O3
	Aspartate	C4H7NO4
Products	AMP	C10H14N5O7P
	Diphosphate	H4P2O7
	Argininosuccinate	C10H18N4O6

Elemental balances for reaction	
C	0
H	0
N	0
O	0
P	0

V2 catalyzed by EC 4.3.2.1

2-(Nomega-L-arginino)succinate = fumarate + L-arginine

		Chemical formula
Substrate	Argininosuccinate	C10H18N4O6
Products	Fumarate	C4H4O4
	Arginine	C6H14N4O2

Elemental balances for reaction	
C	0
H	0
N	0
O	0

V3 catalyzed by EC 3.5.3.1

L-arginine + H₂O = L-ornithine + urea

		Chemical formula
Substrates	Arginine	C ₆ H ₁₄ N ₄ O ₂
	Water	H ₂ O
Products	Ornithine	C ₅ H ₁₂ N ₂ O ₂
	Urea	CH ₄ N ₂ O

Elemental balances for reaction	
C	0
H	0
N	0
O	0

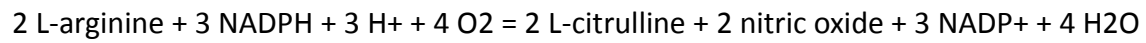
V4 catalyzed by EC 2.1.3.3

carbamoyl phosphate + L-ornithine = phosphate + L-citrulline

		Chemical formula
Substrates	Carbamoyl phosphate	CH ₄ NO ₅ P
	Ornithine	C ₅ H ₁₂ N ₂ O ₂
Products	Phosphate	H ₃ PO ₄
	Citrulline	C ₆ H ₁₃ N ₃ O ₃

Elemental balances for reaction	
C	0
H	0
N	0
O	0
P	0

V5 (reversible) catalyzed by EC 1.14.13.39



		Chemical formula	Stoichiometry
Substrates	Arginine	C ₆ H ₁₄ N ₄ O ₂	2
	NADPH	C ₂₁ H ₃₀ N ₇ O ₁₇ P ₃	3
	H ⁺	H	3
	O ₂	O ₂	4
Products	Citrulline	C ₆ H ₁₃ N ₃ O ₃	2
	Nitric oxide	NO	2
	NADP ⁺	C ₂₁ H ₂₉ N ₇ O ₁₇ P ₃	3
	H ₂ O	H ₂ O	4

Elemental balances for reaction	
C	0
H	0
N	0
O	0
P	0

Part C: The rate of urea production is 1.266 mmol/gDW-hr