Chemistry and Biochemistry 153A, Spring 2011

Exam 2 Answers

1. a. (1) True
   b. (1) False
   c. (1) False
   d. (1) True
   e. (1) True
2. a. (1) lyase
   b. (1) isomerase
   c. (1) oxidoreductase
   d. (1) hydrolase
   e. (1) transferase
   f. (1) hydrolase
3. a. (4) A, B, D, E
   b. (2) They can pack together tightly
   c. (2) stiffer, thicker (additional answers possible)
4. (2) integral
5. a. (2) Na^+, Ca^{2+}, Cl^-
   b. (2) K^+
   c. (2) B
6. (4) b, d, e
7. a. (1) mass/charge
   b. (1) ellipticity (over UV wavelengths)
   c. (1) absorbance (of IR radiation)
8. a. (2) $K_{4,2} = \frac{[\alpha\beta]^2}{[\alpha_2\beta_2]} = \frac{k_1}{k_2}$
   b. (2) deoxygenated
   c. (5)

$$\%\ \text{dissociated} = 100\% \times \frac{[\alpha_2\beta_2]_{dissociated}}{[\alpha_2\beta_2]_{total}}$$

$$[\alpha_2\beta_2]_{total} = [\alpha_2\beta_2]_{dissociated} + [\alpha_2\beta_2]$$

$$[\alpha_2\beta_2]_{dissociated} = \frac{1}{2}[\alpha\beta]$$

$$[\alpha_2\beta_2] = 5\text{mM} = 5 \times 10^{-3}\text{M}$$

from **a**, $[\alpha\beta] = \sqrt{K_{4,2} \times [\alpha_2\beta_2]}$

Arterial blood is (usually) oxygenated, so $K_{4,2} = 5\mu\text{M} = 5 \times 10^{-6}\text{M}$, and

$$[\alpha\beta] = \sqrt{5 \times 10^{-6}\text{M} \times 5 \times 10^{-3}\text{M}} = 1.58 \times 10^{-4}\text{M}$$

% dissociated:

$$= 100\% \times \frac{{}^1\!/_2\,[\alpha\beta]}{{}^1\!/_2\,[\alpha\beta] + [\alpha_2\beta_2]} = \frac{100\% \times 0.5 \times 1.58 \times 10^{-4}\text{M}}{(0.5 \times 1.58 \times 10^{-4}\text{M}) + (5 \times 10^{-3}\text{M})} = \mathbf{1.56\%}$$

   d. (4) 2,3-BPG binds and stabilizes the T-state (deoxyhemoglobin), which has a lower $K_{4,2}$ than oxyhemoglobin
9. a. (3) 1
   b. (3) 6 (1pt for '7')
   c. (3) 4
   d. (3) 2 (1pt for '1')
   e. (3) 3
10. (2 pts per reason)
    - S_N1 carbocation intermediate is too unstable
    - Other retaining glycosidases use S_N2
    - A covalent intermediate has been observed
11. (4) a, c
12. (4) b, d
13. (2) $k_1[A] + k_4[D] = k_2[B][C] + k_3[C]$
14. (3) So that [S] can be considered constant (and equal to the concentration of substrate added to the reaction)
15. (4) b, e, f
16. a. (8 – each mechanism worth 1pt, except Prox. & Orient. – needed to list for all aa's to get 1 pt)
    - Lys 396: Proximity and orientation effects, Electrostatic catalysis, Preferential binding of TS & intermediate
    - Lys 345: Proximity and orientation effects, General base catalysis
    - Glu 211: Proximity and orientation effects, General acid catalysis
    - Mg^{2+}: Proximity and orientation effects, Metal ion catalysis, Electrostatic catalysis, Preferential binding of TS & intermediate

    b. (2) lyase
    c. (2) Lys 345 is deprotonated and Glu 211 is protonated
    d. (3) *For example:* Each aa could sit in a hydrophobic pocket, which would promote the neutral charge state. (Other correct answers could include that Lys 345 is near positively charged groups & Glu 211 is near negatively charged groups.)