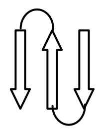
Chem 153A, Spring 2010

Exam 2 Answers

1. (5) a, c, d, f, g
2. (2) c, a, b
3. (4 pts) (1) b; (2) c; (3) a; (4) d
4. (3) A β-barrel is like a β-sheet rolled up so the edges H-bond. If there are an odd number of strands, two bonded strands will be parallel (see edge strands in pic), and the barrel is not wholly antiparallel.



5. (2) False – *cholesterol clusters in rafts*
6. (2) False – *[S] is constant because [S] >> [E$_T$]*
7. (2) True
8. (2) True
9. a. (3) $\theta = \frac{pO_2}{P_{50}+pO_2}$

$\theta(P_{50} + pO_2) = pO_2$

$\theta \cdot P_{50} + \theta \cdot pO_2 = pO_2$

$\theta \cdot P_{50} = pO_2 - \theta \cdot pO_2$

$\theta \cdot P_{50} = pO_2(1 - \theta)$

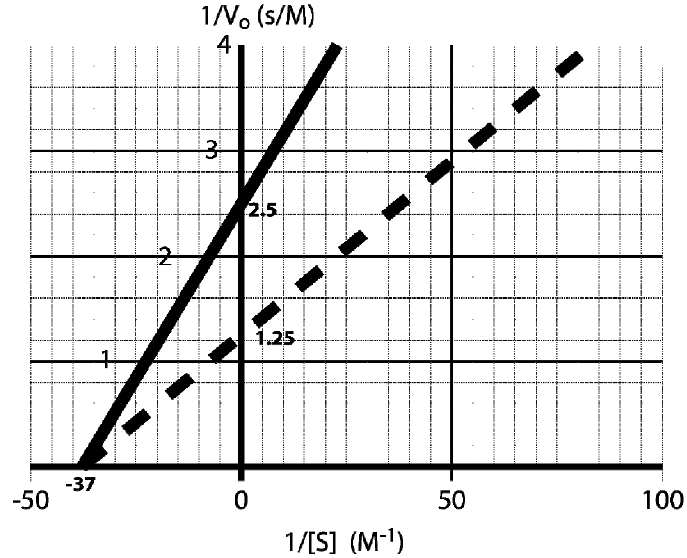
$$P_{50} = pO_2 \frac{(1-\theta)}{\theta} = 44 \text{ torr} \cdot \frac{0.1}{0.9} = 4.9 \text{ torr}$$

   b. (4) x-axis: pO_2 (torr); y-axis: θ, with values 0 to 1.0; 'N' curve: hyperbolic, passing through (2.8, 0.5) and approaching 1.0 in y; 'A' curve (right of 'N' curve): hyperbolic, passing through (4.9, 0.5) and (44, 0.9)
   c. (2) lower
   d. (3) Affinity depends on the rate constants for binding and unbinding. To have a lower affinity, O_2 would unbind (dissociate) faster from the altered myoglobin.
10. a. (2) hydrolase, phosphatase
   b. (2) ligase, synthetase
   c. (1) isomerase
11. a. (2) ΔG_6
   b. (2) $\Delta G_2 - \Delta G_6$ *or* $\Delta G_2 - \Delta G_8$ *accepted*
   c. (1) unimolecular (1st order)
12. a. (3) Substrates are positioned for maximal reactivity, because they bind the enzyme at an optimal orientation and distance relative to each other and to the enzyme's reactive groups.
   b. (2) True
13. a. (1) in red blood cells
   b. (2) $CO_2 + H_2O \rightleftharpoons HCO_3^- + H^+$
   c. (2) lyase
   d. (5) In the capillaries, where CO_2 levels are high, the enzyme catalyzes the formation of bicarbonate and H^+. The protons protonate Hb and stabilize the T-state, promoting release of O_2. Bicarbonate exiting the RBCs results in the entry of Cl^-, which also stabilizes the T-state.
   e. (2) The maximal number of S→P conversions per single enzyme per unit time.
   f. (2) cat. eff. $= \frac{k_{cat}}{K_m}$

$$K_m = \frac{k_{cat}}{\text{cat. eff.}} = \frac{4 \times 10^5 \text{s}^{-1}}{1.5 \times 10^7 \text{M}^{-1}\text{s}^{-1}} = 0.027 \text{ M } or \text{ 27 mM}$$

(f. continued) (2) $V_{max} = k_{cat}[\text{E}_\text{T}] = 4 \times 10^5 \text{s}^{-1} \cdot 10^{-6}\text{M} = 0.4 \text{ M/s}$

   g. h. (6)

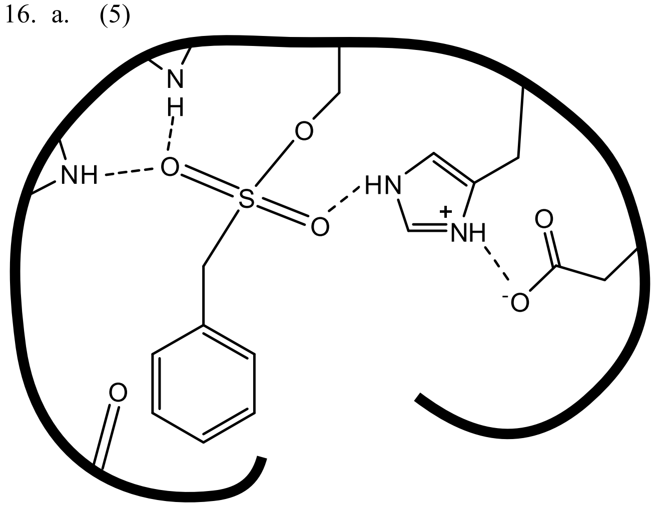


   i. (3)

$$K_m = \frac{k_{cat}}{\text{cat. eff.}} = \frac{10^6 \text{s}^{-1}}{8.3 \times 10^7 \text{M}^{-1}\text{s}^{-1}} = 0.012 \text{ M } or \text{ 12 mM}$$

K_m for CO_2 is lower, so affinity for <u>CO_2</u> is higher

   j. (1) False
14. a. (2) Retaining glycosidases hydrolyse glycosidic bonds and maintain the anomeric configuration in the product
   b. (2) There are two S_N2 steps
15. (4) b, d, e
16. a. (5)



   b. (3) A
   c. (2) True
17. a. (3) Cysteine has a lower pKa, so it will deprotonate more readily, to form the reactive nucleophile.
   b. (3) Because of cysteine's lower pKa, its deprotonated form is less nucleophilic than serine's deprotonated hydroxyl.