Chemistry and Biochemistry 153A, Winter 2011

Exam 2 Answers

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1. (1) True
2. (1) True
3. (1) True
4. (1) False – *greater K_D = lesser affinity*
5. (1) False – *Hb is not an enzyme*
6. (1) False – *Mb is only in muscle cells*
7. (1) True
8. (1) False – *mutases are isomerases*
9. (1) True
10. (1) True
11. (1) False – *S_N2 involves covalent catalysis*
12. (1) True
13. (2) specificity
14. (2) divergent
15. (3) a
16. a. (2) hydrolase
    b. synthase is a subclass of lyase, not hydrolase

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17. a. (3) Probably not. Lys is longer but flexible, and it maintains positive charge.
    b. (5) Lys is not readily deprotonated at physiologic pH (like His), so the salt bridge (with Asp) is formed irrespective of pH, making the T-state more stable.
    c. (3) A
18. (2) False – *positive cooperativity*
19. (2) False – *enzymes catalyze this movement*
20. (2) True – *the ion gradient produced by primary active transport is used as the driving force for secondary active transport*
21. (2) False – *Cl^- and HCO_3^- have the same charge (no electrical gradient is formed)*
22. (2) cooperativity
23. (4) b, c, e
24. (4) b (partial credit +2 for 'c' or +1 for 'a')

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25. (2) False – *sortase is amphipathic, but always affiliated w/ membrane*
26. (3) b
27. (3) a
28. (4) b, c
29. (2) transferase
30. (2) hydrolase, protease (or proteinase or peptidase)

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31. (2) Proximity & orientation effects: hydrophobic contacts with Pro, Val, Leu & H-bond with Arg properly position substrate in active site (substrate binding)
    (1) Electrostatic catalysis: in (iii) and (v), charge interaction between His and intermediate
    (1) Preferential binding of TS: in TS leading to (iii) and (v), electrostatic stabilization by His
    (2) General acid-base catalysis: His protonates 1st product and deprotonates 2nd substrate
    (1) Covalent catalysis: between Cys and 1st substrate
    (1) Metal ion catalysis: binding of Ca^{2+} to stabilize active conformation
32. (2) induced fit
33. (4) Cys & His are predominantly uncharged at physiologic pH, but both must be charged for sortase to be active
34. (5) The negative charge of Asp can raise the pKa of His so that it is more likely to be protonated & active at physiologic pH

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35. (4) No. This plot provides info for only one V_o vs [S] measurement, but you'd need multiple (at differing [S]) to determine K_m and V_{max} (and K_m^{app} and V_{max}^{app}).
36. (8) +1: $V_{max} = k_{cat}\cdot[E_T] = 0.0073/\text{min}\cdot 1.5\mu M = \underline{0.011\ \mu M/\text{min}}$
    +4 for axes (+1 each, correct label and units)
    +1 for hyperbolic M-M curve, passing through (K_m, $1/2V_{max}$) and approaching V_{max}
    +2 for double-reciprocal line, passing through $-1/K_m = 0.05\ \mu M^{-1}$ and $1/V_{max} = 91\ \text{min}/\mu M$