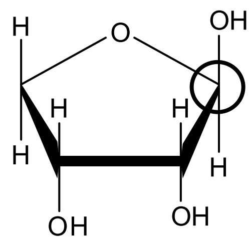
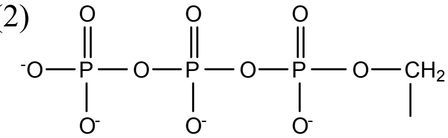
Chemistry and Biochemistry 153A, Spring 2010

Exam 1 Answers

1. (2) True
2. (2) True or False (because of ambiguity in the question)
3. (3) b, c
4. a. (3) C_1, C_2, O_1, N_2, C_3, C_6
   b. (2) C_2, N_2, C_3, C_7
   c. (2) N_1, C_1, C_2, N_2
5. a. (2) 2^n stereoisomers for n chiral centers: $2^2 = 4$ aldoses and $2^1 = 2$ ketoses; <u>6</u> total
   b. (1) 3
   c. (4)



6. (4) Both anomeric carbons (of glucose and fructose) are involved in the glycosidic linkage of sucrose. This leaves no free anomeric carbons available to form glycosidic bonds between sucrose units.
7. (3) a, d
8. (4) a. pH < 2
   b. none
   c. none
   d. none
   e. 2 < pH < 8.5
   f. 8.5 < pH < 9.5
   g. pH > 9.5
   h. none
9. (2) a
10. (6) a. E, b. C, c. F
11. (5) The hydrophobic effect drives protein folding, pushing together a protein's hydrophobic sidechains to free up ordered water. The hydrophobic portions of amphipathic compounds can interact with the protein's hydrophobic sidechains and shield them from water. They allow water entropy to increase without the protein needing to fold.
12. a. (2)

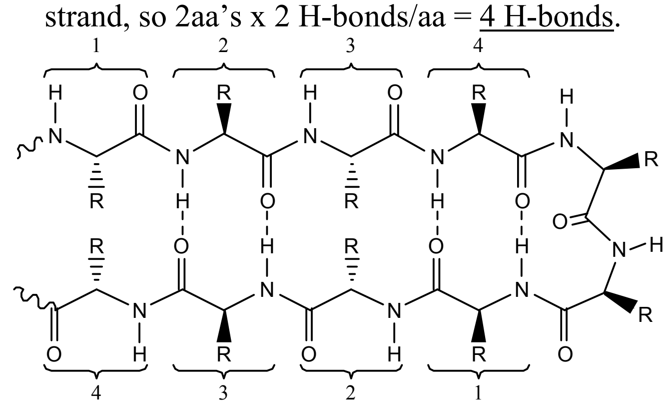


   b. (3) Charge on predominant form = -4; charge on minor form = -3
   Let x = fraction of predominant form
   $-4x + -3(1-x) = -3.86$, $x = 0.86$, so <u>86%</u>
   c. (3) $\mathrm{pH} = \mathrm{p}K_a + \log\left(\frac{[\mathrm{A}^-]}{[\mathrm{HA}]}\right)$

   $$\mathrm{p}K_a = \mathrm{pH} - \log\left(\frac{[\mathrm{A}^-]}{[\mathrm{HA}]}\right)$$

   $$\mathrm{p}K_a = 7.4 - \log\left(\frac{86\%}{14\%}\right) = 7.4 - 0.8 = 6.6$$

   d. (4) <u>Decrease.</u> At pH 7.4, most molecules of ATP are deprotonated; these would be able to absorb added protons (to give singly protonated ATP) that would otherwise lead to a decrease in pH.
   e. (2) β-D-ribofuranoside (–osyl or –ose OK)
   f. (2) β-(1→N) glycosidic bond
13. (2) True
14. (3) No. Because H-bonds in a β-sheet are formed between separate regions of sequence, there's no fixed sequence separation between the two residues participating in an H-bond.
15. (6) In an antiparallel beta-sheet, each aa extends 3.5 Å; 14Å/3.5Å = 4 aa. Every-other aa of a strand forms 2 H-bonds with the neighboring strand, so 2aa's x 2 H-bonds/aa = <u>4 H-bonds</u>.



16. a. (2) m/z (or mass/charge, or Da/charge)
   b. (3) D
   c. (2) A
   d. (2) Arg, Lys
   e. (2) Six
   f. (3) 3, 2, 5, 4, 6, 1
   g. (6) 1. NC; different polarity
   2. NC; uncharged vs. neg charged
   3. C; similar size, same neg charge
   h. (4) Identity: (150/153)*100 = 98%; Similarity: (151/153)*100 = 98.7%
   i. (4) Bison. Only change (2) will influence pI; Ala is neutral, Asp is neg. So with the extra negative charge, water-buffalo protein requires higher $[H^+]$ (lower pH) to achieve charge neutrality.