

BMB 401 Spring EXAM 1

February 6, 2003

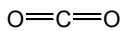
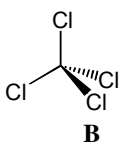
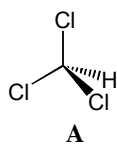
1. Which of the following could be used to detect any amino acid upon elution from a gel-filtration column
 - a. **ninhydrin**
 - b. dithiothreitol
 - c. DTNB
 - d. 2-mercaptoethanol
 - e. none of the above

2. Which of the following **best** describes why biomolecules are carbon based?
 - a. this allows radiocarbon dating to take place
 - b. **carbon can form up to four stable bonds**
 - c. hydrogens on carbon can function as hydrogen bond donors
 - d. both b and c
 - e. none of the above

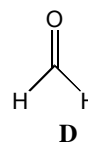
3. The side chain of which of the following amino acids would form the strongest ionic interaction with the side chain of **R** at a pH of 7.
 - a. Q
 - b. K
 - c. A
 - d. **E**
 - e. Y

4. Which of the following is not a one-letter code for one of the 20 standard amino acids found in proteins?
 - a. **B**
 - b. P
 - c. T
 - d. V
 - e. C

5. Which of the following compounds would not be expected to bear a net dipole moment?



C



- a. A
b. B
c. C
d. D
e. **both B and C**
6. List the amino acids **H, A, D, P, Y, and R** in order of increasing isoelectric points (lowest to highest)
- a. D, A, P, Y, H, R
b. D, P, A, Y, H, R
c. D, P, Y, A, H, R
d. **D, Y, A, P, H, R**
e. D, P, Y, A, H, R
7. What is the formal charge associated with a hydronium ion?
- a. +2
b. -2
c. 0
d. -3
e. **none of the above**
8. Which of the following amino acids would make the best buffer at pH 6?
- a. F
b. R
c. E
d. S
e. **H**
9. What is the pOH of a 0.2 μM solution of HCl?
- a. 0.7
b. **7.47**
c. 6.52
d. 7.30
e. 13.8

10. What is the pH of a 100 mM solution of formic acid? (pKa of formic acid = 3.75)
- a. ~4.76
 - b. ~2.38**
 - c. ~6.05
 - d. ~3.75
 - e. ~2.87

For question 11-14, consider the following peptide A-P-K-Y-D-G-V-W-N-K-M-R-Q-V-F-I-E-G.

11. If the above peptide were subjected to complete cleavage by trypsin, how many of the resulting peptides would absorb UV-visible light in the 220 – 300 nm range?

- a. 0
- b. 1
- c. 2**
- d. 3
- e. 4

12. If the above peptide were subjected to acid hydrolysis (6 N HCl, 110°C for 24 h), which of the following amino acid profiles would represent the true hydrolysate?

- a. A, P, K, Y, D, 2G, 2V, W, N, K, M, R, Q, F, I, E
- b. A, P, K, Y, D, 2G, 2V, N, K, homoS, R, Q, F, I, E
- c. A, P, K, Y, 2D, 2G, 2V, K, homoS, R, F, I, D 2E
- d. A, P, K, Y, 2D, 2G, 2V, K, M, R, F, I, 2E**
- e. A, P, K, Y, 2D, 2G, 2V, W, K, M, R, Q, F, I, E

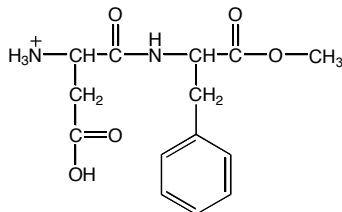
13. If the above polypeptide were subjected to cleavage by chymotrypsin, and then treated with 1-fluoro, 2,4-dinitrobenzene (Sanger's Reagent), which of the following amino acids would be detected as the 2,4-dinitrobenzene derivative

- a. asparagine**
- b. tyrosine
- c. phenylalanine
- d. none of the above
- e. all of the above

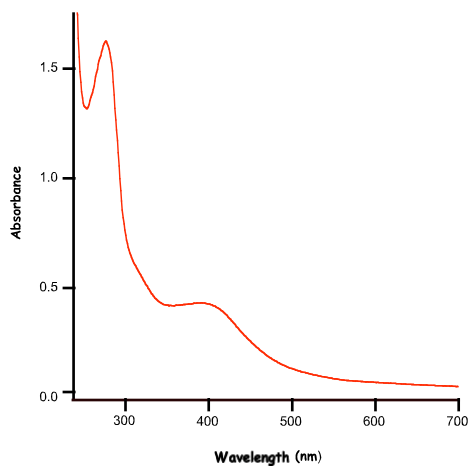
14. If no acid or base were added to pure water at pH 7, what would the hydronium ion concentration be?

- a. 7 M
- b. 14 M
- c. 0.1 μ M**
- d. 0
- e. none of the above

15. The structure shown below is that of L-aspartyl-L-phenylalanine methyl ester (aspartame). Estimate the pI of this dipeptide.



- a. 14.0
 - b. 6.02×10^{23}
 - c. 9.83
 - d. 0
 - e. **6.85**
16. Which of the following methods allows the separation of proteins based on molecular weight
- a. anion exchange chromatography
 - b. **gel-filtration chromatography**
 - c. affinity chromatography
 - d. isoelectric focusing
 - e. cation exchange chromatography
17. A spectrum of lipoyl synthase from *Escherichia coli* was obtained by Rob Cicchillo in a cuvet of 1 cm path length, and is displayed below. It was determined from amino acid analysis that the concentration of the protein in the cuvet is $30 \mu\text{M}$. What is the molar absorptivity of the 1-mL sample *E. coli* lipoyl synthase at 400 nm.



- a. $1200 \text{ M}^{-1} \text{ cm}^{-1}$
 b. $0.5 \text{ M}^{-1} \text{ cm}^{-1}$
 c. **$16,667 \text{ M}^{-1} \text{ cm}^{-1}$**
 d. $50,000 \text{ M}^{-1} \text{ cm}^{-1}$
 e. $150,000 \text{ M}^{-1} \text{ cm}^{-1}$
18. What is the pH of a 0.12 M propionic acid ($\text{CH}_3\text{CH}_2\text{COOH}$) solution if the pKa for propionic acid is 4.87?
 a. **~ 2.89**
 b. ~ 2.78
 c. ~ 6.05
 d. ~ 3.40
 e. none of the above
19. The side chain of which amino acid below cannot function as a hydrogen bond donor to water.
 a. S
 b. N
 c. R
 d. **I**
 e. T
20. Amino acid analysis of a peptide seven residues long gave D, L, K, M, F, and Y. Determine the sequence of the peptide from the following four experiments.
- trypsin treatment of the peptide had no apparent effect on it.
 - the phenylthiohydantoin released upon one round of Edman degradation is shown below.
 - chymotrypsin treatment yielded a dipeptide a tetrapeptide, and free phenylalanine. The amino acid composition of the tetrapeptide was L, K, and M.
 - cyanogen bromide treatment yielded a dipeptide, a tetrapeptide, and free K
-
- D-L-K-M-F-Y-W
 - F-D-Y-M-L-K-W
 - F-D-Y-M-L-M-K**
 - F-M-Y-D-L-M-K
 - none of the above

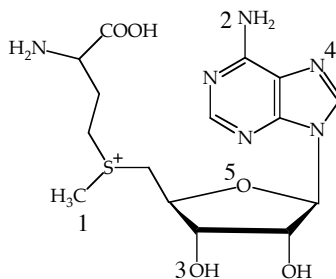
21. Which of the following characteristics correlates with the pI of a biomolecule?

- it is the point of maximum solubility in water
- it is the point of minimum solubility in water**
- it is the point of greatest stability
- it is the point at which the molecule bears no net charge**
- both b and c

22. If the pH of an aqueous solution is 4, what is the pOH?

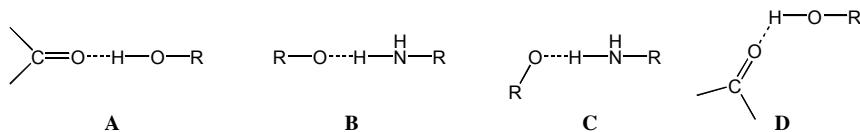
- 0.602
- 1×10^{-4}
- 10**
- 10,000
- none of the above

23. What reagent can be used to detect the molecule shown below?



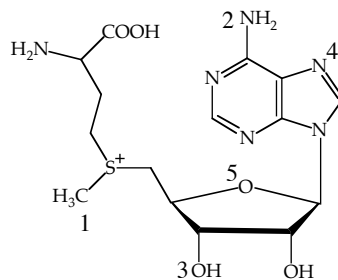
- DTNB
- iodoacetate
- ninhydrin**
- dithiothreitol
- none of the above

24. Which of the following hydrogen bond interactions would be expected to be the weakest?



- A
- B
- C
- D**
- C and D are equally weak

25. Which of the numbered atoms in the molecule shown below cannot act as a hydrogen bond acceptor?



- a. 1
- b. 3
- c. 4
- d. 5
- e. both 1 and 5