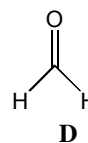
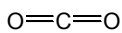
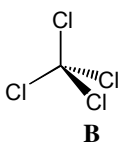
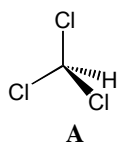


# BMB 401 Spring EXAM 1

## 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?



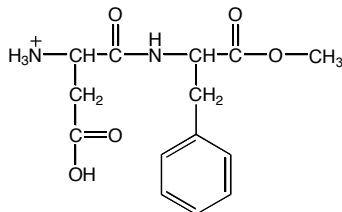
- a. A  
b. B  
c. C  
d. D  
e. both B and C
6. List the amino acids **H**, **A**, **D**, **P**, **Y**, and **R** in order of increasing isoelectric points (lowest to highest)
- a. D, A, P, Y, H, R  
b. D, P, A, Y, H, R  
c. D, P, Y, A, H, R  
d. D, Y, A, P, H, R  
e. D, P, Y, A, H, R
7. What is the 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  $\mu$ M 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

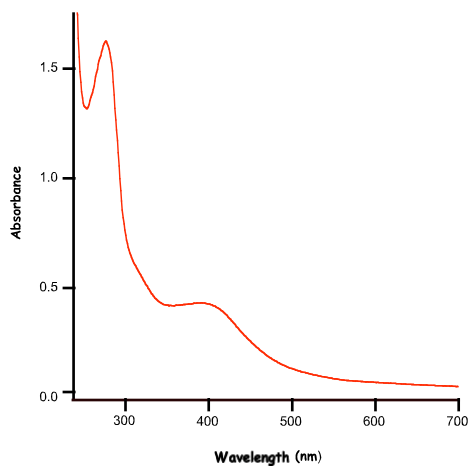
For question 11-14, consider the following peptide A-P-K-Y-D-G-V-W-N-K-M-R-Q-V-F-I-E-G.

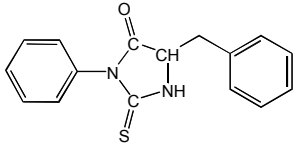
11. If the above peptide were subjected to complete cleavage by trypsin, how many of the resulting peptides would absorb UV-visible light in the 220 – 300 nm range?
- a. 0
  - b. 1
  - c. 2
  - d. 3
  - e. 4
12. If the above peptide were subjected to acid hydrolysis (6 N HCl, 110°C for 24 h), which of 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  $\mu$ 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.  $6.02 \times 10^{23}$
  - 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.  $\sim 2.89$   
 b.  $\sim 2.78$   
 c.  $\sim 6.05$   
 d.  $\sim 3.40$   
 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

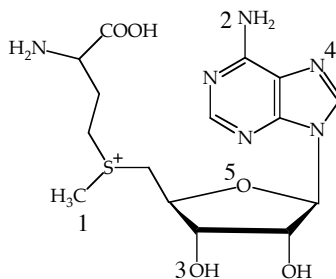
21. Which of the following characteristics correlates with the pI of a biomolecule?

- 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?

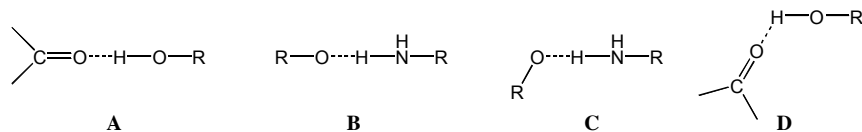
- 0.602
- $1 \times 10^{-4}$
- 10
- 10,000
- none of the above

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



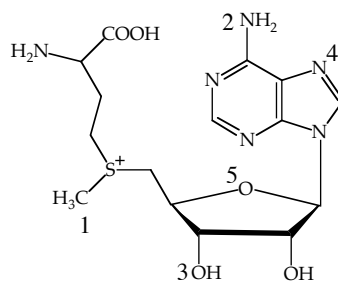
- DTNB
- iodoacetate
- ninhydrin
- dithiothreitol
- none of the above

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