

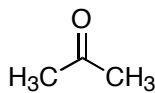
BMB 401 Spring 2004

Make-Up EXAM 1

Please make sure that you include your student ID number on your Scantron Sheet.

Please print your name on your exam and turn it in with your Scantron Sheet.

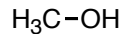
- Which of the following best describes why life is carbon-based.
 - Carbon atoms are resistant to the Bohr effect
 - Carbon can form strong ionic interactions
 - Carbon can form strong covalent bonds.
 - Both A and C
 - Both B and C
- Which of the following interactions is not a result of a direct physical attraction between two molecules?
 - Covalent interactions
 - Ionic interaction
 - Hydrophobic interaction
 - Dipole–dipole interaction
 - London dispersion interactions
- Arrange the compounds below from lowest to highest dielectric constant



A



B



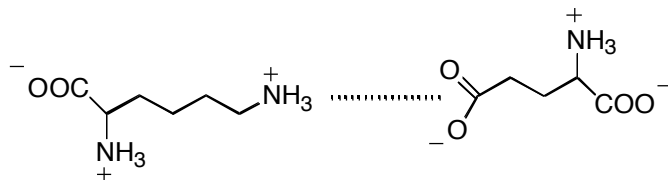
C



D

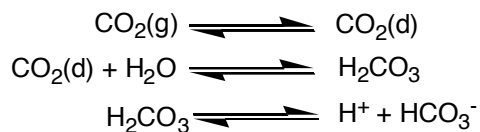
- A, B, C, D
 - B, A, C, D
 - B, C, A, D
 - A, C, B, D
 - D, A, C, B
- What is the one-letter code for amino acid 14?
 - A
 - V
 - I
 - L
 - None of the above

5. Which of the following is true about the ionic interaction shown below?

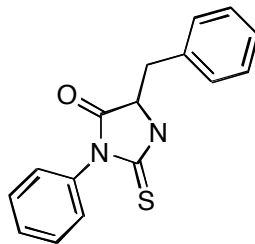


- It is between a glutamine and a lysine amino acid
 - It is between an arginine and an aspartate amino acid
 - It is between a lysine and an aspartate amino acid
 - It would not occur in solutions of pH value greater than 12.
 - None of the above
6. What is the pH of a 0.1 M solution of acetic acid?
- 1.48
 - 2.15
 - 2.88
 - 3.56
 - 4.76
7. What is the pH when 100 mL of 0.1 N NaOH is added to 150 mL of 0.2 M acetic acid?
- 3.88
 - 10.28
 - 2.84
 - 6.12
 - 5.07
8. What is the concentration of hydronium ions at pH 5?
- 1×10^5 M
 - 0.0005 M
 - 1×10^{-7} M
 - 5 μ M
 - none of the above

9. Shown below are the relevant equations for the bicarbonate buffering system. If the pK_a for carbonic acid is 3.77, and the $pK_{overall}$ for the reaction is 6.1. What is the equilibrium constant for hydration of dissolved CO_2 ?



- a. 1×10^{-7}
 b. 1.35×10^{-10}
 c. 8.07×10^{-7}
 d. 1
 e. None of the above
10. Determine the sequence of the following heptapeptide of amino acid composition (D, L, K, M, F, Y) from the following experimental results.
- N-terminal analysis of the heptapeptide released the phenylthiohydantoin shown below.

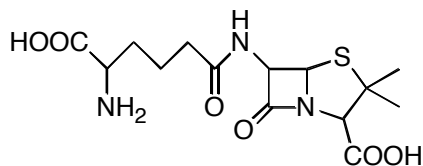


- Trypsin digestion of the heptapeptide had no effect on it.
- Chymotrypsin digestion of the heptapeptide yielded several products, which included a dipeptide and a tetrapeptide.
- The amino acid composition of the tetrapeptide was L, K, and M
- Cyanogen bromide treatment yielded a dipeptide, a tetrapeptide, and free K.
 - a. F-Y-D-L-M-M-K
 - b. Y-F-L-D-K-M-M
 - c. F-D-Y-M-M-L-K
 - d. F-D-Y-L-M-M-K
 - e. none of the above

11. The molar absorptivity of tyrosine changes as a function of the protonation state of its R group. In its protonated state the molar absorptivity of tyrosine is $1400 \text{ M}^{-1} \text{ cm}^{-1}$. In its deprotonated state the molar absorptivity of tyrosine is $2400 \text{ M}^{-1} \text{ cm}^{-1}$. Calculate the absorbance of a 0.5 mM solution of tyrosine at pH 9. Assume a cuvet pathlength of 1 cm .
- 0.70
 - 1.2
 - 1.0
 - 0.74
 - None of the above
12. Which statement is incorrect about the nature of the hydrogen bond?
- The donor is a hydrogen atom bonded to a less electronegative atom than hydrogen
 - The more linear the bond, the stronger the interaction
 - The acceptor is a fairly electronegative atom containing a nonbonding pair of electrons
 - It is a type of noncovalent bond
 - It is stronger than a van der Waals interaction
13. Predict the order of elution of the following amino acids from a cation exchange column at pH 7.0: D, E, C, H, K
- D, E, C, H, K
 - K, H, C, E, D
 - D, H, K, C, E
 - E, D, C, H, K
 - E, D, H, C, K
14. What forms of phosphoric acid are present at pH 8?
- H_3PO_4 only
 - PO_4^{3-} only
 - HPO_4^{2-} and PO_4^{3-}
 - H_2PO_4^- and HPO_4^{2-}
 - H_3PO_4 and H_2PO_4^-
15. Which of the following molecules can induce formation of cystine from two molecules of cysteine.
- DTNB
 - Oxygen
 - Dithiothreitol
 - iodoacetate
 - N-ethylmaleimide

16. Which of the following reagents will produce a color change upon reacting with cystine?
- Dithiothreitol
 - Ninhydrin
 - DTNB
 - All of the above
 - Ninhydrin and DTNB only

17. Shown below is the structure for penicillin. How many chiral centers does penicillin have?



- 0
 - 1
 - 2
 - 3
 - None of the above
18. Which of the values below is closest to the pI of penicillin?
- 2
 - 4
 - 5.5
 - 9.5
 - 12
19. What would be the resulting pH following addition of 0.5 moles of NaOH to 1 mole of isoelectric alanine?
- 6.0
 - 2.3
 - 8.2
 - 4.1
 - 9.7
20. Which of the following peptides would have the highest molar absorptivity at 280 nm?
- PICKME
 - HAPPILY
 - REALLY
 - WISEPICK
 - WHEW

Amino Acid	pK_a (-COOH)	pK_a (-NH₃⁺)	pK_a (R group)
Glycine	2.34	9.60	
Alanine	2.34	9.69	
Proline	1.99	10.96	
Valine	2.32	9.62	
Leucine	2.36	9.60	
Isoleucine	2.36	9.68	
Methionine	2.28	9.21	
Phenylalanine	1.83	9.13	
Tyrosine	2.20	9.11	10.07
Tryptophan	2.38	9.39	
Serine	2.21	9.15	
Threonine	2.11	9.62	
Cysteine	1.96	10.28	8.18
Asparagine	2.02	8.80	
Glutamine	2.17	9.13	
Lysine	2.18	8.95	10.53
Histidine	1.82	9.17	6.00
Arginine	2.17	9.04	12.48
Aspartate	1.88	9.60	3.65
Glutamate	2.19	9.67	4.25
Acid	pK_a1	pK_a2	pK_a3
Formic	3.75		
Acetic	4.76		
Imidazole ⁺	6.99		
Phosphoric	2.14	7.20	12.40
Carbonic	3.77	10.20	

Some Useful Equations

$$\Delta G = \Delta H - T\Delta S$$

$$F = \frac{kq_1q_2}{Dr}$$

$$\Pi = icRT$$

$$pH = -\log[H^+]$$

$$K_w = [H^+][OH^-]$$

$$pK_a = -\log K_a$$

$$pH = pK_a + \log \frac{[A^-]}{[HA]}$$

$$A = \epsilon cl = \log \frac{I_0}{I}$$

$$\mu = \frac{V}{E} = \frac{Z}{f}$$

$$E = -\frac{A}{r^6} + \frac{B}{r^{12}}$$

$$[H^+] + [OH^-] = 1 \times 10^{-14}$$

