1. Which of the following amino acids **does not have** a cyclic (ring) structure in its R-group?

    A) arginine B) proline C) tyrosine D) tryptophan E) phenylalanine

2. Which of the following amino acids does **NOT** possess a hydrophobic (non-polar) side chain?

    A) threonine B) leucine C) valine D) phenylalanine E) isoleucine

3. The **net** charge on the dipeptide aspartyllysine at pH 7 is ?

    A) -2   B) -1   C) 0   D) +1   E) +2

4. A 20 mL volume of 0.072 M HCl solution requires 7.2 mL of a NaOH solution for complete titration. What is the <u>concentration</u> of the NaOH?

    A) 0.072 M   B) 0.144 M   C) 0.1 M   D) 0.2 M   E) 0.4 M

5. 20 mL of 0.072 M HCl solution is added to 80 mL of pure water. What is the pH of the resulting solution?

    A) 1.14   B) 1.84   C) 3.68   D) 7.0   E) 3.68

6. A buffer solution is prepared by mixing 500 mL of 0.4 M sodium acetate and 500 mL of 0.2 M acetic acid. What is the pH of the buffer solution prepared? (Pk_a for acetic acid $= 4.76$)

    A) 5.46   B) 5.06   C) 4.76   D) 4.46   E) 4.06

7. 100 mL of 0.5 M HCl is added to the buffer prepared above in question 6. What is the pH of the final solution?

    A) 4.16   B) 4.63   C) 4.76   D) 4.88   E) 5.36

8. 0.05 mol of NaOH was added to a solution containing 0.1 mol of a weak acid and 0.1 mol of its conjugate base. After mixing, the pH of the solution was found to be 5.24. What is the pK_a of the weak acid?

    A) 4.28   B) 4.40   C) 4.76   D) 5.04   E) 5.18

9. Which of the forms of aspartate shown below CANNOT exist in solution at any pH?

    A   B   C   D   E
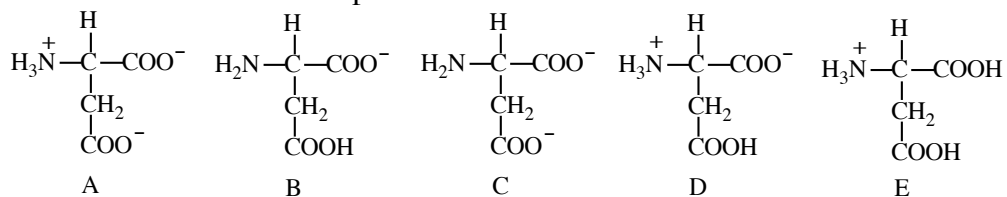
10.   Which pair of the forms of aspartate shown in question 9 will predominate in solution at pH 4.5? (pK$_a$ values for aspartate are 1.88, 3.65 (R-group) and 9.60)

  A) A & E   B) A & D   C) B & C   D) D & E   E) A & C

11.   The ratio of the concentrations of the conjugate base and weak acid forms of aspartate predominating in solution at pH 4.5 is close to ? (pK$_a$ values for aspartate are given in Q. 10).

  A) 1:3   B)   1:1   C) 3:1   D) 7:1   E)   10:1

12.   The regular folding pattern of adjacent (contiguous) portions of a polypeptide chain is called ?

  A) primary structure   B) secondary structure   C) tertiary structure
  D) quaternary structure   E) covalent structure

13.   The linear sequence of peptide-bonded amino acids in a polypeptide is called ?

  A) primary structure   B) secondary structure   C) tertiary structure
  D) random coil structure   E) alpha-helical structure

14.   The peptide bond is planar because ?

  A) the large >C=O group causes steric hindrance
  B) the H in the >N-H group is small
  C)   free rotation is possible around the bond between the alpha carbon and the carbonyl   (>C=O)   carbon
  D) the C-N bond has partial double bond character
  E) H-bonds can form between polar R-groups

15.   Which of the following correctly depicts intrachain H-bonding in the alpha helix?

  A) >N-H ///// H-N<   B) >C=O ///// H-C-   C) >C=O ///// O=C<
  D) >N-H ///// H-R-   E) >C=O ///// H-N<

16.   In the beta pleated-sheet, the R-groups of the amino acids ?

  A) cause only anti-parallel sheets to form
  B) generate H-bonds to stabilize the sheet
  C) stack within the interior of the helix
  D) are found above and below the plane of the sheet
  E) lie in the plane of the sheet

17. Which of the following statements about the fibrous protein silk fibroin are TRUE?

1) Fibroin consists of stacked beta-sheets   2) Fibroin consists of right handed helices
3) Fibroin has a high content of glycine 4) Disulfide bonds are important in stabilizing the structure of fibroin
5) The stacked beta-sheets of fibroin are held together by van der Waal's forces

   A) 1,2 & 5   B) 2,4 &5   C) 1, 2 &4   D) 1,3 & 5   E) 2,3 & 4

18. Which of the following statements about the fibrous protein keratin are UNTRUE?

1) Keratin consists of stacked beta-sheets   2) Keratin consists of right-handed helices arranged into left-handed superhelices 3) Keratin has a relatively high cysteine content 4) the stability of keratin is due to electrostatic interaction between adjacent helical chains 5) Disulfide bonds are important in stabilizing the structure of keratin

   A) 1 & 2   B) 1, 2 & 4   C) 1 & 4   D) 2, 3 & 5   E) 1 & 5

19. Which of the following does NOT contribute to the formation and stability of tertiary structure in proteins?

A) electrostatic interaction between amino acid R-groups
B) entropy increase resulting from a decrease in the number of ordered water molecules forming a solvent shell ("cage") around non-polar amino acid R-groups
C) formation of disulfide bonds
D) van der Waal's forces
E) formation of covalent bonds between amino acid R-groups containing -OH groups

20. Which of A), B), C), D) and E) in question 19 above makes the biggest single contribution to the formation and stability of tertiary structure in proteins?

21. The role of the enzyme in an enzyme-catalyzed reaction is to:

A) ensure the product is more stable than the substrate
B) make the overall free energy change for the reaction more favourable
C) increase the rate of conversion of substrate to product
D) ensure all the substrate is converted to product
E) increase the equilibrium constant for the reaction

22. Which of the following is a correct statement about K_m for an enzyme-catalyzed reaction showing a hyperbolic v versus [S] curve?

A) the enzyme's active site is saturated with substrate when $[S] = K_m$

B) If two different substrates can bind to the same active site, the substrate with the smaller K_m will bind more strongly

C) the rate of reaction is equal to K_m multiplied by V_{max}

D) K_m for the substrate is decreased in the presence of a competitive inhibitor

E) the larger the K_m the more strongly the substrate binds to the enzyme

23. For an enzyme which follows simple Michaelis-Menten kinetics, what is the V_{max} if $v = 33$ micromol/min when $[S] = K_m$?

A) 50 μmol/min   B) 66 μmol/min   C) 99 μmol/min

D) 110 μmol/min   E) 130 μmol/min

24. The kinetic data in the table below were obtained using an enzyme known to follow Michaelis-Menten kinetics:

[S] mM	0.8	2.0	4.0	6.0	500.0	1000.0
Velocity (micromol per min)	217	325	433	488	635	647

The K_m for the substrate of this enzyme is approximately:

A) 1 mM   B) 2 mM   C) 3 mM   D) 4 mM   E) 500 mM

25. In another study on the same enzyme and substrate, but in the presence of an inhibitor, the following data were obtained:

K_m for the substrate = 4 mM   and V_{max} = 650 micromol/min

The inhibitor is __?__

A) competitive   B) uncompetitive   C) a weak base   D) Allosteric
E) non-competitive