

Name: .....

Date: 6/8/2011

**Number of questions :50****Duration of exam: 90 minutes**

## CHOOSE THE BEST ANSWER

1. A weak monoprotic acid (HA) has an acid dissociation constant of  $4 \times 10^{-5}$  M. Which one of the solutions containing the acid and its sodium salt (NaA) will have a pH of exactly 5?
- A. [HA] = 0.25 M; [NaA] = 0.1 M
  - B. [HA] = 0.4 M; [NaA] = 0.1 M
  - C. [HA] = 0.1 M; [NaA] = 0.4 M
  - D. [HA] = 0.1 M; [NaA] = 0.25 M
  - E. None of the above
2. The most abundant amino acid in collagens is:
- A. Proline.
  - B. Hydroxyproline.
  - C. Hydroxylysine.
  - D. Glycine.
  - E. Aspartate.
3. Separation of an enzyme from a mixture of proteins by binding to its substrate which is covalently linked to a resin in a chromatography column is known as:
- A. ion exchange chromatography.
  - B. gel filtration chromatography.
  - C. high performance liquid chromatography (HPLC).
  - D. affinity chromatography.
  - E. gas – liquid chromatography.
4. All the following statements regarding phosphatidyl choline are correct **EXCEPT**:
- A. it contains two fatty acid.
  - B. it carries one positive charge & one negative charge at neutral pH.
  - C. it is called Lecithine.
  - D. the molecule contains 2 ester bonds.
  - E. it contains phosphatidic acid.

Answer question 5 and 6 based on the short peptide fragments (1-4) obtained from a larger polypeptide chains :

- 1.----- Gly-Met-Pro-Lys-Ala-----
- 2.-----Gly-Cys-Asp-Ser-His-----
3. -----Cys-Phe-Gly-Ser-Val-Gln---
- 4.----- Gly -Arg-His-Lys-Arg-----

5. Which one will move fastest toward the anode during electrophoresis at pH 7.0 :
- A. 1 and 4
  - B. 3
  - C. 2
  - D. 1
  - E. 4
6. Which one of above segments can NOT form one continuous  $\alpha$  helical segments:
- A. 1 only
  - B. 2 only
  - C. 3 and 2
  - D. 4 and 1
  - E. 3 and 4
7. An aqueous solution that contains 0.10 M ammonia and 0.10 M ammonium chloride acts as a buffer solution with a pH of 9. Calculate  $pK_b$  of ammonia.
- A. 5
  - B. 9
  - C. 4
  - D.  $10^{-5}$
  - E.  $10^{-9}$
8. The fatty acid eicosapentaenoic belongs to which  $\omega$  family.
- A.  $\omega 3$
  - B.  $\omega 5$
  - C.  $\omega 4$
  - D.  $\omega 7$
  - E.  $\omega 9$

Answer questions 9 and 10 regarding the following compound (1-4)

1. cerebrosides
2. plasmalogens
3. chondroitin
4. gangliosides

9. Which of the above lipids contain glycerol:

- A. 1
- B. 2
- C. 1 and 4
- D. 1 and 3
- E. 3

10. Which of the above lipids contain ceramide :

- A. 3
- B. 2
- C. 2 and 3
- D. 1
- E. 1 and 4

11. Glycoproteins:

- A. are found in cells but not in plasma.
- B. In the plasma membrane, typically have the carbohydrate portion on the cytosolic side.
- C. May have the carbohydrate portion covalently linked to the protein through asparagine residues.
- D. May have the carbohydrate portion covalently linked to the protein mostly to the hydroxylysine residue in most proteins.
- E. All of the above are correct.

Consider the following peptide for the questions numbered (12 - 13)

Lys-Ser-Ala-Cys-Phe-Ser-Lys-Gly-Met-Trp-Leu-Arg-Cys-Tyr- Lys-Glu-Asp-Arg

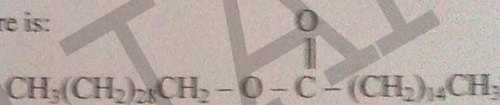
12. The number of peptide bonds that can be cleaved when the peptide is incubated with the digestive enzyme chymotrypsin is :

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

13. How many positive & negative charges carried by the peptide at neutral pH:
- one negative four positive.
  - two negative & three positive
  - three negative & six positive
  - nine negative & 12 positive
  - no charges because the pH is neutral.

14. You are given 1 liter of 0.5 M histidine solution at pH=0.5. How many moles of NaOH you need to add to the solution to raise the pH to 6 (note the  $pK_a$  for the side chain is 6):
- 0.25
  - 0.5
  - 0.75
  - 1.5
  - 3.0

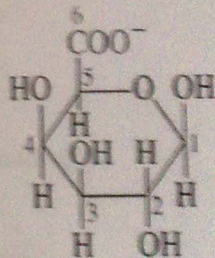
15. The following structure is:



- Monoacylglycerol
- Prostaglandin
- Leukotriens
- Wax
- Long fatty Acid Chain

16. The following structure is:

- Galactose.
- Sorbitol.
- Glucuronic acid.
- Gluconic acid.
- Galacturonic acid.



17. Digoxin, an effective drug for congestive heart failure, is an ether that contains a sugar component and a non sugar component attached via oxygen. Digoxin would be classified as :
- glycoprotein
  - glycoside
  - glucuronic acid
  - glucosteroid
  - a disaccharide

18. How many chiral center(s) is/ are present in the open chain structure of 2- Deoxyribose:

- A. 1
- B. 2
- C. 3
- D. 4
- E. none

19. If 0.1 M solutions of sodium dihydrogen phosphate ( $\text{NaH}_2\text{PO}_4$ ) and disodium hydrogen phosphate ( $\text{Na}_2\text{HPO}_4$ ) are mixed together in equal proportions, what is the approximate pH of the mixture? (Note that the  $\text{pK}_a$  -values of orthophosphoric acid ( $\text{H}_3\text{PO}_4$ ) are (2.0, 6.8, 12.0)

- A. 2.0
- B. 4.4
- C. 6.8
- D. 9.4
- E. 12.0

20. Below is the  $\text{pK}_a$  for some weak acids, Which weak acid will be approximately 91% undissociated at pH 4.86:

- |                                    |                    |
|------------------------------------|--------------------|
| A. acetoacetic acid                | $\text{pK}' = 3.6$ |
| B. lactic acid                     | $\text{pK}' = 3.9$ |
| C. $\beta$ - hydroxyl butyric acid | $\text{pK}' = 4.8$ |
| D. propionic acid                  | $\text{pK}' = 4.9$ |
| E. imidazolium                     | $\text{pK}' = 5.9$ |

21. All the following statements are correct regarding linoleic acid EXCEPT:

- A. there are two double bonds.
- B. double bonds are in trans configuration.
- C. double bonds are separated by  $-\text{CH}_2-$  group.
- D. it is an essential fatty acids.
- E. it contains 18 carbon atoms

22. One of the following designates palmitoleic acid:

- |                      |                      |                           |
|----------------------|----------------------|---------------------------|
| A. 18 : 1 $\Delta^9$ | B. 16 : 1 $\Delta^9$ | C. 16 : 1 $\Delta^{9,12}$ |
| D. 18 : 0            | E. 16 : 0            |                           |

23. All the followings are derived from cholesterol EXCEPT:  
A. testosterone.                      B. progesterone                      C. bile acids.  
D. leukotriens                      E. estradiol.

24. A medical student becomes extremely anxious the night before a biochemistry exam and begins to hyperventilate uncontrollably (excessive breathing). What initial effects does hyperventilation have on the student's blood pH, and  $H_2CO_3$  concentration:

- A.  $H_2CO_3$  increases and pH increases.
- B.  $H_2CO_3$  decreases and pH increases.
- C.  $H_2CO_3$  increases and pH decreases.
- D.  $H_2CO_3$  increases and pH decreases.
- E.  $H_2CO_3$  decreases and pH decreases.

25. if a 10 mmoles of NaOH were dissolved in 1 liter of water. The pH of the solution will be :

- A. 2
- B. 3
- C. 1
- D. 12
- E. 9

26. Which of the following amino acid(s) has a polar side chain :

- A. valine.
- B. leucine.
- C. methionine.
- D. tryptophan.
- E. tyrosine.

27. All sphingolipids have in common:

- A. phosphate group.
- B. ceramide.
- C. phosphorylcholine.
- D. N-acetylneuraminic acid.
- E. mono- or disaccharide

28. The amino acid methionine :

- A. Is required for the formation of tertiary structure in proteins.
- B. Is the site where peptide bonds are broken by cyanogen bromide.
- C. Forms disulfide bonds in secreted proteins.
- D. Has an acidic pK for the thiol on the side chain.
- E. all of the above are correct.

29. oleic acid will be produced if a one double bond is introduced to one of the followings :

- A. linoleic.                      B. stearic acid.                      C. palmitoleic acid.  
D. linolenic acid.                      E. plamitic acid.

30. Compare the  $[H^+]$  of gastric juice ( assume  $pH= 1.4$ ) to that of blood plasma (assume  $pH= 7.4$ ) :

- A. the  $[H^+]$  of gastric juice is 6 times higher .  
B. the  $[H^+]$  of gastric juice is  $10^6$  times higher.  
C. the  $[H^+]$  of blood plasma is 6 times higher than gastric juice.  
D. the  $[H^+]$  of blood plasma is  $10^7$  times higher.  
E. the  $[H^+]$  of gastric juice is about 7 times higher.

31. Separation of proteins based on solubility is done by which of the separation methods:

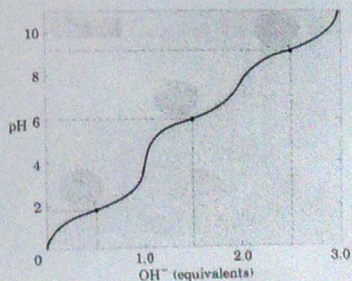
- A. electrophoresis.  
B. affinity chromatography.  
C. ion-exchange ehromatography.  
D. salting out  
E. gel filtration.

32. Regarding the pI of proteins, which is **NOT CORRECT** :

- A. the pI is the pH at which a protein has a total net charge of zero.  
B. A basic protein will have a pI greater than 7.  
C. A protein will not move in an electric field at a pH value equal to it's pI.  
D. The pI is the pH at which a protein has no negative or positive charges.  
E. A protein have least solubility at pH equal to its pI.

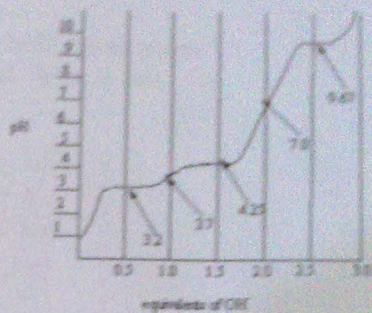
33. Shown is a titration curve of an amino acid, what is this amino acid?

- A. Cysteine  
B. Valine  
C. Lysine  
D. Histidine  
E. Glutamic acid



34. What is the isoelectric point of the amino acid whose titration curve is shown to the right?

- A. 3.2
- A. 3.7
- B. 4.25
- C. 7
- D. 9.67



35. Which amino acid substitution will most likely cause a dramatic change in a protein's tertiary structure:

- A. Threonine to serine
- B. Arginine to lysine
- C. Valine to leucine
- D. Isoleucine to arginine
- E. Asparagine to glutamine

36. Super secondary structure is:

- A. association of protein subunits (monomers)
- B. aggregate of  $\alpha$ -helical and  $\beta$ -sheet structures
- C. spatial arrangement of amino acids that are near each other in the linear sequence.
- D. is called a domain
- E. any single secondary structure consist of more than 20 residues.

37. The major role of SDS in SDS-PAGE is to

- A. make proteins negatively charged
- B. increase buffering capacity
- C. prevent proteins from denaturation
- D. increase the pI of proteins
- E. prevent proteins from degradation

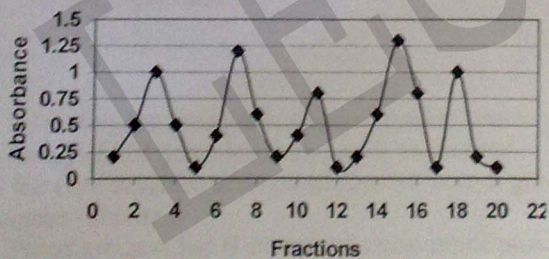


38. A mixture of proteins is applied in a pH 6.5 buffer to an anion-exchanger chromatography column and eluted. What is the FIRST protein eluted:

Protein	pI	mol. Wt.
urease	5.1	482,700
catalase	5.6	247,500
lactoglobulin	5.2	37,100
hemoglobin	6.9	64,500

- A. Urease
- B. Lactoglobulin
- C. Catalase
- D. Hemoglobin
- E. Both hemoglobin and lactoglobulin

39. You have performed a size-exclusion chromatography to separate different proteins with different sizes. Based on the plot shown to the right, the smallest protein is the one eluted (came out) at fraction:



- A. 3
- B. 7
- C. 11
- D. 15
- E. 18

40. You can determine when a protein is eluted out of a chromatography column by directly measuring the protein samples absorbance at nearly:

- A. 190 nm
- B. 260 nm
- C. 280 nm
- D. 460 nm
- E. 590 nm

41. In  $\alpha$  - helix, which is not true:

- A. Side - chain groups project outward from the helix.
- B. Each peptide bond can form two hydrogen bonds.
- C. There are 3.6 amino acid residues per turn of the helix.
- D. H - bonds are parallel to  $\alpha$  - helix.
- E. Frequent small amino acid, glycine, is very compatible to  $\alpha$  - helix structure.

42. the bond connecting the two monosaccharides in sucrose is a (an) \_\_\_\_\_ linkage:

- A.  $\alpha$ -1,4 glycosidic
- B.  $\beta$ -1,4 glycosidic
- C. 1,2 anomeric
- D.  $\alpha$ -1,6 glycosidic
- E.  $\beta$ -1,6 glycosidic

43. Regarding the membrane oligosaccharide structure in various blood Groups (ABO), which statement is not correct :

- A. the core structure in all people is:- N- acetyl- glucose amine- galactose - fucose .
- B. blood group A has N-acetyl galactose amine plus the core structure.
- C. blood group B has galactose plus the core structure .
- D. blood group O has only the core structure.
- E. blood group AB contain core structure plus the disaccharide unit, galactose- N- acetyl galactose amine .

\*\*\*\*\* For the following questions (44 - 50) choose:

- A. if 1, 2 & 3 are correct.
- B. If 1 & 3 are correct.
- C. 2 & 4 are correct.
- D. If only 4 is correct.
- E. If all 1, 2, 3 & 4 are correct

44. Which of the followings are (is) glycosaminoglycan:

- 1. chondroitin -6-sulfate
- 2. heparan sulfate
- 3. hyaluronate
- 4. dermatan sulfate

45. Hemoglobin & myoglobin have which of the following characteristics in common :

- 1. highly  $\alpha$ -helical structures.
- 2. bind one molecule of heme per globin chain.
- 3. can bind one  $O_2$  per heme
- 4. bind heme in a hydrophobic pocket in the globin chain.

46.  $\beta$  turn:

- 1. Is a type of super secondary structure.
- 2. It usually has a proline residue.
- 3. It is stabilized by hydrogen bonds with another adjacent  $\beta$  turn.
- 4. It changes the direction of polypeptide chain.

47. D-glucose & D- galactose are:

- 1. constituent of lactose.
- 2. isomers
- 3. epimers.
- 4. aldoses

48. Which of the following is/are a reducing carbohydrate(s) :

- 1. sucrose
- 2. lactose
- 3. amylose
- 4. Erythrose

49. Which of the following can cause protein denaturation :

- 1. 6 M guanidine
- 2. 70% ethanol
- 3. 8 M urea
- 4. strong acids or bases

50. Correct statements regarding the structure of various polysaccharides include :

1. amylopectin is a branched polymer of  $\alpha$ -D- glucose with  $\alpha$ -1,4-glycosidic linkages & with  $\alpha$ -1,6 branching points.
2. Glycogen is a branched polymer of  $\alpha$ - D-glucose with  $\alpha$ - 1,4 glycosidic linkages & with  $\alpha$ -1,6 branching points.
3. Cellulose is a non-branched polymer of glucose with  $|\beta$ -1,4 – linkage.
4. glycogen molecule is more branched than starch.