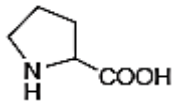
QUESTION ONE:

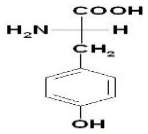
Choose one correct answer and mark in the answer sheet:

(65×1=65 Marks, 65 min)

1. **Which of the following is a polar amino acid?**



a.



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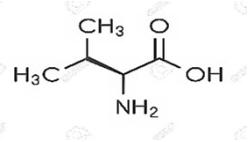

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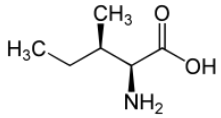


d.

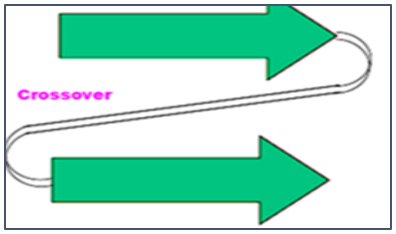
2. **Branched chain amino acids are:**
   a. Cysteine and cystine
   b. Tyrosine and Tryptophan
   c. Glycine and Serine
   d. Valine, Leucine and Isoleucine

3. **An amino acid which contains a disulphide bond is:**
   a. Lysine
   b. Homocysteine
   c. Methionine
   d. Cystine

4. **Which among the following is a nutritionally essential amino acid for man?**
   a. Alanine
   b. Proline
   c. Glycine
   d. Valine

5. **The 21st amino acid present in human proteins is?**
   a. Tyrosine
   b. Proline
   c. Glutamic
   d. Selenocysteine

6. **The opposite protein structure indicates:**
   a. Antiparallel β- sheets
   b. Chaperons
   c. Parallel β - sheets
   d. Helix structure



7. **All the followings are modified amino acids EXCEPT:**
   a. γ-carboxyglutamate
   b. 4-hydroxyproline
   c. Pyrrolysine
   d. 5-hydroxylysine

8. **Non conservative changes in protein structures resulted in:**
   a. Alzheimer disease
   b. Sickle cell anemia
   c. Prion disease
   d. Same biological activity of protein

9. All the followings are incorrect regarding β-sheet protein structures <u>EXCEPT:</u>

a. The amino acids are stabilized by covalent disulfide bonds
b. It is stabilized by intrachain H- bonds of amino acids every four residues.
c. It is stabilized by intrachain ionic bonds of hydrophobic residues.
d. Stabilized by interchain H- bonds between amino acids of two parallel peptide chains.

10. Which of the following are examples of globular proteins?

a. Insulin and hemoglobin c. Hemoglobin and keratin
b. Collagen and hemoglobin d. Collagen and elastin

11. Which of the following statement about the peptide bond is true?

a. It is a carbon-carbon bond
b. It has cis hydrogen and oxygen groups
c. It is planar
d. It has rotational freedom

12. All of the following are correct regarding protein denaturation <u>ECXEPT:</u>

a. The denatured proteins are precipitated from solution
b. Extreme pH results in intramolecular electrostatic attraction which does not change the conformational structure.
c. Urea and guanidinium chloride are denaturing agents
d. 2-mercaptoethanol and dithiothreitol are used to disrupt disulfide bonds

13. Which of the following amino acids is <u>NOT</u> required for dopamine synthesis?

a- Arginine b- Phenylalanine c- Tyrosine d-Both b & c

14. Sickle cell disease is characterized by all of the following <u>EXCEPT:</u>

a. HbS represents non-conservative substitution in primary structure.
b. It is a genetic disorder due to change in the α-globin gene.
c. The infant begins showing symptoms if HbF has been replaced by HbS
d. Sickle cell disease is severe in homozygotes.

15. Protein pool contraction means:

a. Protein synthesis equaling protein degradation
b. Decreased protein synthesis and increased degradation
c. Increased protein synthesis and decreased degradation
d. Regulation of antigen processing and apoptosis

16. Which of the following is correct regarding prion protein?

a. It is a causative agent of TSEs and Alzheimer disease
b. Noninfectious PrP consists of α-helices & β-sheets
c. Its insoluble fibrils are resistance to proteolytic degradation
d. The normal and the infectious forms are different in their primary structure

17. In conjugation step of UPP, which is correct?

a. Ubiquitin is attached to substrate protein between the C-terminal methionine residue of ubiquitin and Lys residues of protein
b. It requires activating enzyme, conjugating enzyme, and ligase
c. The substrate protein is tagged by 26S proteasome
d. Ubiquitin conjugation is irreversible process

18. Bortezomib acts as:

a. Peroxidase inhibitor
b. Ligase inhibitor
c. Proteasome inhibitors
d. Trypsin inhibitor

19. Formation of serotonin from tryptophan requires the action of:

a. Dopa decarboxylation
b. Diamine oxidase
c. Peroxidase
d. Hydroxylase

20. Exopeptidases catalyse the hydrolysis of peptide bonds:

a. At amino terminal
b. At carboxyl terminal
c. Of only dipeptides and tripeptides
d. Both a and b

21. The amino acid which synthesizes many hormones is:

a. Alanine
b. Valine
c. Phenylalanine
d. Histidine

22. The amino acid which synthesizes carnitine is:

a. Valine
b. Lysine
c. Arginine
d. Histidine

23. HGPRTase enzyme catalyze the conversion of:

a. Guanine → GMP
b. Adenine →IMP
c. Hypoxanthine → IMP
d. Adenine → AMP

24. Which of the following enzymes is inhibited by Methotrexate?

a. HGPRTase
b. Glutamine amidotransferase
c. DHF-reductase
d. Transaminase

25. The committed step of purine biosynthetic pathway is catalyzed by:

a. HGPRTase
b. Glutamine phosphoribosyl amidotransferase
c. DHF-reductase
d. CPS-II

26. Pyrimidine and purine nucleoside biosynthesis share a common precursor:

a. PRPP
b. Fumarate
c. Glycine
d. Alanine

27. The first true pyrimidine ribonucleotide synthesized is:

a. UMP b. UDP c.TMP d. CTP

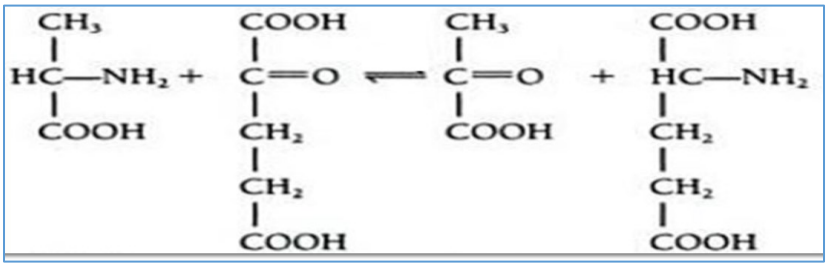
28. Which of the following is a tripeptide hormone, with the sequence of Glu-His-Pro and released from hypothalamus?

a. ADH
b. TSH
c. TRH
d. Glutathione

29. Proline is synthesized from:

a. Alanine
b. Glycine
c. Glutamate
d. Asparagine

30. The enzyme which catalysis the following reaction is:



a. Asparginase
b. AST
c. ALT
d. Reductase

31. Serine can be formed from:

a. Arginine through transfer of a hydroxymethyl group
b. D-3-phosphoglycerate through reduction and then transamination
c. From NH_4^+ and CO_2 by *synthetase* enzyme
d. Threonine through transamination

32. The antioxidant peptide in human body is:

a. Oxytocin
b. Glutathione
c. Vasopressin
d. Encephalin

33. Vasopressin hormone is:

a. Nanopeptide
b. Octapeptide
c. Tripeptide
d. Pentapeptide

34. All the following peptide hormones increase blood pressure <u>EXCEPT</u>:

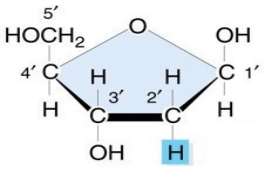
a. Vasopressin
b. Aldosterone
c. Angiotensin
d. Serotonin

35. Met-encephalin amino acid sequence is:

a. —Gly—Arg—Lys—Phe—
b. —Arg—Lys—Phe—Asp—
c. —Tyr—Gly—Gly—Phe—Met—
d. —Tyr—Gly—Gly—Phe—Leu—

36. The illustrated structure of figure (K) is for…….

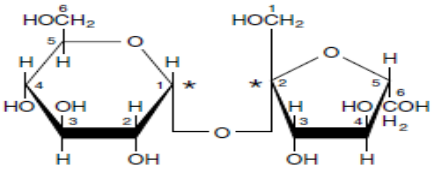
a. Fructose
b. Ribose
c. Deoxyribose
d. Glucose



(K)

37. The illustrated disaccharide (M) is ……

a. Maltose
b. Isomaltose
c. Sucrose
d. Lactose



(M)

38. The nonbranching helical structure of starch is called ……..

a. Amylose
b. Amylopectin
c. Dextrin
d. Amino sugars

39. The primer molecule for glycogen synthesis is called ……..

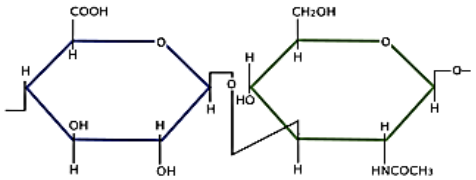
a. Glycosphingolipid
b. Glycogenin
c. Syndecan
d. Glypican

40. …….. consists of β-glucose units linked by β(1 → 4) bonds.

a. Cellulose
b. Glycogen
c. Starch
d. Glycosaminoglycan

41. The repeated units of disaccharide structure (W) is called ……

a. Dermatan sulfate
b. Heparin
c. Chondroitin sulfate
d. Hyaluronic acid



(W)

42. …… is glycosaminoglycan present in horny structures formed from dead cells like hair and nails.

a. Chondroitin sulfate
b. Keratan sulfate
c. Dermatan sulfate
d. Heparan sulfate

43. Thrombin and antithrombin are crystallized in the presence of a short segment of ……..

a. Chondroitin sulfate
b. Keratan sulfate
c. Dermatan sulfate
d. Heparan sulfate

44. Which of the following statement about the carbohydrate digestion is Correct?

a. Digestion of carbohydrates begins in stomach.
b. Salivary α-amylase acts on starch breaking α-(1$\rightarrow$6) bonds.
c. Maltase cleaves maltose, producing glucose.
d. Lactase cleaves lactose producing galactose and fructose.

45. Which of the following statements about lactose intolerance is Correct?

a. It is due to lactose-deficient.
b. It can be treating by remove lactose from the diet.
c. Lactose is passed into the large intestine causing abdominal cramps, diarrhea, and flatulence.
d. Both b and c are correct.

46. ……. are proteins conjugated to polysaccharides with serial repeat units

a. Proteoglycans
b. Glycoproteins
c. Glycosphingolipids
d. Collagen

47. …….. cuts proteins close to membrane surface to release syndecan ectodomains outside the plasma membrane.

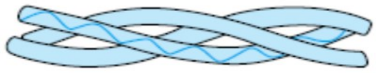
a. Protease
b. Phospholipase
c. Disaccharidase
d. Oligosaccharidase

48. Which of the following statement about glycoprotein is Correct?

a. It contains higher amount of protein than carbohydrate
b. It contains higher amount of carbohydrate than protein
c. Syndecan and glypican are examples of glycoprotein
d. Both b and c are correct

49. The protein structure (Q) is unique to……

a. Mucins
b. Transferrin
c. Immunoglobulins
d. Collagen



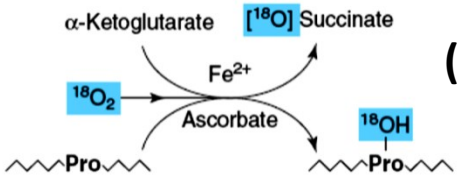
(Q)

50. ……. fits into the restricted spaces where the three chains of the triple helix of collagen come together.

a. Glycine b. Proline c. Hydroxyproline d. Hydroxylysine

51. The reaction (S) is catalyzed by……..

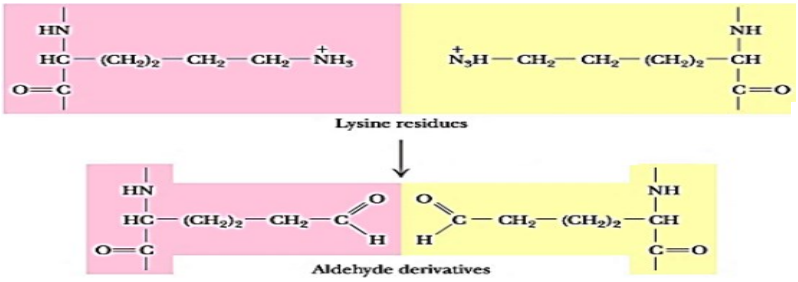
a. Lysyl oxidase
b. Prolyl oxidase
c. Prolyl hydroxylase
d. Lysyl hydroxylase



(S)

52. The reaction (Z) is catalyzed by ……

a. Lysyl hydroxylase
b. Lysyl oxidase
c. Vitamin C
d. Vitamin D



(Z)

53. The genetic inability to add the GlcNAc-GlcA disaccharide to the growing heparan sulfate chain results in ……..

a. Scheie syndrome c. Multiple hereditary exostoses
b. Hurler syndrome d. Scurvy

54. Maltotriose is considered …….

a. Monosaccharide c. Disaccharide
b. Oligosaccharide d. Polysaccharide

55. Which of the following is a ketohexose (ketone-containing hexose)?

a. Ribose b. Fructose c. Glucose d. Erythrulose

56. Which of the following is C4 epimer of glucose?

a. Mannose b. Fructose c. Galactose d. Sorbose

57. Which of the following statement about glypicans is correct?

a. They are membrane bounded glycoprotein
b. They are attached to the membrane by a lipid anchor
c. They contain higher amount of protein than carbohydrate
d. They are anchored to the membrane by peptide transmembrane domain

58. Glycogen is a more highly branched structure than amylopectin, with chains of 12–14 monomers.

a. True b. False

59. Pancreatic α-amylase acts on starch in small intestine breaking β-(1-4) bonds.

a. True b. False

60. Fructose is transported only by facilitated diffusion utilizing carriers that are independent of Na^+

a. True b. False

61. Heparan sulfate molecules could bind nonspecifically to extracellular proteins and signaling molecules to alter their activities.

a. True b. False

62. Glycoconjugates consist of carbohydrates non-covalently bound with protein or lipid.

a. True b. False

63. Shedding is highly regulated and is activated in proliferating cells, such as cancer cells.

a. True b. False

64. The glycosaminoglycan in proteoglycan is joined to core protein through a trisaccharide bridge.

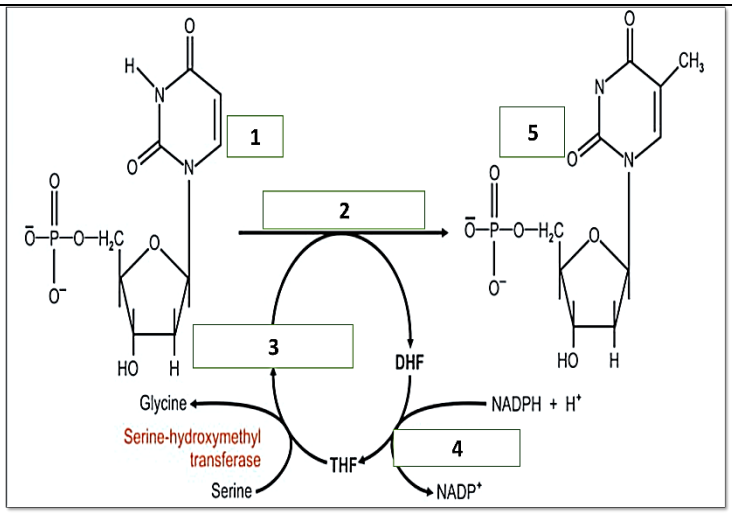
a. True b. False

65. Glycosphingolipids are plasma membrane components and play a role in signal transduction in cells.

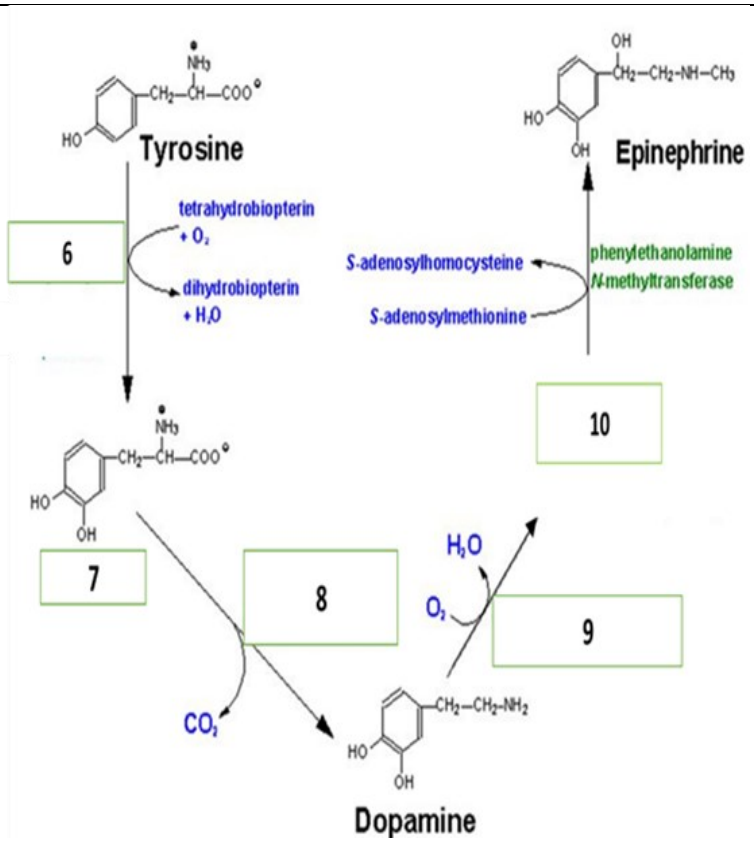
a. True b. False

QUESTION TWO

Complete the following chemical equations with suitable substrates, products and enzymes: (5 Marks, 10 min)



1- The compound name is …….
2- The enzyme name is ……
3- The cofactor name is……
4- The enzyme name is……..
5- The compound name is……



6- The enzyme name is ……
7- The compound name is ……
8- The enzyme name is ……
9- The enzyme name is ……..
10- The compound name is …… and **DRAW** its chemical structure…….

QUESTION THREE:

I. Complete the following statements with correct terms:

(20x1.5=30 Marks, 20 min)

1- Regarding regulation of enzyme activity by feed-back inhibition, end product may act as ..... and .....

2- Phosphorylation reactions are catalyzed by a family of enzymes called ..... and it's one of the method regulating enzyme activity by .....

3- During the enzyme-catalyzed reactions, enzymes provide an alternate reaction pathway with .....

4- The class of enzymes that catalyze the formation of bonds between carbon and O, S, N atoms is named .....

5- ..... serve as recyclable shuttles such as folates

6- ..... are closely related variants of the same enzyme with the same catalytic function, but with different physical and chemical properties such as .....

7- Sildenafil promotes penile erection by competing with the ..... leading to the inhibition of ..... enzyme

8- The neurotoxic effects of organophosphorus insecticides are a result of .....

9- Certain proteins such as proteases are synthesized and secreted as inactive precursor known as .....

10- Effectors induce a ..... in enzyme, altering it's ..... for a substrate

11- The number of molecules of substrate converted to product per enzyme molecule per second is called .....

12- The inducible enzymes are defined as .....

13- Regarding Lineweaver-Burk plot, competitive enzyme inhibitors increase ..... so the affinity of the enzyme to its substrate is decreased

14- In the lock and key model of enzyme action the part of the enzyme that recognizes the substrate is known .....

15- If an enzyme solution is saturated, the most effective way to obtain an even faster yield of products would be .....

II. Given the following Eo, calculate the Δ G_0^- of oxidation of FADH2 by O2 (½ O2 + FADH2 → H2O + FAD): (2.5 Marks, 5 min)

½ O_2 + 2 H^+ + 2 e- → $2H_2O$ E_o = +0.820 V

FAD + 2 H^+ → $FADH_2$ E_o = -0.219 V

Remember: Δ G_0^- = - nFΔ E_o and F=23.06

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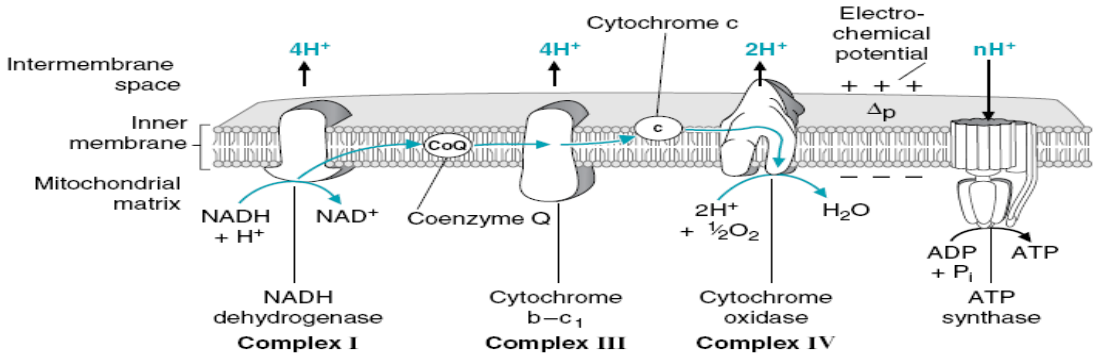
III. The following figure illustrates the reactions of electron transport chain and oxidative phosphorylation, complete the following as indicated: (7x2.5=17.5 Marks, 10 min)



1. Explain why CoQ is the suitable interface between two-electron carriers and the one-electron carriers.

.....

.....

.....

2. What is the hypothesis that explains how the free energy generated by the transport of electrons by ETC is used to produce ATP?

.....

.....

3. In resting conditions, the demand ATP synthesis is limited. Is PMF high?

   Yes ☐ No ☐

4. What is the P/O ratio of succinate?

   ……

   ……

5. Illustrate the biological importance of thermogenin.

   ……

   ……

6. What are the inhibitors of complex IV of ETC?

   ……

   ……

7. What is the dominant shuttle for aerobic oxidation of cytosolic NADH in heart and muscle tissues?

   ……

   ……

QUESTION FOUR:

I. Answer each of the following questions as required:

(3x4= 12 Marks, 15min)

1. **Describe with structural chemical equation the rate limiting step of Heme biosynthesis**

2. **Some fatty acids are essential in human and must be provided in diet (give reasons and name of two examples)**

3. **Define the four major groups of plasma lipoproteins and give the function of each group**

II. Compare between each pair of the following: (3X6=18Marks, 15min)

1- Carbon-Monoxide poisoning and methemoglobinemia

Items	Carbon Monoxide Poisoning	Methemoglobinemia
Definition		
Symptoms		
Treatment		

2- Multiple sclerosis and respiratory distress syndrome

Items	Multiple sclerosis	Respiratory distress syndrome
Genetic cause		
Symptoms		

3- Triacylglycerol and glycerophospholipids

Items	Triacylglycerol	Glycerophospholipid
Chemical structure		
Digestive pancreatic enzyme		
Structural chemical equation that describe pancreatic digestion