

PART 1 - Multiple choice - Select the correct answer in each case. Read the questions and the possible answers with care. (75%)

- The type of chemical linkage involved in the polymerization of amino acids into proteins is:
  - phosphodiester bond.
  - peptide bond.
  - hydrogen bond.
  - carbon-carbon sigma bond.
- The native conformation of a protein is most dependent on what aspect of protein structure?
  - Primary amino acid sequence
  - Secondary structure
  - $\alpha$ -helix and  $\beta$ -pleated sheets
  - The total number of hydrogen bonds present
- The absorption spectrum of a protein is related to which group of amino acids?
  - Ile, Leu, Met
  - Phe, Tyr, Trp
  - Asp, Glu
  - Lys, His, Arg
- Which of the following reagents could best be used to cleave disulfide bonds in proteins?
  - p-nitrophenylacetate
  - Iodoacetamide
  - phenyl isothiocyanate
  - $\beta$ -mercaptoethanol
- Which reagent would be most useful in producing a small number of fragmentation products from a protein?
  - dilute HCl hydrolysis
  - chymotrypsin digestion
  - pepsin digestion
  - treatment with cyanogen bromide
- Ninhydrin would be most useful in which of the following?
  - determination of protein sequence.
  - determination of protein composition.
  - electrophoretic separation of proteins.
  - determination of tertiary structure.
- A protein separation method based primarily on the molecular size and shape of molecules is:
  - ion exchange chromatography (Dowex)
  - gel filtration chromatography (Sephadex)
  - disc gel electrophoresis (polyacrylamide)
  - salting out (ammonium sulfate precipitation)
- The identity of a species is preserved by and due to:
  - The presence of unchanging morphological traits.
  - The possession of simple building block molecules in common with other species.
  - Possession of a unique set of nucleic acids and protein molecules.
  - The presence of similar cellular organelles and metabolic-enzymatic pathways.

9. A catalyst is able to increase the rate of a chemical reaction primarily by:
- A. lowering the free energy difference between the reactants and products.
  - B. Speeding the forward reaction at the expense of the reverse reaction.
  - C. lowering free energy of activation.
  - D. decreasing the energy of the transition state in the forward reaction relative to that in the reverse reaction.
10. If RNA were hydrolyzed completely in acid the resultant products would be:
- A. Adenine, thymine, uracil, cytosine, ribose, phosphoric acid.
  - B. Guanine, cytosine, adenine, uracil, ribose, phosphoric acid.
  - C. Adenylic acid, guanylic acid, cytidylic acid, uridylic acid.
  - D. Guanosine, adenosine, cytosine, uridine, phosphoric acid.
11. The chemical bond linking successive nucleotides in nucleic acids is:
- A. a phosphoric acid anhydride bond
  - B. peptide (amide) bond
  - C. N-glycosidic bond
  - D. phosphodiester bond
12. Which statement is not true of most unsaturated fatty acid.
- A. The double bond is in a trans configuration.
  - B. They are more abundant in nature than saturated fatty acids.
  - C. They have lower melting points than saturated fatty acids.
  - D. When more than one double bond is present they are never conjugated.
13. Lipids are biochemical substances placed in a class of compounds because they are all:
- A. nonpolar, organic compounds.
  - B. made up of carbon, hydrogen, and oxygen.
  - C. found in membranes.
  - D. soluble in nonpolar, organic solvents such as chloroform, ether, and benzene.
14. In deoxyribonucleic acids the hydroxyl group has been replaced by a hydrogen at what position?
- A. the 1' sugar position.
  - B. the 2' sugar position.
  - C. the 3' sugar position.
  - D. the 5' sugar position.
15. The complete oxidation of pyruvate occurs in the :
- A. cytoplasm.
  - B. mitochondria.
  - C. nucleus.
  - D. student union cafeteria.
16. The main function of the glyoxylate cycle is to:
- A. form ribose-5-phosphate and NADPH + H<sup>+</sup>.
  - B. form succinate from two acetyl CoA's.
  - C. form pyruvate which is reduced to ethanol.
  - D. form CO<sub>2</sub>, water, and reduced nucleotides.

17. The TCA cycle is mainly involved with:
- A. production of oxaloacetate and other intermediates.
  - B. reduction of NADP<sup>+</sup> and production of ribose-5-phosphate.
  - C. oxidation of acetate groups to CO<sub>2</sub> and H<sub>2</sub>O while reducing NAD<sup>+</sup>.
  - D. production of ATP from the hydrolysis of succinyl-CoA.
18. The cytochromes are involved in:
- A. electron transport.
  - B. hydrogen transport.
  - C. proton transport.
  - D. water transport.
19. The final electron acceptor in cellular aerobic respiration is:
- A. water.
  - B. oxygen.
  - C. NAD<sup>+</sup>.
  - D. ADP.
20. Oxidation of fatty acids does not take place in:
- A. lung.
  - B. liver.
  - C. heart.
  - D. erythrocyte.
21. Which ketone body is not further metabolized?
- A. acetone
  - B.  $\beta$ -hydroxy- $\beta$ -methyl glutaryl CoA
  - C. acetoacetate
  - D.  $\beta$ -hydroxy-butyrate
22. The formation of carbohydrates from non-carbohydrate precursors such as amino acids and lactic acid is called:
- A. phosphorylysis.
  - B. gluconeogenesis.
  - C. glycogenogenesis.
  - D. photosynthesis.
23. A sample of L-alanine labeled with <sup>14</sup>C in the  $\beta$ -carbon atom is injected into a rat. The animal is sacrificed one hour later and a sample of palmitic acid isolated from the liver lipids. Which carbon atoms of the palmitic acid will be most strongly labeled?
- A. 1, 3, 5
  - B. 2, 6, 10, 14
  - C. 1, 3, 5, 7, 9, 11, 13
  - D. 2, 4, 6, 8, 10, 14, 16
24. A conjugated protein is one which:
- A. consists of multiple peptide bonds.
  - B. exhibits an oligomeric structure.
  - C. contains an additional non-protein component.
  - D. exhibits molecular absorption in the aromatic range.

25. A protein solution exhibited an absorbance of 2.0 at 280 nm. In order to achieve an absorbance of 1.0 the solution would be:
- A. diluted with an equal volume of solvent.
  - B. diluted with twice the volume of solvent.
  - C. concentrated to one half the original volume.
  - D. concentrated to 1/4 the original volume.

Part 2.

1. Hydrolysis of the following nucleic acid with bovine ribonuclease would result in what products? (5%)
- 5'pApGpCpUpAp3'
2. The amino acid sequence of a wild type protein showed leucine as the 37th amino acid in the chain. A mutant strain was isolated which could not produce the product formed by this enzyme. Utilizing a mutagen which allows substitution of any one base pair for another, back mutants were isolated. The functioning enzymes of these back mutants were subjected to amino acid analyses. Some had leucine at position 37; some had serine; some had tyrosine. What are the possible codons for the wild type, the mutant and the back mutants? What amino acid should be found in position 37 of the mutant protein, if it could be isolated? (20%)