M.Sc. MICROBIOLOGY
FIRST SEMESTER
MICROBIAL PHYSIOLOGY & BIOCHEMISTRY
MMB-102

(Use separate answer scripts for Objective & Descriptive)

Duration : 3 hrs. **Full Marks : 70**

(PART-A : Objective)

Time : 20 min. **Marks : 20**

Choose the correct answer from the following: ***1×20=20***

1. Water molecule which accepts a proton becomes a:
   a. Negatively charged hydroxide ion
   b. Negatively charged oxygen ion
   c. Negatively charged hydrogen ion
   d. Positively charged hydronium ion

2. Which one of the following is equal to the pK_a of a weak acid?
   a. Its relative molecular mass.
   b. The pK_b of its conjugate base.
   c. The pH of a solution containing equal amounts of the acid and its conjugate base.
   d. The equilibrium concentration of its conjugate base.

3. Which of the following relationships is true for an acidic solution at 25°C?
   a. $[H^+] > [OH^-]$
   b. pH > 7.00
   c. $K_w > 10^{-14}$
   d. The solution is negatively-charged

4. If the solution has to be a buffer its p H should be:
   a. At its pKa value
   b. At its Ka value
   c. At 7
   d. At 14

5. Buffers are mixture of:
   a. Strong acid and strong base
   b. Strong acid and weak base
   c. weak acid and weak base
   d. Weak base and conjugate acid

6. For a reaction if $\Delta G°$ is positive, then:
   a. The products will be favored.
   b. The reactants will be favored.
   c. The concentration of the reactants and products will be equal.
   d. All of the reactant will be converted to products.

7. All of the reactant will be converted to products:
   a. Will never reach equilibrium
   b. Will not occur spontaneously
   c. Will proceed at a rapid rate
   d. Will proceed at a rapid rate

8. If energy releases excessively in environment, having less energy products than reactants, resulting reaction is called:
   a. Redox reaction
   b. Thermodynamics
   c. Exergonic reaction
   d. Endergonic reaction

9. Metal ions that temporary binds substrate and active site of 'enzyme' is called:
   a. Inhibitors
   b. Coenzymes
   c. Prosthetic group
   d. Cofactors

10. In carbohydrates a special functional groups is present in the given following:
    a. Alcohol & Carboxyl groups
    b. Aldehyde & Ketone groups
    c. Hydroxyl groups & Hydrogen groups
    d. Carboxyl groups & Others

11. Nutritional polysaccharide is:
    a. Starch and glycogen
    b. Starch and chitin
    c. Starch and cellulose
    d. Starch and glucose

12. Peptide bond is:
    a. Rigid with partial double bond character
    b. Planar covalent
    c. Covalent
    d. All the above

13. Disulphide bonds are formed between:
    a. Cysteine residues that are close together
    b. Cystine residues that are close together
    c. Proline residue that are close together
    d. Histidine residue that are close together

14. The 3-D structure of a protein can be determined by:
    a. Nuclear magnetic resonance
    b. X-ray crystallography
    c. Both a and b
    d. Spectroscopy

15. α- helix has:
    a. 3.4 amino acid residues per turn
    b. 3.6 amino acid residues per turn
    c. 3.8 amino acid residues per turn
    d. 3.0 amino acid residues per turn

16. Fats and oils are respectively rich in:
    a. Unsaturated fatty acids
    b. Saturated fatty acids
    c. Saturated and unsaturated fatty acids
    d. None of these

17. The synthesis of glucose from fats are called:
    a. Glycolysis
    b. Krebs cycle
    c. Glycogenolysis
    d. Gluconeogenesis

18. If enzyme change active site rate of the reaction will:
    a. Decrease
    b. Increase
    c. Remains same
    d. Fluctuate

19. Enzyme which helps in changing shape of a molecule:
    a. Ligases
    b. Dehydrogenases
    c. Hydrolases
    d. Isomerases

20. A short length of DNA molecule has 80 thymine and 80 guanine bases. The total number of nucleotide in the DNA fragment is:
    a. 160
    b. 40
    c. 320
    d. 640

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[PART-B : Descriptive]

Time : 2 hrs. 40 min. **Marks : 50**

[Answer question no.1 & any four (4) from the rest]

1. a. Write the structure of dipalmitoyl phosphatidylserine and predict the products of saponification. (1+2)+2+2+3=10
   b. What is the purpose of Ramachandran plot?
   c. Compare and contrast fermentation and anaerobic respiration.
   d. Compare and contrast bacterial and mitochondrial electron transport chain.

2. a. Write the structure of a DNA and write a note on the two type bonds present within them to maintain their structure. 5+5=10
   b. What are the various factors responsible for the denaturation of DNA?

3. a. What is meant by buffering capacity of a buffer? 2+2+3+3=10
   b. Use the Fisher projection method to draw the D and L enantiomers of glucose.
   c. Supposing a chemical reaction has a ΔH=-65 kJ and ΔS=-105 J/K, at what temperature will it change from spontaneous to non spontaneous?
   d. The pKa of acetic acid is 4.75. A solution of has a pH of 6.75. What is the ratio of acid to conjugate base in this buffer?

4. a. State the role of thioredoxin and RuBisCo activase on Calvin cycle. 3+2+3+2=10
   b. Cite example of a transition state analog of RuBisco.
   c. What do you mean by photorespiration? Why is it a wasteful process?
   d. What is reductive TCA cycle?

5. a. Why can hydrogen oxidizing bacteria donate electrons to NAD+ while ammonia oxidizing bacteria cannot? How do ammonia oxidizing bacteria obtain NADH? (2+1)+(1+2)+4=10
   b. You have isolated a bacterial strain that can carry out oxygenic photosynthesis. What photosystems does it possess and in what group of bacteria does it most likely belong to? How does it obtain energy?
   c. Why does a microbe with active EM pathway and TCA cycle need to operate pentose phosphate pathway?

6. a. Make a cellular and molecular comparison between cyanobacterial photosynthesis and photosynthesis by green algae and sulfur-oxidizing bacteria. 5+3+2=10
   b. How does NADH reoxidize in anaerobic organisms?
   c. Describe the rate limiting steps of TCA cycle.

7. a. Write a note on activation energy. 4+6=10
   b. Explain the role of allosteric modulators in enzyme substrate reaction.

8. a. What are lipids? How are they classified? 6+4=10
   b. Write the reaction involved when fatty acid is reacted with alkali.

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