

# RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIRST SEMESTER EXAMINATION, DECEMBER 2018

FIRST YEAR [BATCH 2018-21]

MICROBIOLOGY (Honours)

Date : 14/12/2018

Time : 11 am – 3 pm

Paper : I

Full Marks : 100

**(Use a separate Answer Book for each group)**

## **Group – A**

Answer **any six** of the following:

[6×10]

1. a) Mention the advantages of agar over gelatin as a solidifying agent in preparation of culture medium. [2]  
b) Write down the functions of the two subunits of ribosome. [3]  
c) Mention the important differences between Ascomycota and Basidiomycota. [3]  
d) What is an appressorium? [2]
2. a) Mention the important contributions of Louis Pasteur in Microbiology. [3]  
b) What is  $T_m$  value ? How does it help in classification of bacteria? [2+1]  
c) State four important features of bacterial (*E. coli*) chromosomes. [2]  
d) State two distinct features of Archaeobacteria. [2]
3. a) Define Signature Sequences. [2]  
b) How was it proved that *Bacillus anthracis* is the causative agent for anthrax? [2]  
c) How are the asci formed in Ascomycetes after fertilization? [3]  
d) Mention the name of the fungi where the following reproductive structures are formed (one-in each)- Chlamyospore, teleutospore, spermatia, sclerotia, multicelled conidia, cleistothecium. [3]
4. a) The GC content of *Micrococcus* is 66-75 moles %, and of *Staphylococcus*, 30-40 moles %. According to this information, would you conclude that these two genera are closely related ? [2]  
b) What is identified by phage typing? [2]  
c) Why is the study of ribosomal RNA especially useful in studying evolutionary relationship among organisms? [2]  
d) What evidence supports classifying organisms into three domains? [2]  
e) Define episome. [2]
5. a) What is a type strain and a type culture collection? Why is such a collection essential to researchers? [1.5+1.5+2]  
b) List some proteins used in phylogenetic and taxonomic studies. Why are they useful? [2]  
c) How is genomic fingerprinting similar to rRNA sequence analysis? How do the two techniques differ? [1.5+1.5]

6. a) Write short notes on chromatic aberration. [2]  
 b) What is the role of phase plate in phase contrast microscope? Explain with diagram. [2+2]  
 c) Write down the differences between TEM and SEM. [2]  
 d) What is meant by Limit of Resolution ? [2]

7. a) How do triaminotriphenylmethane stains are useful to differentiate microorganism? [2.5]  
 b) Differentiate between chromophore and auxochrome. [2]  
 c) "Few stains have the ability to produce different colour in various histological and cytological structure"— Explain this fact with suitable example. [3]  
 d) Write down the theory and principle of acid-fast staining used in bacteriology. [2.5]

8. a) Calculate mean, median, SD and variance from the following distribution. [5]

Class interval	95-105	105-115	115-125	125-135	135-145
Frequency	19	23	36	70	52

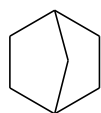
- b) What are histogram and pie chart? Write down the difference between the standard deviation and standard error. [2.5+2.5]
9. a) What the three different parts of peptidoglycan polymer? [3]  
 b) What are the functions of lipopolysaccharides of gram negative bacterial outer membrane? [3]  
 c) What is periplasmic space? [2]  
 d) What is pseudomurein? [2]
10. a) What is the difference between cortex and spore coat of endospore? [3]  
 b) Distinguish between plasmid & episome. [2]  
 c) What do you mean by stator and rotor in bacterial flagella? [3]  
 d) What are pilli? [2]
11. a) Differentiate between the monochromism and photochromism. [2]  
 b) Why are the phospholipid molecules amphipathic in nature? [2]  
 c) Why did Singer use the term "fluid mosaic" to describe membrane structure? [3]  
 d) What happens when cell membrane is treated with SDS? [3]
12. a) Name a bacterial energy reserve compound. Give its structure and significance. [1+3]  
 b) What is hypnospore? [2]  
 c) How does auxospore form? [3]  
 d) What are leuco compounds? [1]

### Group – B

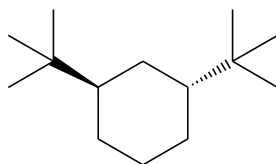
Answer **any four** of the following:

[4×10]

13. a) Mention the importance of hydrophobic interaction in biological system. Explain with proper example. [3]  
b) (i) How many grams of solid NaOH are required to prepare 500 ml. of a 0.04 M solution?  
(ii) Express the concentration of this solution in terms of N, g/liter, % w/v, mg% and osmolarity. [1+2.5]  
c) (i) How many milliliters of 0.025 M H<sub>2</sub>SO<sub>4</sub> are required to neutralize exactly 525 ml. of 0.06 M KOH ?  
(ii) What is the p<sup>H</sup> of the "neutralized" solution? [2.5+1]
14. a) Define "enthalpy" and "entropy". [1+1]  
b) What are coupled reactions? Explain with example. [3]  
c) How many carboxyl terminals of polypeptide chains are present in a molecule of hemoglobin? [2]  
d) Are collagen and myoglobin related in their structural aspects? [3]
15. a) In protein structure, how are the properties of an  $\alpha$  helix different from a  $\beta$  strand ? How are they similar? [2+2]  
b) Enumerate the nature of forces that stabilize a protein structure. [4]  
c) How many different tripeptides are possible out of 20 naturally occurring amino acids? [2]
16. a) With suitable examples describe what is meant by tautomerism in nucleobases. [3]  
b) What do you mean by Kinetic complexity and Chemical complexity of a stretch of DNA double helix? [2+2]  
c) In a structure of a nucleotide, label a) phospho anhydride bond b) phospho ester bond c) N-glycosidic bond. [1×3]
17. a) Define hyperchromic effect. What do you understand by propeller twist in DNA. [2+2]  
b) Which type of DNA is abundantly found in nature? Justify. [1+3]  
c) What do you mean by helix rise? [2]
18. a) Define zwitter ion and isoelectric point ? Name two basic and two acidic amino acids. How does cyanogen bromide react with peptides ? [2+2+1]  
b) You are given with 3mg/mL albumin solution and a cell lysate of unknown protein concentration. How can you determine the protein concentration of the unknown lysate using Folin's reagent? What do you mean by formol titration of an amino acid? What is selenocysteine? [3+1+1]
19. a)  $\alpha$ -L-Rhamnose exists in the <sup>1</sup>C<sub>4</sub> conformation whereas  $\beta$ -D-Glucose exists predominantly in the <sup>4</sup>C<sub>1</sub> conformation. Explain. [2]  
b) Give the stable conformations of norbornane and trans -1,3-dit-t-butyl cyclohexane. Explain your answer. Structures are depicted below. [2+2]



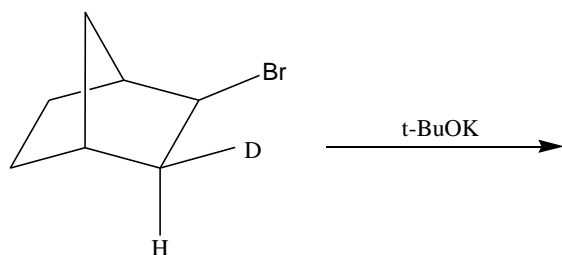
norbornane



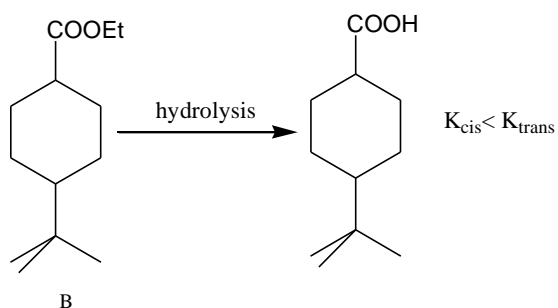
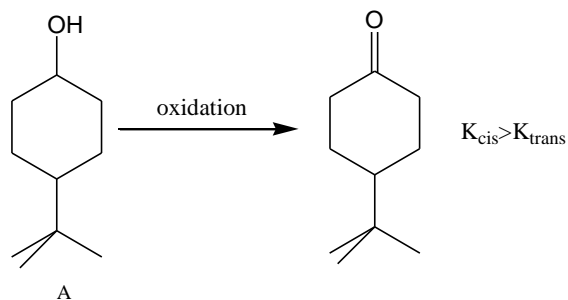
trans- 1,3- di-tert-butyl cyclohexane

- c) Trans-1,2-dibromo cyclohexane exists as mixture of (a,a) and (e,e) forms. In the gaseous state, the relative distribution between the two forms is 95:5, but in the liquid phase, the ratio shifts to 35% in favour of the (e,e) form. Explain this observation. [2]
- d) What is the anomeric effect? Can you predict the most favourable conformation of cyclohexene based on the energy profile diagram for cyclohexane? [1+1]

20. a) Predict the product: [1]



- b) Explain the observations. [3]



- c) trans-2-bromo-cyclohexyl brosylate undergoes acetolysis about 800 times faster than the cis isomer. Explain the observation. When the bromo substituent is changed to an iodo moiety, the same reaction is enhanced almost 10000 times faster in favour of the trans isomer. Rationalize this observation.[ Brosylate = 4-bromobenzene sulfonate] [2+1]
- d) Predict the products when cis-1,2-cyclohexane diol and trans-1,2-cyclohexane diols are subjected to the pinacol-pinacolone rearrangement. [3]

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