

2020

MICROBIOLOGY — HONOURS

Fifth Paper

(Group - A)

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Question no. 1 is compulsory and answer **any three** questions from the rest.

1. Answer **any five** questions :

4×5

- (a) Distinguish between LINE and SINE.
- (b) What is the function of telomere?
- (c) Draw the base pair structure of A : T and G : C.
- (d) What is a suicide enzyme?
- (e) Differentiate between Hfr and F⁻.
- (f) All episomes are plasmids but all plasmids are not episomes. Justify.
- (g) What is the significance of Hershey and Chase experiment?
- (h) Write down the significance of DNA methylation in DNA repair.
 - (i) What are bypass polymerases?
 - (j) What is plasmid addiction?
- (k) Write down any one mechanism that controls copy number of a plasmid inside a cell.
 - (l) Why is 5-methyl cytosine but not cytosine considered as a potential mutational hotspot?
- (m) Distinguish between mis-sense and non-sense mutation.
- (n) Phage PI has a dsDNA with 91,000 bps. Approximately how many double-helical turns does the DNA contain? What is the molecular wt. of the DNA? [Given Mol wt. of a nucleotide is 330]
- (o) What is the tertiary structure of tRNA? How is it stabilized?

2. In the mating

Hfr met⁻ his⁺ leu⁺ trp⁺ × F⁻ met⁺ his⁻ leu⁻ trp⁻ the met⁻ marker is known to be transferred very late. A short time after the Hfr and F⁻ cells are mixed, the mating cells are interrupted, and the cell suspension is plated on four different growth media. The amino acids in the growth media and the number of colonies observed on each are as follows :

histidine + tryptophan 250 colonies

histidine + leucine 50 colonies

Please Turn Over

leucine + tryptophan 500 colonies
histidine 10 colonies.

- (a) In the above experiment, what is the purpose of using met^- mutation in the Hfr strain?
(b) What is the order of transfer of the genes?
(c) Why is the number of colonies so small for the medium containing only histidine? 2+4+4
3. (a) When an Hfr carrying lambda prophage transfers its chromosome into a F^- cell that does not contain lambda, the prophage is induced and the F^- cell is killed. Why?
(b) How does the action and mutagenic effect of 5-bromouracil differ from that of nitrous acid? 4+6
4. (a) Double helical DNA has three major helical forms. Name them and mention three major characteristics of these forms for all types.
(b) What is ARS? (2+6)+2
5. (a) Schematically represent a Holliday Junction.
(b) Name the enzymes responsible for the resolution of this junction.
(c) What are hotspots of recombination? 4+4+2
6. (a) What are the differences and similarities between Intergenic and Intragenic suppression?
(b) Acridine dyes induce frame shift mutations. Why are frameshift mutations likely to be more detrimental than point mutations? 6+4
7. (a) What are the topological isomers of plasmid DNA? How can they be studied through electrophoresis methods?
(b) The relationship between the melting T_m and GC content can be expressed, in its much simplified form, by the formula $T_m = 69 + 0.41 (\%GC)$.
(i) Calculate the melting temperature of *E.coli* DNA that has about 50% GC
(ii) Estimate the % GC of DNA from a human kidney cell where $T_m = 85^\circ C$. 4+6
8. (a) How did reconstitution experiment of Fraenkel-Conrat and colleagues show that genetic information of tobacco mosaic virus (TMV) is stored in its RNA rather than its protein?
(b) Why DNA contains only thymine and not uracil? 6+4
9. Differentiate between the following pair of terms. 4+4+2
(a) Reversion and Suppression
(b) Generalized and Specialized transduction
(c) Mutation and Polymorphism.
10. (a) What is the basic unit of chromatin structure? Write down its composition.
(b) Briefly describe how do the above components contribute to the compaction of eukaryotic chromosomes. 4+6
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