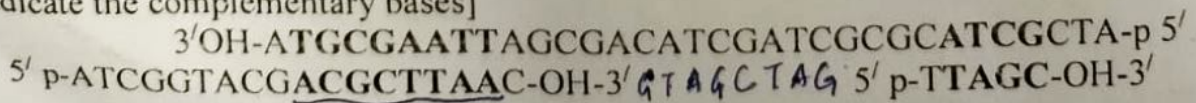


1. a) Write stepwise equation for DNA curving using k , t and N^* [p = pitch, k = curvature, t = twist, N^* = bp steps in complete one turn]
 b) Write stepwise equation for DNA curving using P , k and t [p = pitch, k = curvature, t = twist, N^* = bp steps in complete one turn]
2. Assume that Histone Octamers form a cylinder of diameter 12 nm with a height of 6 nm, where human genome has 35 million nucleosomes
 - a) What **volume** of nucleus (having 8-micron diameter) is occupied by Histone octamers?
 - b) What **fraction** (in percent) of the nuclear volume do the DNA and Histone Octamers occupy?
3. Assume that 30 nm chromatin fiber contains about 30 nucleosomes (1 nucleosome= 200 bp) per 75 nm of DNA.
 - a) Calculate the degree of compaction of DNA associated with the level of chromatin structure.
 - b) What fractions (in percent) of 15000-fold condensation does this DNA packing represent?
4. Show the steps of Meselson and Stahl's experiment. If Meselson and Stahl's experiment is continued for 4 generations in *E. coli*, then what would be the ratio of $^{15}\text{N}/^{15}\text{N}$: $^{15}\text{N}/^{14}\text{N}$: $^{14}\text{N}/^{14}\text{N}$ in the end?
5. Excess of ^3H labeled DNA replicated in a medium with ^{32}P dCTP. Incubation was continued for the cell cycles and then DNA was extracted by CSCI gradient. Show the graph(s) **radioactivity vs time** for i) one cycle ii) two cycle of replication.
6. A 200 nucleotide segment is responsive for replication of a gene X of a cell. It is found that this segment is moved different places in genome and those new sites are also amplified in cells.
 - a) Sketch the amplified DNA cluster.
 - b) Calculate the fold of DNA amplification after 6 round of replications.
 - c) What is the role of 200 nucleotide amplification control element of the gene X cluster?
7. Explain with diagram why Okazaki fragments are formed during DNA replication?
8. What are the steps in base excision repair? Show the diagram.

(Marks: 3 x 8 = 24)

9. a) What are the major activities of Klenow enzyme?
 b) Write the final structure when the partial DNA (shown below) is placed in a mixture containing four dNTPs, buffer and Klenow enzyme? [Bold letters indicate the complementary bases]



(Marks 2+4: 6)