

Please write legibly. If it takes me too long to decipher your handwriting, I won't be able to give credit for your answer.

If you wish to keep your grade hidden from others, you must write your name above and also on the back of the last sheet.

1. A team of aggravated and determined renegade scientists storm the Area 51 complex, which has been previously and secretly moved to a site in Utah. They discover cultures of cells, which it seems were taken from the bodies of extra-terrestrial aliens, shortly after they died of the massive injuries received during the crash of their aircraft, which was shot down from the skies above New Mexico by the US airforce. The scientists take the cultures to their underground laboratory for experimentation to learn about the nature of the aliens' genetic or information molecule. (a-d each is worth 10 points)
 - a) Why would the scientists expect that there is a genetic or information containing molecule?

 - b) They discover 6 different types of monomers in the genetic "information" polymer. They also discover 23 different amino acid-like monomers in molecules analogous to our proteins. How long a "word" or codon should they suspect?

 - c) When conducting an experiment similar to the Melseison and Stahl, after just one round of replication, 2 bands were observed and after 2 round, 2 bands were observed. The bands corresponded to just light and just heavy relative weights. How do these aliens replicate their genetic molecules?

 - d) It is found that in the aliens' genetic molecules, and even in microorganisms in the aliens, the amount of the base designated B always equals the bases C and D ($B=C=D$ and $E=F=G$). The base E always equals F and G.
 - 1) Propose a structure for the polymer

 - 2) If the base B is found to be 8%, what percentage would the base G be expected to be found?

2. Draw the structure of a nucleotide. Be sure to number the carbons of the sugar. Point an arrow to the location on the molecule where the next base (nucleotide) will be added during *in vivo* DNA replication.

3. Describe in absolute detail the process of DNA replication as it occurs in a replication fork. (Use the back of this sheet.)

4. Describe the structure and components of a nucleosome, excluding the presence of the H1.

5. a) Approximately how many nucleotide pairs are in the prokaryote, *E. coli*?
b) Approximately how many nucleotide pairs are in the haploid human genome?
c) Approximately how many nucleotide pairs are in the haploid mouse genome?

6. The template for an mRNA molecule is as follows:
5' AAAAGTTTAATTTCTACGAGCCATGTATTAAGAAT3'
Write the polypeptide this sequence would code for. (Forget about the Shine-Dalgarno issue when answering.)

7. Explain rho-independent termination in detail.

Extra Credit (5 points): Describe post-transcriptional modifications that occur in eukaryotes.