Questions:

1. Assume that the sequence of DNA below is a short protein-encoding gene; the sequences in between the transcription start and stop sites are shown. The entire DNA sequence of the very short gene is:

5' CGCTTATAGAAC**C**CAATCTCTCATAGGC 3'
3' GCGAATATCTTGGGTTAGAGAGTATCCG 5'

iv. What would the resulting mRNA be if the top strand of this DNA molecule were used as a template in transcription? Label the 5′ and 3′ ends of your molecule.

5'GCCUAUGAGAGAUUGGGUUCUAUAAGCG3'

v. What is the full sequence of the protein that would be translated from this RNA? Label the N and C termini of your molecule.

N-met-arg-asp-trp-val-leu-C

vi. What would happen to the encoded protein if the underlined nucleotide **C** were mutated to a **T**?

N-met-arg-asp-C (This creates a premature stop codon resulting in a truncated protein).

2. Drawn below is part of a wild-type gene. The DNA sequence shown encodes the last amino acids of a protein that is normally 380 amino acids long. The **bold** & **underlined** codon indicates the correct reading frame of this gene. The lower strand of the gene is used as the template during the transcription of mRNA from this gene.

...**GCT**AAGTATTGCTCAAGATTAGGATGATAAATAACTGG—3'
...CGATTCATAACGAGTTCTAATCCTACTATTTATTGACC—5'

iii. In the copy of the sequence drawn below, circle one base pair that you could change to make a mutant form of the gene that produces a protein that is now 381 amino acids long. Indicate the identity of one new base pair that could take its place.

You should change the stop codon immediately after the codon for 380ᵗʰ amino acid to get a protein that is 381 amino acids long. Please note that the codon immediately after the first stop codon is also a stop codon.

iv. In the copy of the sequence drawn below, draw a slash between two base pairs where you could add one extra base pair in order to make a single mutant form of the gene that produces a protein that is 373 amino acids long. Indicate the identity of the one new base pair you are adding.

You should add a "T" before the 1st base in the 374ᵗʰ codon so that you get a stop codon.

3. For each of the following types of mutations, state whether they can cause a loss-of-function of the gene product, a gain-of-function of the gene product, either, or neither:

i. Silent: *It changes a codon but does not change the amino acid encoded by that codon neither)*

ii. Missense: *It changes the identity of the amino acid at one position (either)*

iii. Frameshift: *It change that either inserts or deletes a single nucleotide from the coding region of a gene, leading to a change in the reading frame of that gene (usually a loss-of-function)*

iv. Nonsense: *It results in a truncated protein due to a premature stop codon (usually a loss-of-function)*

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