Unit 1 Progress Check: FRQ

1. Read each question carefully. Write your response in the space provided for each part of each question. Answers must be written out in paragraph form. Outlines, bulleted lists, or diagrams alone are not acceptable and will not be scored.

White blood cells called B cells produce proteins that can be used for the treatment of certain illnesses. However, these B cells do not live for very long on their own. To keep the B cells growing for a long time in laboratories, scientists fuse the B cells with cancer cells (fused B-cancer cells) that do grow for a very long time. The particular cancer cells used for the fusion are treated with chemicals that make them unable to produce the nitrogenous bases adenine and guanine, but the B cells with which they are fused do produce these nitrogenous bases. The scientists grow the large fused B-cancer cells in a growth medium that contains necessary nutrients for the cells and includes a source of carbon.

(a) **Describe** the role of carbon in biological systems.

Please respond on separate paper, following directions from your teacher.

(b) The membranes of both B cells and the cancer cells are largely composed of phospholipids. **Explain** how, when the membranes are fused, the polar parts of the phospholipids from one cell will interact with the phospholipids from the other cell and how the nonpolar parts of the phospholipids from one cell will interact with the phospholipids from the other cell.

Please respond on separate paper, following directions from your teacher.

(c) **Make a claim** about the most immediate effect on the fused B-cancer cells if the fused cells are transferred to a growth medium that lacks a source of nitrogen.

Please respond on separate paper, following directions from your teacher.

(d) **Provide reasoning** with evidence based on the composition of biological macromolecules to support your claim.

Please respond on separate paper, following directions from your teacher.

Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

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0	1 ✓

The response indicates that carbon is used to build biological macromolecules such as carbohydrates, proteins, nucleic acids, and lipids.

Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1 ✓

The response indicates that the polar part of the phospholipids from one cell will align or interact with the polar parts of the phospholipids from the other cell, and nonpolar parts of the phospholipids from one cell will align or interact with nonpolar parts of the phospholipids from the other cell.

Part C

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1 ✓

The response indicates that the cells will die OR that they will be unable to synthesize DNA and RNA/nucleic acids/nucleotides and amino acids/polypeptides/proteins.

Part D

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1 ✓

The response indicates that nucleic acids (DNA, RNA, or nucleotides) and amino acids (polypeptides, or proteins) contain nitrogen.

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2. Read each question carefully. Write your response in the space provided for each part of each question. Answers must be written out in paragraph form. Outlines, bulleted lists, or diagrams alone are not acceptable and will not be scored.

Scientists are studying the structure and function of Receptor X, a single-polypeptide protein that is found in the membrane around certain types of cells. Receptor X contains no alpha-helices or beta sheets. A specific molecule outside the cells is recognized and bound by Receptor X. The binding of the molecule to Receptor X causes the cells to have a particular response.

To study the structure and function of Receptor X, the scientists are altering the sequence of small sections of the receptor. Both the normal sequence of a five-amino acid section of Receptor X and an altered sequence that contains two amino acid substitutions are shown in Figure 1.

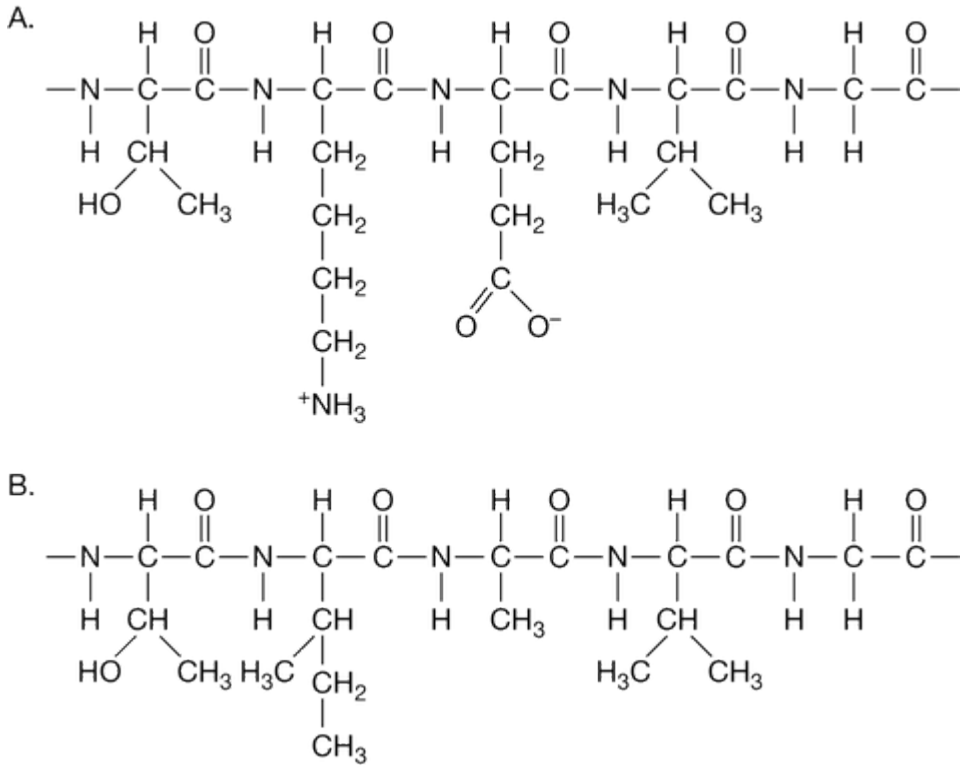

Figure 1. (A) The normal sequence and (B) the altered sequence of a five-amino acid section of Receptor X

(a) **Identify** the process used to form the covalent peptide bonds that join amino acids into a polypeptide.

Please respond on separate paper, following directions from your teacher.

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(b) The change in the amino acid sequence illustrated in Figure 1 caused a change in the shape of Receptor X. Based on the R groups of the original and substituted amino acids, **explain** why Receptor X changed shape.

Please respond on separate paper, following directions from your teacher.

(c) Using the template below that represents the four levels of protein structure, **place** an X on each level that is expected to be altered as a result of the amino acid substitutions shown in Figure 1.

Please respond on separate paper, following directions from your teacher.

(d) **Explain** how the amino acid substitution shown in Figure 1 is most likely to affect the function of Receptor X.

Please respond on separate paper, following directions from your teacher.

Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1 ✓

The response indicates that the process that joins amino acids into a polypeptide is a dehydration synthesis OR a condensation reaction.

Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1 ✓

The response indicates that two amino acids with charged or ionic or hydrophilic R-groups were replaced by two amino acids with uncharged or nonpolar or hydrophobic R-groups.

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Part C

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1 ✓

The response meets both of the criteria below.

- [ ] The response indicates primary structure.
- [ ] The response indicates tertiary structure.

Part D

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1 ✓

The response indicates that because function is determined by shape, the function of receptor X is likely to change OR the structural change might alter the binding of the molecule to receptor X OR the structural change might alter the ability of receptor X to cause a cellular response.