This is a Class 1 exam

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Stage Exam 05

Monday 09MAY2022

Do NOT write in this box. Your MARK will be placed here.

Subject :	Biology
Class :	11S
Teacher :	Christine Khalil
Duration :	1 hour

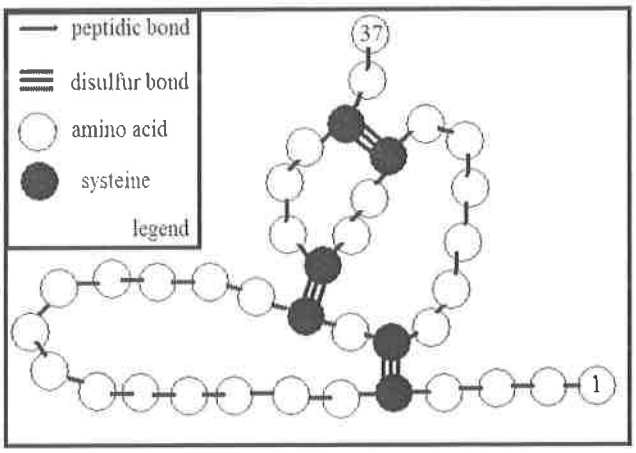
Please write your answers on a separate sheet of paper.

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

Exercise 1 (10 points)

The opposite diagram shows the structure of a molecule found in a cell.



1. Justify that:

a. This molecule is a protein molecule. (1)

b. The structure of this molecule is three-dimensional. (1.5)

The sequence of the first 7 codons of the DNA that codes for this molecule is the following:

1 2 3 4 5 6 7

ACA, CAA, CAT, TAG, TGT, GGC, AAA, …

2. Complete the second strand of this molecule. Justify. (1.5)

A change of the DNA sequence that codes for this protein is done as follows.

1 2 3 4 5 6 7

ACA, CAA, CAT, TAG, GGT, GGC, AAA, …

3. Compare the two sequences of DNA. Draw out the change done on this molecule and its location. (2)

4. Explain the change obtained at the level of the protein molecule concerning its structure and its function. (2)

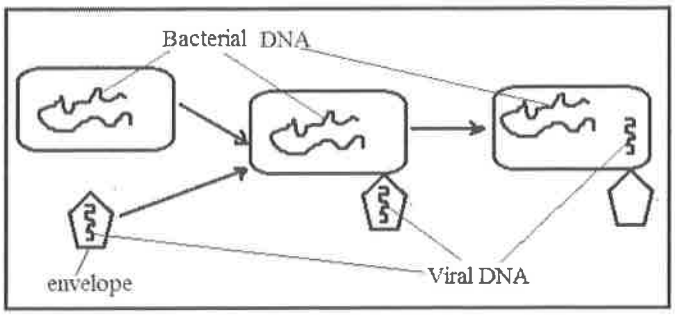
5. Write the chemical equation taking place between 2 consecutive amino acids leading to the formation of a peptide bond. (2)

Exercise 2 (9 points)

The bacterium is a unicellular prokaryotic cell having a single chromosome that is not surrounded by a nuclear membrane. Its chromosome is made up of DNA similar in its structure to the DNA of the eukaryotic cells.

The bacteria are able to receive new DNA molecules that become **functional** soon after their introduction in the cytoplasm of these bacteria.

On the other hand, the virus contains DNA molecules that can be introduced in the cells that come in contact with it. The next document shows the events happening after the contact between a bacterium and a virus.

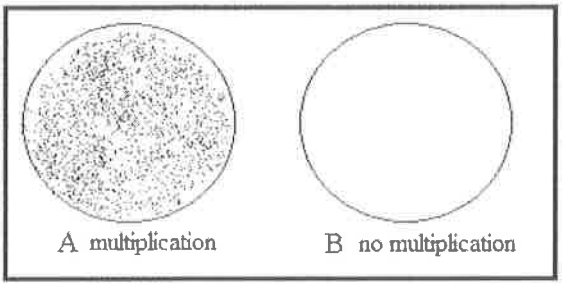


Document 1

1. Describe the events that occur during the contact between the bacterium and the virus. (1.5)

A bacterium has two strains A and B. The strain A is able to digest the lactose in order to use it as a source of energy while the other is not. The culture of bacteria A and B in a medium rich in lactose gives the results given in the document 2.

2. Explain the results obtained in the cultures given in the document 2. (2)



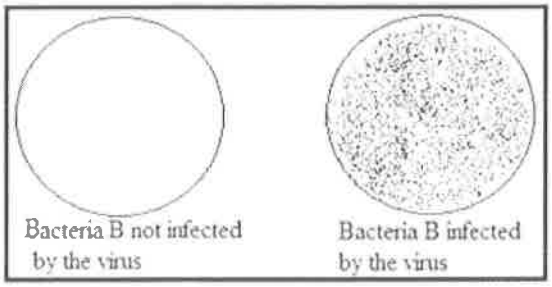
Document 2

We get bacteria B and we infect them with a virus and the same culture is done again in a medium similar to that used in the document 2. The results are shown in the document 3.

3. Interpret the results of this experiment. (1.5)

4. What can be deduced from the results of this experiment? (1)

5. What does the word **functional** (in the given) mean in this context? (1)



Document 3

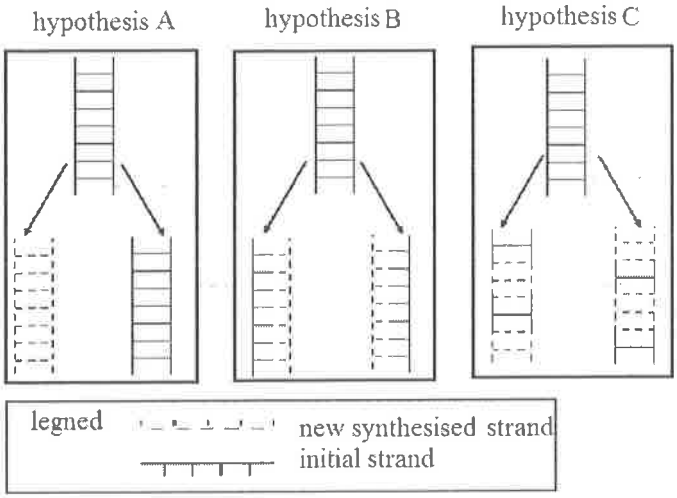
6. Explain why bacteria B infected with the virus are qualified as transgenic. (1)

7. This technique is called transgenesis and leads to the creation of genetically modified organisms. Can you think of another application of this technique that could be beneficial for the worldwide community? (1)

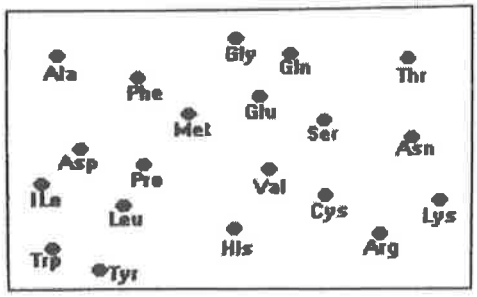
Exercise 3 (16 points)

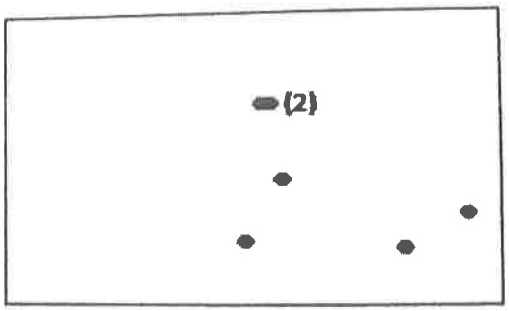
Briefly answer the following questions.

1. How is DNA repaired upon error in replication?
2. A culture of human tissue is being grown in a lab to study mitosis. A solution containing radioactively labelled cytosines was added to the culture in the middle of prophase, and then growth was stopped at the end of telophase. Where would the scientists see radioactively labelled DNA?
3. What is the function of the helicase?
4. DNA polymerase will extend the 5' or the 3' end of the primer?
5. Define origin of replication.
6. Why can bacteria recognize a human gene and then produce a human protein?
7. Why do we have 64 different codons but only 20 different amino acids?
8. A piece of double stranded DNA has 30% A, what will be the % of G?
9. Name each hypothesis represented in the figure below.



10. Name the technique used, and establish the constituents of the chain.





11. What makes DNA replication fast even though all the chromosomes are being replicated at the same time?

12. a. To how many amino acids does this sequence lead? Justify your answer.

TTTAGAGTAGAAACTGCA

b. In reality, this sequence coded to a smaller number of amino acids than expected. Give a reason that explains this observation.

13. What is the major discovery of Griffith? Of Avery and his team?

Answer Key for SE05 11S

Exercise 1 (10 points)

1. a. This molecule is a protein because it is made up of a chain of amino acids. (1)

b. Its structure is three-dimensional because it has disulfur bridges (not peptide bonds) between amino acids located far from each other. The folding of the protein is beyond (more) than alpha helix of beta sheet so the structure of the protein is 3D. (1.5)

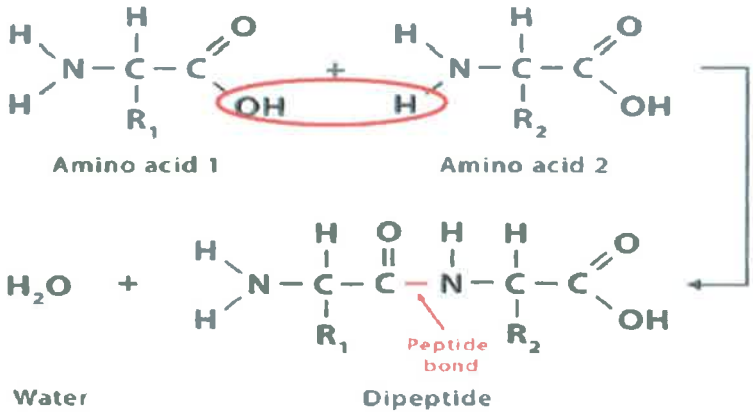
2. TGT, GTT, GTA, ATC, ACA, CCG, TTT, … (1)

Since in the DNA T and A are complementary and C and G are complementary. (0.5)

3. The two sequences have the same sequence of the nucleotides except in the codon 5 the first nucleotide in the first is T while in the second is G. The change is a replacement of T by G on the codon 5. (2)

4. When the codon 5 changes the corresponding amino acid that is a cysteine changes, the disulfur bridge will be lost and it leads to the change in the three dimensional structure then leads to a decrease in the function of the protein. (2)

-



(2)

Exercise 2 (9 points)

1. The virus comes in contact with the bacterium, its DNA is inserted into the bacteria but the envelope stays outside. (1.5)

2. Bacteria A were able to multiply because they are able to release energy from the digestion of the lactose because they are capable of digesting the lactose but with bacteria B, in absence of the digestion of the lactose, the energy is not released so no multiplication. (2)

3. Bacteria B that are not infected with the virus do not develop in the medium containing lactose as in the first experiment, while bacteria B that are infected with the virus become able to

multiply in the medium containing lactose. This means that the insertion of the viral DNA in the bacteria leads to the acquisition of a new trait of digestion of lactose. (1.5)

4. DNA is a carrier of the genetic information. (1)

5. Functional DNA means that DNA fragments or genes will be able to code for the proper protein. (1)

6. Bacteria B received foreign DNA from another species. (1)

7. Production of insulin, growth hormone, interleukin or any suitable idea. (1)

Exercise 3 (16 points)

1. DNA polymerase is capable of proof reading. (1)

2. DNA is replicated in S phase while prophase is part of mitosis. Since all of the DNA that would be present at the end of telophase had already been synthesized in S phase, none of the radioactively labelled cytosines would be incorporated into the DNA of any cells in the culture. (1)

3. It opens and unwinds the DNA double helix by disrupting the hydrogen bonds. (1)

4. 3'. (0.5)

5. Particular site at which DNA replication starts. (1)

6. The basic components of DNA are the same in humans and bacteria, same genetic code. (1)

7. Among these 64, 3 codons are stop codon that will stop the protein synthesis. The 61 remaining codons code for the 20 different amino acids because more than 1 codon can lead to the same amino acid. (1)

8. The percentage of T will also be 30% leaving 40% for both G and C. Since G and C are equally present in the DNA then it will be 20%. (1)

9. A. conservative B. semi-conservative C. Dispersive (1.5)

10. Double chromatography. Glu, Glu, Val, His, Lys, Arg. (2)

11. Many replication bubbles at different loci appear simultaneously. (1)

12. a. 6 amino acids because each 3 nucleotides from a codon and each leads to an amino acid. (1)

b. One of the codon could be a stop codon that stopped the protein synthesis before having 6 amino acids. (1)

13. Griffith discovered the transforming principle that was exchanged between bacteria and qualified as genetic material. While Avery and his team demonstrated that this transforming principle is DNA. (2)