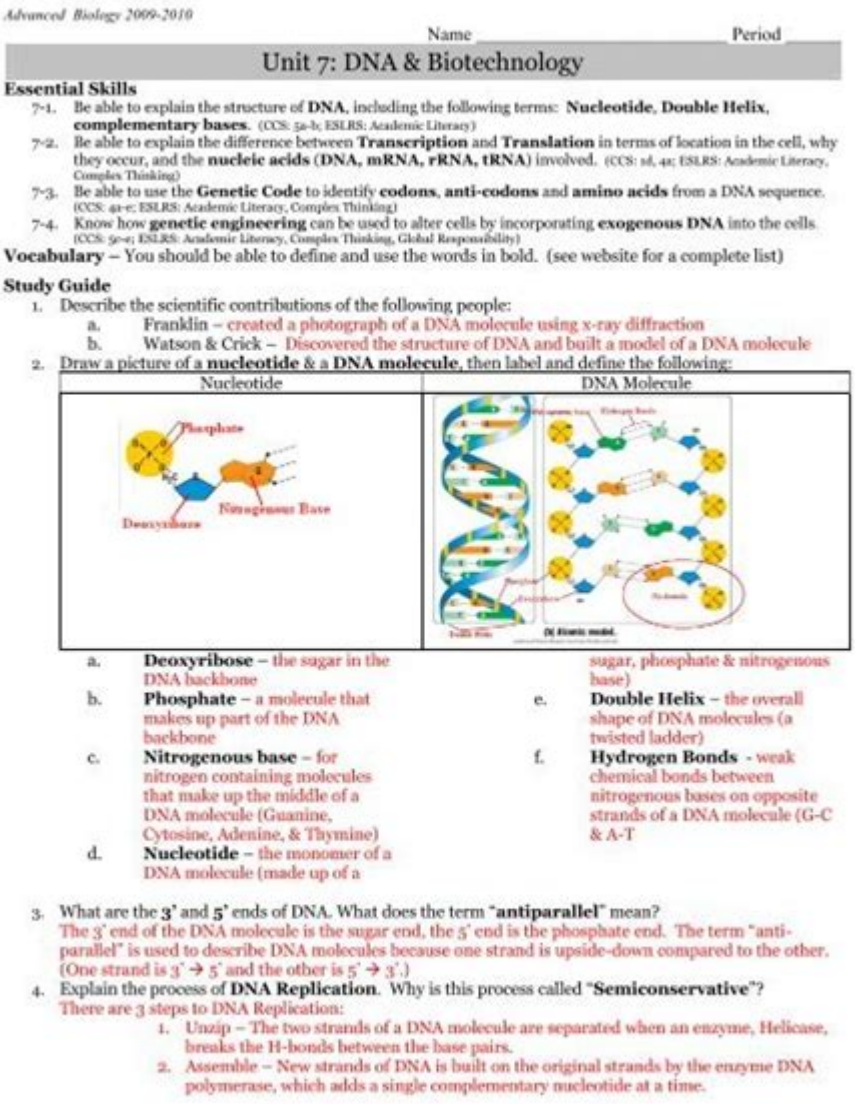
Dna The Double Helix Worksheet Answers



Advanced Biology 2009-2010

Name _____ Period ____

Unit 7: DNA & Biotechnology

Essential Skills

7-1. Be able to explain the structure of **DNA**, including the following terms: **Nucleotide**, **Double Helix**, **complementary bases**. (CCS: 5a-b; ESLRS: Academic Literacy)

7-2. Be able to explain the difference between **Transcription** and **Translation** in terms of location in the cell, why they occur, and the **nucleic acids (DNA, mRNA, rRNA, tRNA)** involved. (CCS: 1d, 4a; ESLRS: Academic Literacy, Complex Thinking)

7-3. Be able to use the **Genetic Code** to identify **codons**, **anti-codons** and **amino acids** from a DNA sequence. (CCS: 4a-e; ESLRS: Academic Literacy, Complex Thinking)

7-4. *Know* how **genetic engineering** can be used to alter cells by incorporating **exogenous DNA** into the cells. (CCS: 5a-e; ESLRS: Academic Literacy, Complex Thinking, Global Responsibility)

Vocabulary – You should be able to define and use the words in bold. (see website for a complete list)

Study Guide

1. Describe the scientific contributions of the following people:
   a. Franklin – created a photograph of a DNA molecule using x-ray diffraction
   b. Watson & Crick – Discovered the structure of DNA and built a model of a DNA molecule
2. Draw a picture of a **nucleotide** & a **DNA molecule**, then label and define the following:

Nucleotide	DNA Molecule
Phosphate Nitrogenous Base Deoxyribose	(b) Kinetic model

   a. **Deoxyribose** – the sugar in the DNA backbone
   b. **Phosphate** – a molecule that makes up part of the DNA backbone
   c. **Nitrogenous base** – for nitrogen containing molecules that make up the middle of a DNA molecule (Guanine, Cytosine, Adenine, & Thymine)
   d. **Nucleotide** – the monomer of a DNA molecule (made up of a sugar, phosphate & nitrogenous base)
   e. **Double Helix** – the overall shape of DNA molecules (a twisted ladder)
   f. **Hydrogen Bonds** - weak chemical bonds between nitrogenous bases on opposite strands of a DNA molecule (G-C & A-T
3. What are the **3'** and **5'** ends of DNA. What does the term "**antiparallel**" mean?
   The 3' end of the DNA molecule is the sugar end, the 5' end is the phosphate end. The term "anti-parallel" is used to describe DNA molecules because one strand is upside-down compared to the other. (One strand is 3' → 5' and the other is 5' → 3'.)
4. Explain the process of **DNA Replication**. Why is this process called "**Semiconservative**"?
   There are 3 steps to DNA Replication:
   1. Unzip – The two strands of a DNA molecule are separated when an enzyme, Helicase, breaks the H-bonds between the base pairs.
   2. Assemble – New strands of DNA is built on the original strands by the enzyme DNA polymerase, which adds a single complementary nucleotide at a time.

DNA the Double Helix Worksheet Answers are crucial for students studying genetics and molecular biology. Understanding the structure and function of DNA is foundational to many fields, including biology, medicine, and forensic science. In this article, we will explore the double helix structure of DNA, the significance of its discovery, and provide comprehensive answers to common worksheet questions related to DNA. This will serve as a valuable resource for students and educators alike.

The Structure of DNA

DNA, or deoxyribonucleic acid, is a molecule that carries the genetic instructions essential for the growth, development, functioning, and reproduction of all known living organisms. The structure of DNA was first described by James Watson and Francis Crick in 1953, a discovery that earned

them the Nobel Prize in Physiology or Medicine in 1962.

The Double Helix Shape

The most defining feature of DNA is its double helix shape. This structure can be described in several key components:

1. Nucleotides: DNA is made up of smaller units called nucleotides, each consisting of three components:
- A phosphate group
- A sugar molecule (deoxyribose)
- A nitrogenous base (adenine, thymine, cytosine, or guanine)

2. Base Pairing: The nitrogenous bases pair specifically: adenine (A) pairs with thymine (T) and cytosine (C) pairs with guanine (G). This complementary base pairing is crucial for DNA replication and function.

3. Antiparallel Strands: The two strands of DNA run in opposite directions, which is referred to as antiparallel orientation. One strand runs in the 5' to 3' direction, while the other runs from 3' to 5'.

4. Major and Minor Grooves: The twisting of the double helix creates spaces known as major and minor grooves, which play a significant role in protein binding and interaction with other molecules.

The Importance of DNA Structure

The double helix structure of DNA is not only aesthetically pleasing but also functionally significant. Here are several reasons why this structure is essential:

- Stability: The double helix is more stable than a single-stranded structure, protecting genetic information from degradation.
- Replication: The complementary base pairing allows for accurate replication of DNA, ensuring that genetic information is passed on during cell division.
- Gene Expression: The structure allows for the regulation of gene expression. Proteins can bind to specific sites on the DNA, influencing which genes are turned on or off.

Applications of DNA Structure in Science

The understanding of DNA’s double helix has led to various applications in scientific research and technology, including:

1. Genetic Engineering: Techniques such as CRISPR rely on manipulating the DNA sequence to achieve desired traits in organisms.
2. Forensics: DNA profiling utilizes variations in DNA sequences to identify individuals in criminal investigations.
3. Medicine: Understanding genetic disorders at the DNA level has paved the way for targeted therapies and personalized medicine.

Common DNA Worksheet Questions and Answers

To help students grasp the concepts associated with DNA, here are some common worksheet questions along with comprehensive answers.

1. What is the primary function of DNA?

Answer: The primary function of DNA is to store and transmit genetic information. It provides the instructions for building proteins, which are essential for the structure and function of cells.

2. Describe the structure of a nucleotide.

Answer: A nucleotide consists of three components:
- A phosphate group
- A deoxyribose sugar
- A nitrogenous base (either adenine, thymine, cytosine, or guanine)

3. Explain the significance of complementary base pairing.

Answer: Complementary base pairing is crucial for DNA replication and transcription. It ensures the accurate copying of genetic information, as each base pairs with its specific partner (A with T, and C with G), allowing for the formation of two identical DNA molecules from one original molecule.

4. What are the roles of the major and minor grooves in DNA?

Answer: The major and minor grooves in DNA provide binding sites for regulatory proteins and enzymes. These grooves facilitate the interaction between DNA and various molecules, influencing processes such as transcription and replication.

5. How does the structure of DNA contribute to its stability?

Answer: The double helix structure contributes to DNA stability through:
- Hydrogen bonds between complementary bases, which hold the two strands together.
- The sugar-phosphate backbone, which protects the genetic code inside the helix.
- The twisting nature of the helix, which minimizes exposure to environmental factors that could damage the DNA.

Educational Resources for DNA Studies

To further aid understanding of DNA and its double helix structure, several resources are available:

- Textbooks: Books like "Molecular Biology of the Cell" by Alberts et al. provide comprehensive coverage of DNA structure and function.
- Online Courses: Platforms like Coursera and Khan Academy offer courses on genetics and molecular biology that include interactive materials.
- YouTube Lectures: Channels like CrashCourse and TED-Ed provide visual explanations of DNA topics, making learning more engaging.

Conclusion

In conclusion, the understanding of DNA as a double helix is foundational to the fields of biology and genetics. By exploring its structure, functions, and implications, students can appreciate the complexity and elegance of this molecule. The answers to common worksheet questions serve as a guide to reinforce learning and promote a deeper understanding of genetic principles. As we continue to uncover the mysteries of DNA, its significance in science and medicine will only grow, making it an ever-important topic for study.

Frequently Asked Questions

What is the structure of DNA as described by the double helix model?

The double helix structure of DNA consists of two long strands that coil around each other, resembling a twisted ladder. The sides of the ladder are made of sugar and phosphate molecules, while the rungs consist of paired nitrogenous bases.

What are the four nitrogenous bases in DNA and how do they pair?

The four nitrogenous bases in DNA are adenine (A), thymine (T), cytosine (C), and guanine (G). Adenine pairs with thymine (A-T), and cytosine pairs with guanine (C-G).

What role does DNA play in genetics?

DNA carries genetic information that dictates the development, functioning, growth, and reproduction of all living organisms. It encodes the instructions for making proteins, which are essential for various biological processes.

How does the double helix structure facilitate DNA replication?

The double helix structure allows the two strands to separate easily during replication. Each strand serves as a template for the formation of a new complementary strand, ensuring that genetic information is accurately copied.

What is the significance of the complementary base pairing in DNA?

Complementary base pairing ensures the accuracy of DNA replication and transcription. It allows for the formation of stable hydrogen bonds between

bases, maintaining the integrity of the genetic code.

What is the function of the sugar-phosphate backbone in DNA?

The sugar-phosphate backbone provides structural support to the DNA molecule. It forms the sides of the double helix and protects the nitrogenous bases, which are crucial for storing genetic information.

How can mutations in DNA affect an organism?

Mutations in DNA can lead to changes in protein synthesis, potentially causing diseases or altering traits. Some mutations may be harmless, while others can disrupt normal biological functions and lead to serious health issues.

What are the differences between DNA and RNA?

DNA is double-stranded and contains the sugar deoxyribose, while RNA is usually single-stranded and contains ribose. Additionally, RNA has uracil (U) instead of thymine (T), which is found in DNA.

What experimental evidence supported the double helix model of DNA?

X-ray diffraction images taken by Rosalind Franklin provided key insights into the helical structure of DNA. Watson and Crick used this data, along with their understanding of base pairing, to propose the double helix model.

How do scientists use DNA worksheets in education?

DNA worksheets are used in educational settings to help students understand the structure, function, and processes involving DNA. They may include diagrams, questions about base pairing, and activities related to DNA replication and transcription.

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2.0%琼脂糖凝胶：适用于较小的DNA分子，如500 bp以下的线性DNA分子。需要注意的是，琼脂糖凝胶浓度的选择还取决于具体的实验目的和条件。因此，在选择琼脂糖凝胶浓度时，需要 …

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DNA分子中两条核苷酸链的整体几何形状为上图所示的双螺旋结构。每个螺旋对应一个核苷酸链，两条链通过腺嘌呤-胸腺嘧啶或鸟嘌呤-胞嘧啶对连接在一起。这些碱基对堆叠在一起，它们 …

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但是，RNA和DNA在组成上的主要差别是：①RNA的糖分子是核糖，DNA的是脱氧核糖，②四种碱基中有一种不同。所以让我们来总结一下他们的物质关系：染色体包含DNA，蛋白质（组 …

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外源DNA准备：提取和纯化含有目的基因的外源DNA，并将其溶解在合适的缓冲液中。授粉与处理：在植物开花期进行人工授粉，授粉后一定时间（如12-24小时），用微量注射器将外 …

转染时，为什么要将PEI加到质粒DNA中混合，而不是相反的？
按照以下体系配制DNA-PEI核酸-转染试剂复合物： 1.对于每孔细胞，使用100 μL无血清培养基稀释2 μg目的DNA，充分混匀成DNA稀释液。

DNA 和 RNA 有什么区别？ - 知乎
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二苯胺检测DNA的原理主要是基于DNA分子中2-脱氧核糖残基在酸性溶液中加热降解后，与二苯胺反应生成蓝色化合物的特性进行鉴定。具体来说，DNA分子中的2-脱氧核糖在酸性条件下会 …

DNA 的结构和功能是什么？ - 知乎
DNA，全称为脱氧核糖核酸（Deoxyribonucleic acid），是生物体内存储遗传信息的分子，是构成生物体的基本遗传物质之一。DNA的结构和功能如下： DNA的结构： 1. 双螺旋结构：DNA分子由两条反 …

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DNA就是遗传信息，存在于染色体上，染色体上有遗传物质的结构和功能单位——基因（gene），基因是决定一定功能产物的DNA序列。这种功能产物主要是蛋白质和RNA。蛋白质和RNA决定了不同生 …

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