Questions related to **DNA** and **RNA** cover topics including the components of DNA and RNA, nitrogenous bases, and base pairs. You may also see questions concerning transcription and translation.

Let’s get started in understanding how DNA and RNA are important on the ATI TEAS.
UNDERSTANDING FUNCTIONALITY

Every living organism has instructions for growth in the form of DNA and RNA. DNA stands for **deoxyribonucleic acid**. RNA stands for **ribonucleic acid**.

RNA comes in many different forms

- mRNA (messenger RNA)
- tRNA (transfer RNA)
- rRNA (ribosomal RNA)

**DNA**, the larger molecule, stores genetic information for the organism as a whole. It contains the code for creating new cells and is essential for the creation of new organisms during reproduction.

**RNA** is smaller. In fact, it is created from the nucleic acids in DNA. Its function is to help in the creation of proteins and amino acids, and it is found in ribosomes. It also acts as a messenger carrying genetic information around a cell and beyond.
UNDERSTANDING CHROMOSOMES, AMINO ACIDS

Chromosomes are strands of DNA and related proteins that reside in the nuclei of living cells. They carry the genetic information needed to create new cells and organisms. Amino acids are the building blocks of organic material. They are produced by RNA as the building materials for proteins, which in turn are the content of cells and cellular organs. Proteins make up enzymes, which carry out the work of cellular life, like metabolic functions. Proteins also make up polymerases, which transcribe and transfer genetic material.

UNDERSTANDING NUCLEIC ACIDS

Complex compounds are present in all organic cells. Nucleic acids are the core units of life. Both DNA and RNA are nucleic acids. A nucleic acid is composed of nucleotides. Nucleotides are nucleosides together with a phosphate group. Nucleosides are sugars (ribose or deoxyribose) combined with either a purine or a pyrimidine.
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UNDERSTANDING NUCLEIC ACIDS

The five nitrogenous bases, adenine (A), guanine (G), cytosine (C), thymine (T), and uracil (U), are needed to make nucleotides. The sequence in which they appear allows genetic information to be stored in DNA and RNA. This information comes in three nucleotide groupings called codons. They are written as three letters, for example CAG, to show which nitrogenous bases they are composed of. With four nitrogenous bases, this leads to a possible 64 combinations of three letters in different orders.

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UNDERSTANDING PURINES AND PYRIMIDINES

Purine bases, adenine and guanine, are bicyclic. Pyrimidine bases, cytosine and thymine, are monocyclic. Uracil is a form of thymine that replaces this pyrimidine in RNA. They form hydrogen bonds in a complementary fashion, meaning that a purine always pairs with a pyrimidine.

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UNDERSTANDING BASE PAIRS

Purines and pyrimidines have different structures that allow them to form hydrogen bonds, crucial for the formation of DNA. One purine, guanine, bonds with a pyrimidine, cytosine. This is one of the base pairs discovered by Watson and Crick. The other is adenine and thymine. These base pairs are held together by hydrogen bonds. Cytosine bonds with guanine using three hydrogen bonds, while adenine and thymine require only two hydrogen bonds. These bonds connect the double helix of DNA. These codons contain instruction for building amino acids, necessary for building organic structures.

Important Tip
A and T are connected: Think of At Home Unit
• U can replace T in RNA

C and G are connected: Think of CGI

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UNDERSTANDING DNA AND RNA

There are many minor differences between DNA and RNA. The major difference is their function. DNA stores and transmits genetic information for use on a cellular and organism level. RNA transcribes and translates the genetic information into physical structures. DNA relies on four nitrogenous bases – (A) adenine, (G) guanine, (C) cytosine, and (T) thymine – whereas in RNA, (T) is replaced by (U) uracil. DNA has two strands of nucleic acid, referred to as a double helix due to its physical shape. This doubling of genetic information plays a crucial role in genetic diversity during reproduction. RNA has a single strand.

DNA comes in different forms.
Mitochondrial DNA, for example, is only inherited from the mother. RNA also has different forms, such as
• mRNA (messenger RNA)
• tRNA (transfer RNA)
• rRNA (ribosomal RNA)
UNDERSTANDING TRANSCRIPTION

DNA contains all the genetic information necessary to create living cells and organisms. **Transcription** is the process through which this genetic information is copied to make RNA. RNA polymerase, an enzyme created from a strand of RNA, binds with a DNA sequence during the initiation phase. This binding loosens the hydrogen bonds holding the double helix together. The bound section elongates with the addition of nucleotides. Proteins called **transcription factors** provide the needed material. The process terminates with a genetic duplicate strand of mRNA being released into the cell.

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UNDERSTANDING TRANSLATION

At some point, genes must do their work. They contain the instructions for building amino acids, proteins, and larger cellular bodies. **Translation** is the process through which that information is put into reality. Translation means making a protein. The first step in translation is transcription. After the cell’s genetic code is transcribed to an mRNA molecule, the information within is unlocked in the **ribosomes**. Ribosomes are situated in the cytoplasm of a cell or in the endoplasmic reticulum and are the cell’s factories for producing proteins. The mRNA carries the three base pair codons that dictate the type of amino acid needed for a particular protein. A strand of mRNA pairs with a strand of tRNA, carrying complementary codons, during translation. The three-phase process of initiation, elongation, and termination mirrors transcription, but it produces an amino acid.

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