

The nucleus of a cell is densely filled with stew of macromolecules called **chromatin**. Chromatin condenses into long, thin strings called **chromosomes**.

One class of the macromolecules contained in chromatin are **nucleic acids**.

The nucleic acid monomer is called a **nucleotide**.

Each nucleotide is formed to three parts:

- A **sugar** molecule.
- A negatively charged **ion** called **phosphate**.
- A compound called a **nucleobase**.

Polymerization is achieved as the sugar of one nucleotide bonds to the phosphate of the next nucleotide in the chain, which forms a sugar-phosphate backbone for the nucleic acid strand.

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**DNA**-Deoxyribonucleic Acid is a substance contained in all cell.

**Sugar molecule** - deoxyribose

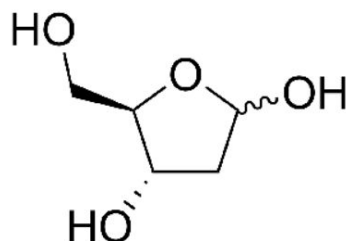
**Nucleobases**-adenine, thymine, cytosine, guanine.

Deoxyribose is a monosaccharide(Monosaccharides mostly have the chemical formula  $C_x(H_2O)_y$ ,although deoxyribose does not obey this pattern.) that occurs in every nucleotide.

Deoxyribose centers around a five-carbon ring, whose carbon atoms are numbered clockwise as 1', 2', 3', 4', 5'. Also like ribose, deoxyribose is a chiral molecule.

The two different molecules are called D-deoxyribose and L-deoxyribose.

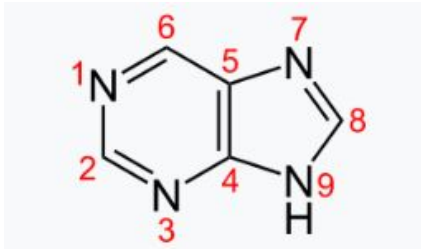
D-deoxyribose is the molecule appearing in DNS, whereas its mirror image L-deoxyribose does not occur naturally.



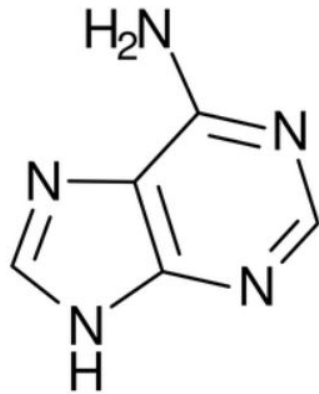
### **Adenine(A):**

Adenine is a **purine** that forms one of the four bases of both RNA and DNA. Adenine is complementary to thymine in DNA and also bonds with uracil in RNA.(Purine is a heterocyclic aromatic organic compound that consists of pyrimidine ring fused to an imidazole ring).

Purine-

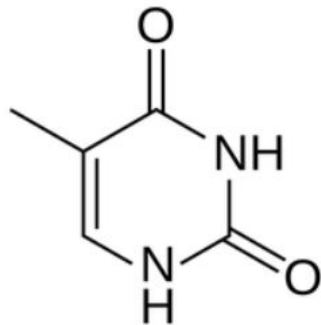


Adenine-



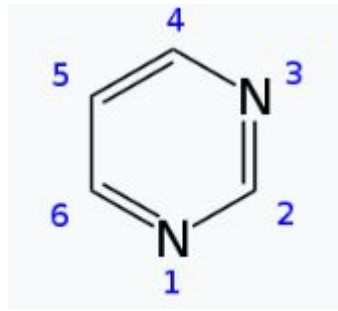
**Thymine(T):**

Thymine is a pyrimidine that forms one of the bases of DNA and is complementary to adenine. In RNA, thymine is replaced everywhere with uracil.

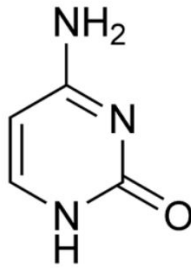


**Cytosine(C):**

Cytosine is a **pyrimidine** that forms one of the four bases of both RNA and DNA. (Pyrimidine is an aromatic heterocyclic organic compound similar to pyridine).



Pyridine-

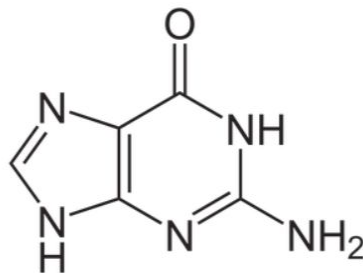


Cytosine-

### **Guanine(G):**

Guanine is a purine that forms one of the bases of both RNA and DNA. It is complementary to cytosine in DNA and also bonds with cytosine during RNA folding. The chemical structure of guanine is shown below:

Guanine-



### **Problem**

A [string](#) is simply an ordered collection of symbols selected from some [alphabet](#) and formed into a word; the [length](#) of a string is the number of symbols that it contains.

An example of a length 21 [DNA string](#) (whose alphabet contains the symbols 'A', 'C', 'G', and 'T') is "ATGCTTCAGAAAGGTCTTACG."

**Given:** A DNA string *S* of length at most 1000 nt.

**Return:** Four integers (separated by spaces) counting the respective number of times that the symbols 'A', 'C', 'G', and 'T' occur in *S*

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