

Section 1: DNA Structure and Nucleotides

Learning Objective: Identify the three components of a nucleotide and describe how complementary base pairing forms the DNA double helix.

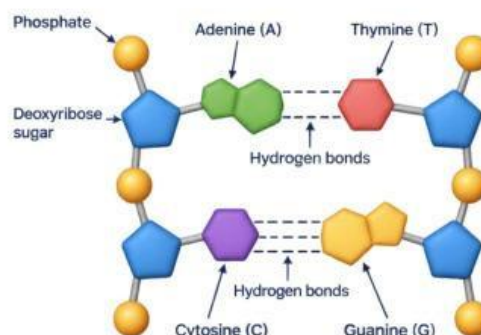
Key Vocabulary: nucleotide, phosphate group, deoxyribose sugar, nitrogenous base, adenine (A), thymine (T), cytosine (C), guanine (G), complementary pairing.

Deoxyribonucleic acid (DNA) is the molecule that carries genetic instructions in all living things. It is shaped like a twisted ladder called a **double helix**. The upright sides of the ladder are made of alternating sugar and phosphate molecules. The rungs of the ladder consist of pairs of nitrogen-containing chemical units called **nitrogenous bases**.

The building block of DNA is the **nucleotide**. Each individual nucleotide has three bonded components: one phosphate group, one five-carbon deoxyribose sugar, and one nitrogenous base.



Base-Pairing Rule: In DNA, Adenine always pairs with Thymine (A:T) using two hydrogen bonds. Cytosine always pairs with Guanine (C:G) using three hydrogen bonds.



1. Examine the diagram of a nucleotide above. Complete the following tasks:

a) Label the three distinct chemical groups

Purple Circular Group

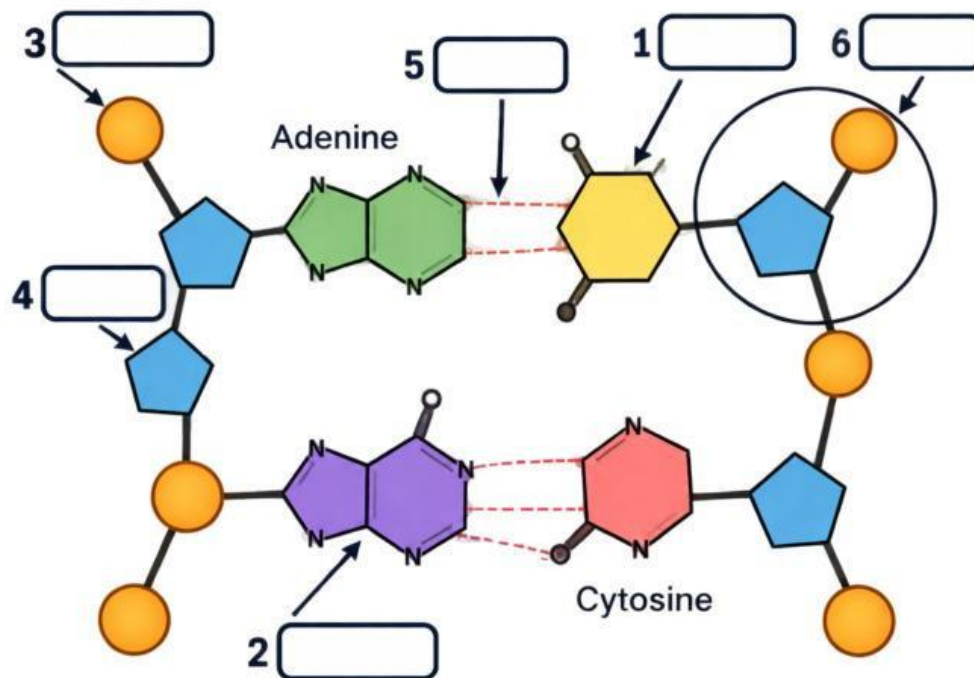
Green Pentagon

Blue Rectangle

b) Which two components create the outer "backbone" of the DNA strand?

c) What two things make up the rungs of the DNA ladder?

Drag and Drop: hydrogen bond • nucleotide • phosphate • deoxyribose sugar • thymine • guanine



d) Look closely at the nucleotide enclosed by circle #6 in the DNA diagram above. Something essential is missing from this nucleotide structure. What is it?

2. Use the base-pairing rules (A pairs with T; C pairs with G) to write the matching complementary base sequence for each given DNA single strand.

Given Strand A: T - A - C - G - G - T -
A - C - T

.....

Given Strand B: G - C - C - A - T - G -
A - A - C

.....

Given Strand C: A - A - T - C - G - C -
T - T - A

.....

a) A double-stranded DNA sample contains 30% adenine (A). Which option gives the expected percentages of thymine (T), cytosine (C), and guanine (G)?

A. T = 30%, C = 30%, G = 10%

B. T = 20%, C = 25%, G = 25%

C. T = 30%, C = 20%, G = 20%

D. T = 25%, C = 22.5%, G = 22.5%