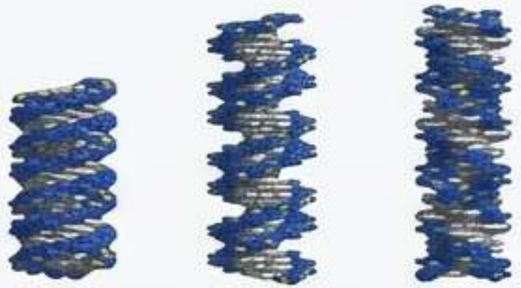
Question 1 | DNA Helix Forms

Which statement about DNA helix forms is correct?

A. A-DNA is the most important biological form.
B. **B-DNA is a right-handed helix with ~10 bp per turn.**
C. Z-DNA is a left-handed mirror copy of B-DNA.
D. Z-DNA is artificial and does not exist in nature.
E. B-DNA is more condensed than A-DNA.



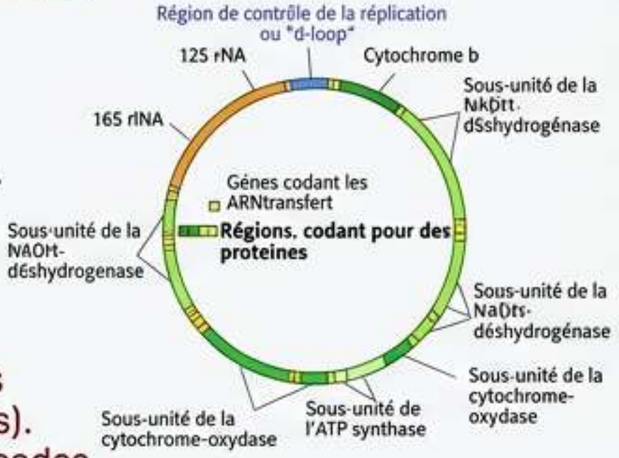
Teacher Mode: B-DNA is the standard physiological form (Watson & Crick), a right-handed helix with 10 base pairs per turn. A-DNA is dehydrated/compact. nnoxaharrot. Z-DNA is left-handed and 'zigzagged', found in GC-rich regions.

Mnemonic: B = Biological (Standard). Z = Zigzag (Left-handed).

Question 2 | Mitochondrial DNA

Characteristics of Mitochondrial DNA:

A. It is linear.
B. Codes for mRNA but not tRNA.
C. Codes for all mitochondrial proteins.
D. Transmitted by both parents.
E. **Circular, double-stranded, genes without introns.**



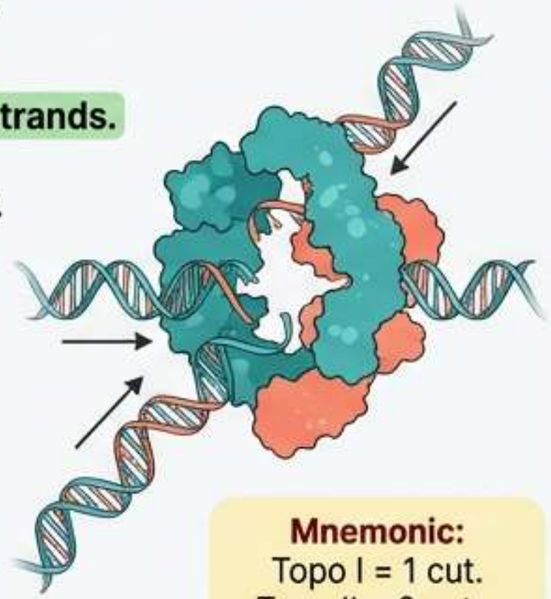
Teacher Mode: Like bacteria, mtDNA is **Circular** and highly efficient (No Introns). Inheritance is **exclusively Maternal**. It codes for only 13 proteins; the nucleus codes the rest.

Mnemonic: Mito Mom Circle (Maternal, Circular, No Introns).

Question 3 | Topoisomerases

Role and mechanism of Topoisomerases:

A. **Some topoisomerases cut both DNA strands.**
B. Cannot modify DNA supercoiling.
C. Types I and II differ by subunit number.
D. They create knots in DNA.
E. Topoisomerase I cuts both strands.



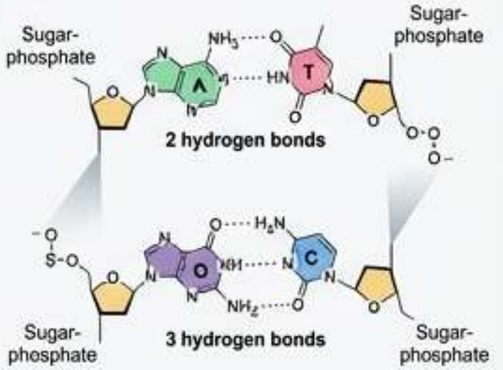
Teacher Mode: Topoisomerases manage supercoiling stress. **Type I** cuts one strand coritin one strand (relaxation). **Type II** (e.g., Gyrase) cuts **BOTH** strands to manage tangles.

Mnemonic:
Topo I = 1 cut.
Topo II = 2 cuts.

Question 4 | Complementarity

The two DNA chains are complementary because:

A. **Bases bind one-to-one between chains.**
B. Sugar-phosphate interactions.
C. Purine always matches Purine.
D. Adenine pairs with Uracil.
E. Cytosine pairs with Adenine.

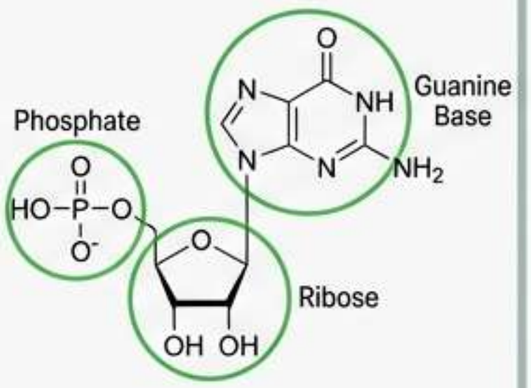


Teacher Mode: Driven by Hydrogen bonding in the helix core. **Purines (A, G)** pair with **Pyrimidines (T, C)**. A pairs with T (2 bonds). G pairs with C (3 bonds).

Mnemonic:
Pure As Gold (Purines).
Cut The Pie (Pyrimidines).

Question 5 | Nomenclature

Regarding nucleotide nomenclature:
A. Adenine is a purine nucleotide.
B. Thymidylic acid is a ribose nucleotide.
C. Guanylate is a purine nucleotide.
D. Deoxycytidylic acid is an RNA nucleotide.
E. Uridine contains a phosphate.



Teacher Mode: Suffixes matter!
Guanylate = Base + Sugar + Phosphate (Nucleotide).
Adenine is just a Base. Uridine is a Nucleoside (No Phosphate).

Mnemonic: -osine/-idine = Side (Sugar only). -ylate/-ylic = Tide (Phosphate).

Question 6 | Chargaff's Rules

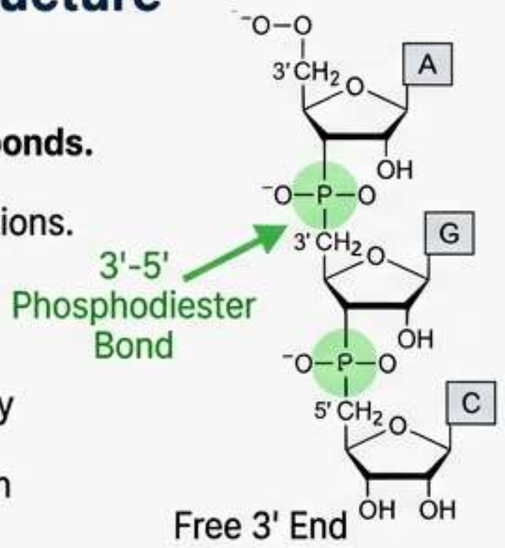
In a DNA molecule:
A. Cytosine quantity equals Thymine.
B. Adenine quantity equals Thymine.
C. Thymine quantity equals Uracil.
D. Quantities of all four bases are different.

Teacher Mode:
Chargaff's Rule: In dsDNA, every A pairs with T, and G with C.
Therefore, molar concentration [A] = [T] and [G] = [C]. Purines = Pyrimidines.

Mnemonic: Chargaff's Balance: A=T and G=C.

Question 7 | Backbone Structure

In nucleic acid structure:
A. Strands have 3'->5' polarity.
B. Nucleotides link via phosphodiester bonds.
C. Free 3' end contains a phosphate.
D. Each nucleotide has two free acid functions.
E. Base attaches to sugar via ester bond.

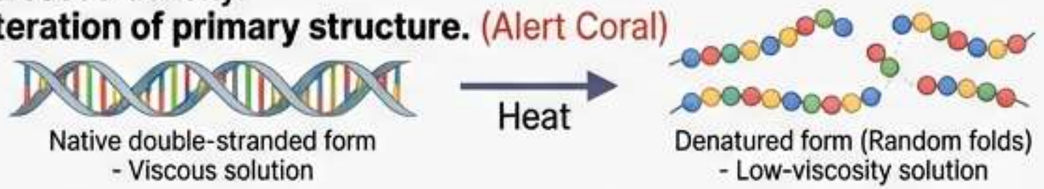


Teacher Mode: DNA is a polymer linked by **3'-5' phosphodiester bonds.** The 3' end always has a free **–OH** group. Bases attach via **N-Glycosidic** bonds.

Mnemonic: Phosphodiester connects the P-eople. 3' is Free (OH).

Question 8 | Denaturation

Consequences of thermal denaturation (Find the FALSE statement):
A. Dissociation of two strands.
B. Increased absorbance at 260nm.
C. Decreased viscosity.
D. Increased density.
E. Alteration of primary structure. (Alert Coral)



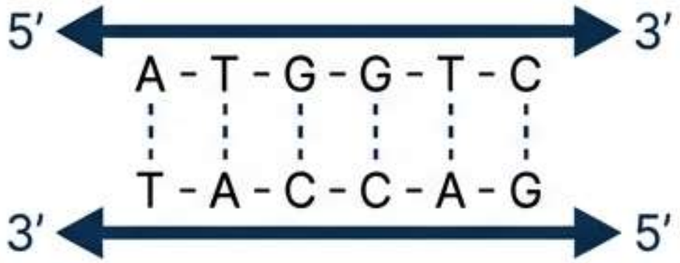
Teacher Mode: Denaturation breaks weak **Hydrogen bonds** (strand separation), but NEVER breaks the phosphodiester bonds. The **Primary Structure (Sequence)** remains intact.

Mnemonic: Heat hurts H-bonds. The Skeleton (Sequence) stays!

Question 10 | Complementary Sequence

What is the complementary strand for: 5′ ATGGTC 3′ ?

A. 3′ TACCAG 5′
B. 5′ TACCAG 3′
C. 5′ CACCAT 3′
D. 5′ TACCAT 3′
E. 3′ TACCAT 5′

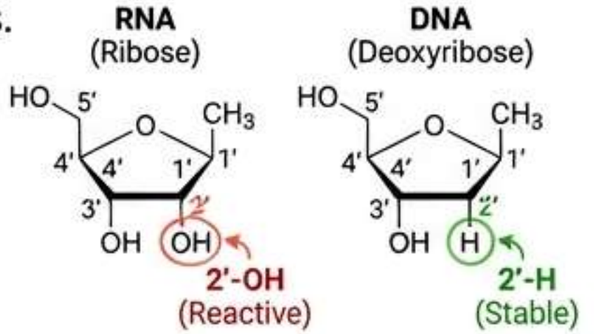


Teacher Mode: DNA is **Antiparallel**.
1. Flip Direction: 5′->3′ becomes 3′<-5′.
2. Swap Bases: A->T, G->C.
Result: 3′ T A C C A G 5′.

Mnemonic: The 'Flip & Swap'. Always check the ENDS (5′ / 3′) first!

Question 12 | DNA vs RNA

Nucleic Acid properties (Find the **FALSE** statement):
A. Formed by phosphodiester bonds.
B. Support genetic information.
C. Control protein synthesis.
D. Two classes: DNA and RNA.
E. dsDNA and RNA are both hydrolyzed by NaOH.

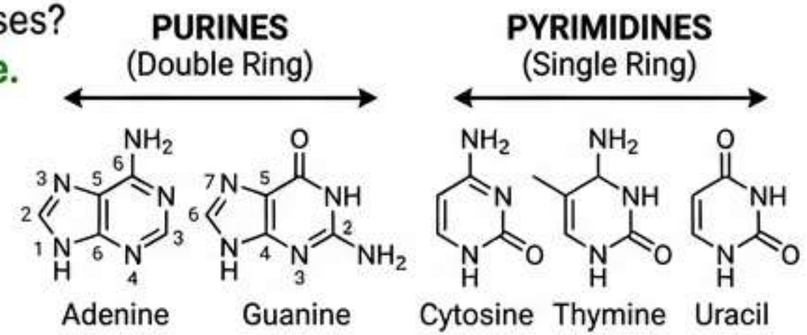


Teacher Mode: RNA has a **2′-OH** group that attacks the backbone in alkaline (NaOH) conditions, destroying it. DNA has a 2′-2′-H, making it resistant to base hydrolysis.

Mnemonic: DNA is Durable. RNA is Reactive (destroyed by Base).

Question 14 | Purines

Which are the Purine bases?
A. Adenine and Guanine.
B. Cytosine.
C. Uracil.
D. Thymine.
E. Pseudouridine.

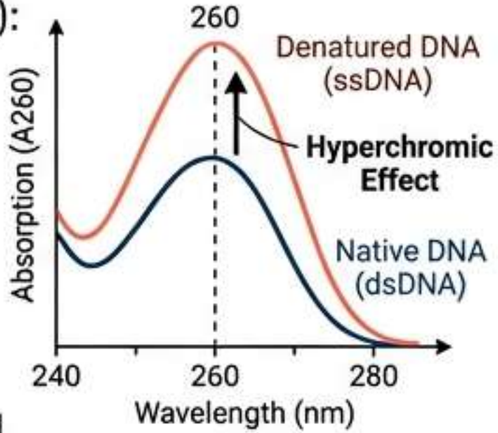


Teacher Mode: Nitrogenous bases families:
Purines: Two rings (Hexagon + Pentagon). Members: Adenine & Guanine.
Pyrimidines: One ring. Members: Cytosine, Thymine, Uracil.

Mnemonic: PUre As Gold (Purines = A & G).

Question 15 | UV Absorption

DNA Properties (Find the **FALSE** statement):
A. Max absorption at 260nm.
B. Single-strand absorbs more than double-strand.
C. Denaturation breaks hydrogen bonds.
D. Tm is temp where 50% is denatured.
E. DNA absorbs significantly MORE than free bases.



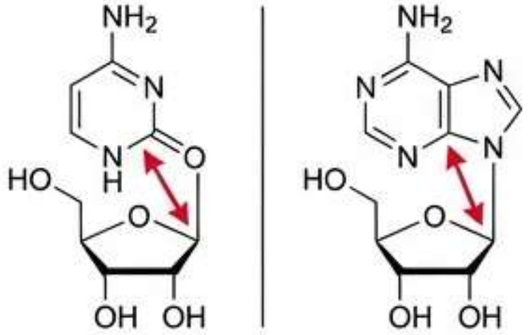
Teacher Mode: Hypochromic Effect: Stacked bases in the double helix 'hide' from UV light. Intact DNA absorbs **LESS** than free bases. Denaturation increases absorption.

Mnemonic: Stacked = Shaded (Double Helix absorbs LESS).

Question 16 | Glycosidic Bonds

A nucleoside is composed of:

A. Pyrimidine linked to pentose via N1-C1'.
B. Purine linked via N1-C1'.
C. Pyrimidine linked via N9-C1'.
D. Purine linked via N9-C5'.
E. Pyrimidine linked via N1-C5'.



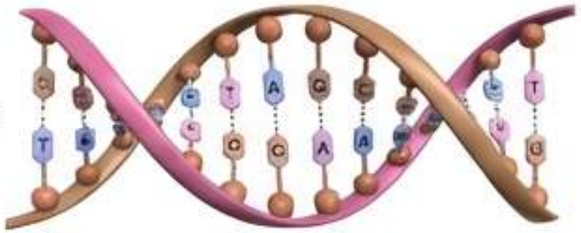
Teacher Mode: The N-Glycosidic bond connects Base to **C1'** of sugar.
Pyrimidines (Small Ring): Connect via **N1.**
Purines (Big Ring): Connect via **N9**.

Mnemonic: Pyrimidines = Small Name (N1). Purines = Big Name (N9).

Question 18 | Watson-Crick Model

Regarding DNA structure:

A. Bicatenary molecule of two chains.
B. Right helix, 10.5 bp/turn, covalent bonds between strands.
C. Left helix, 10.5 bp/turn.



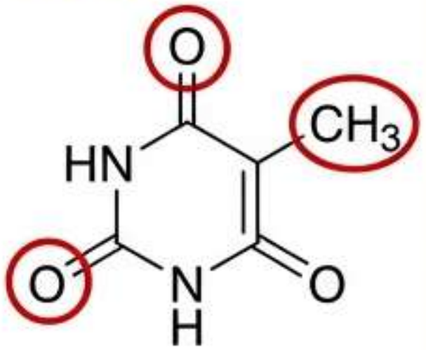
Teacher Mode: DNA is bicatenary (double-stranded).
Option B is wrong: Strands are linked by **Hydrogen bonds**, not covalent.
Option C is wrong: Watson-Crick DNA is a **Right**-handed helix.

Mnemonic: Bicatenary = Bi (Two) + Chain.

Question 25 | Base Structure

Nitrogenous Base Structure:

A. Guanine has 4 Nitrogen atoms.
B. Uracil is methylated Thymine.
C. Thymine possesses two C=O functions.
D. Cytosine has a C=O on C4.



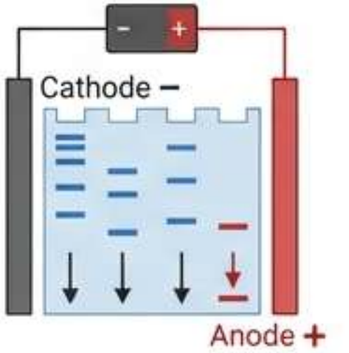
Teacher Mode:
Thymine features: Two Keto (C=O) groups (at C2 and C4) AND a **Methyl** group (at C5).
Correction: Uracil is *demethylated* Thymine. Guanine has 5 Nitrogens.

Mnemonic: Thymine has Two Tones (C=O) and a Tail (Methyl).

Question 31 | Physical Properties

Physico-chemical properties:

A. DNA settles at bottom in centrifugation.
B. ssDNA is more viscous than dsDNA.
C. Positive charge at physiological pH.
D. Acidic character; migrates to Anode (+).
E. Soluble in alcohol.



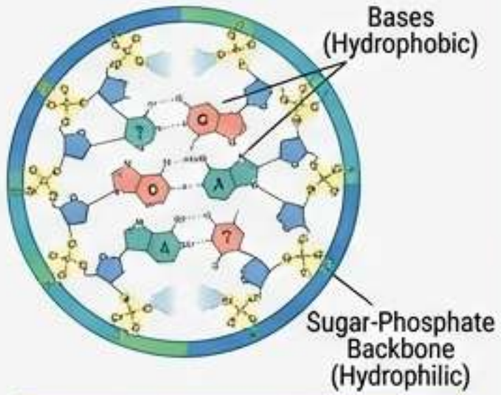
Teacher Mode:
DNA is an **Acid** (Deoxyribonucleic Acid). Phosphate groups are negative at pH 7. In electrophoresis, Negatives migrate to the **Positive Anode**. DNA precipitates in alcohol.

Mnemonic: Run to Red. (DNA runs to the + Anode)

Question 38 | DNA Hydrophobicity

Regarding DNA Structure (Find the FALSE statement):

A. Molecules formed of 2 antiparallel chains.
B. Nitrogenous bases face the exterior.
C. Phosphate forms 3'-5' bridge.
D. Deoxyribose and Phosphates are on the outside.



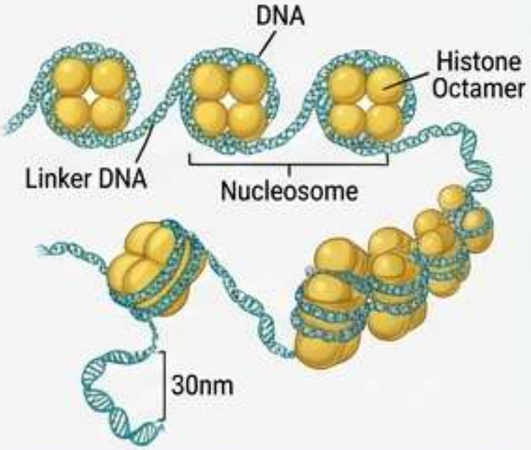
Teacher Mode: Structure is driven by hydrophobicity. Bases are **hydrophobic**, so they **hide INSIDE**. The Sugar-Phosphate backbone is **hydrophilic**, so it faces the **OUTSIDE**.

Mnemonic:
Bases are Shy (Inside).
Phosphates Fly (Outside).

Question 53 | The Nucleosome

The Nucleosome:

A. Is the basic unit of a chromosome.
B. Consists of DNA, RNA, and protein.
C. DNA makes one single turn.
D. Specific to prokaryotes.
E. Histones are rich in acidic amino acids.



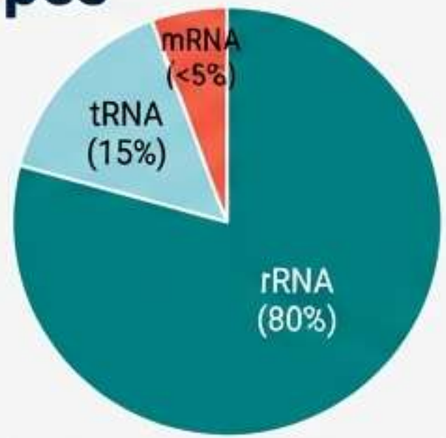
Teacher Mode: The **Nucleosome** is the packing unit of Eukaryotic chromatin. DNA wraps ~1.65 times around **8 Histone proteins**. Histones are **Basic** (+) to attract **Acidil Acidic** (-) DNA.

Mnemonic: Opposites Attract:
(+) Histones hug (-) DNA.

Concept Review | RNA Types

Review: What are the 3 major RNA types and their abundances?

1. **rRNA** (Ribosomal)
2. **tRNA** (Transfer)
3. **mRNA** (Messenger)

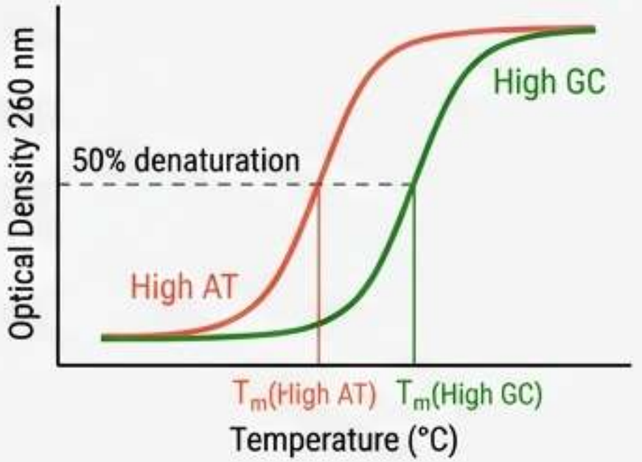


Teacher Mode:
rRNA (80%): Structural factory (Ribosome).
tRNA (15%): Transports Amino Acids (Cloverleaf).
mRNA (<5%): Carries the code. Short lifespan.

Mnemonic: rRNA is Really abundant (80%).
mRNA is Mini (<5%).

Concept Review | Melting Temp (Tm)

Review: What determines the T_m of DNA?
Answer: GC Content & Length.



Teacher Mode: Tm is the temp where 50% of DNA denatures.
GC Content: G-C pairs have **3** Hydrogen Bonds (harder to break than A-T's 2 bonds).
Length: Longer molecules = more bonds = Higher Tm.

Mnemonic:
G-C = Greater Connection
(3 bonds = Higher Heat)