

Practice Test 03 — Answer Key

Module 7: Genetics (DNA, RNA, Protein Synthesis)

Part A: Multiple Choice

1. **C** — DNA (deoxyribonucleic acid) carries the genetic instructions.
2. **B** — The four DNA bases are Adenine, Thymine, Guanine, and Cytosine.
3. **C** — In DNA, Adenine pairs with Thymine (A–T).
4. **C** — The backbone is made of alternating sugar (deoxyribose) and phosphate groups.
5. **B** — Each new DNA molecule keeps one original strand and adds one newly built strand.
6. **C** — Helicase unwinds and unzips the double helix.
7. **B** — The Central Dogma: DNA → RNA → Protein.
8. **C** — Transcription is the process of copying DNA into mRNA.
9. **C** — In eukaryotes, transcription occurs in the nucleus.
10. **D** — RNA uses Uracil (U) instead of Thymine (T).
11. **B** — DNA template 3'–TAC GGA–5' → mRNA 5'–AUG CCU–3' (complement with U replacing T).
12. **C** — Translation builds a polypeptide (protein) using the mRNA code at the ribosome.
13. **C** — Translation takes place at the ribosome (in the cytoplasm).
14. **B** — A codon is a three-nucleotide sequence on mRNA coding for one amino acid.
15. **C** — tRNA brings the correct amino acid to the ribosome during translation.
16. **C** — A silent mutation changes the DNA but not the amino acid (due to redundancy in the genetic code).
17. **C** — Frameshift mutations shift the entire reading frame, changing every codon downstream.

Part B: Fill in the Blank

1. **Deoxyribose; Ribose**
2. **DNA Polymerase**

3. Transcription

4. Start codon

5. Amino acids

Part C: Short Answer

1. DNA vs RNA — Three Structural Differences:

- DNA is double-stranded; RNA is single-stranded.
- DNA contains deoxyribose sugar; RNA contains ribose sugar.
- DNA uses thymine (T); RNA uses uracil (U).

2. Roles in Protein Synthesis:

- **mRNA** (messenger RNA): Carries the genetic code from the DNA in the nucleus to the ribosome in the cytoplasm.
- **tRNA** (transfer RNA): Reads the mRNA codons and delivers the matching amino acid to the ribosome.
- **rRNA** (ribosomal RNA): Forms the structural and catalytic core of the ribosome, where translation takes place.

3. Sequence Conversion:

- DNA coding strand: ATG–CCC–GAT
- mRNA (same as coding strand, with U replacing T): **AUG–CCC–GAU**
- Amino acids: **Met (Start) — Pro — Asp**

4. Frameshift vs Substitution: A frameshift mutation (insertion or deletion) shifts the entire reading frame of the mRNA. Every codon after the mutation is misread, likely changing every amino acid in the protein. A substitution only affects one codon and may even be silent (no change to the amino acid). Because frameshift mutations corrupt the entire downstream message, they are usually far more damaging.