



Attempt questions first; check the separate key afterward. Use labelled diagrams where asked. Give scientific reasons; answer key covers closed questions.

A. Very short answers - 1 mark each

1. Name the enzyme joining DNA fragments.
2. State the direction of new DNA-strand synthesis.
3. Name the usual initiation codon.
4. Name the three stop codons.
5. Which enzyme transcribes most protein-coding genes in eukaryotes?
6. Name the inducer of the lac operon at the textbook level.
7. How many histone molecules form a nucleosome core?
8. Which DNA base pairs with guanine?

B. Short answers / practice - 2 marks each

9. Describe Griffith's transformation experiment.
10. Explain Avery, MacLeod and McCarty's evidence for DNA.
11. Describe Hershey-Chase experimental design and conclusion.
12. Explain why DNA is a stable genetic material compared with RNA.
13. Describe Watson-Crick DNA structure with dimensions.
14. Explain DNA packaging in prokaryotes and eukaryotes.
15. Describe Meselson-Stahl evidence for semiconservative replication.
16. Compare leading and lagging strand synthesis.
17. Explain a transcription unit: promoter, structural gene and terminator.
18. Distinguish template and coding strands.
19. Describe capping, tailing and splicing of eukaryotic transcripts.
20. Explain genetic-code degeneracy, universality and unambiguity.

C. Application / reasoning - 3 marks each

21. A double-stranded DNA has 20% adenine. Find thymine, guanine and cytosine percentages.
22. A DNA segment has 100 base pairs, 40 of them A-T. Find hydrogen bonds.
23. Find approximate length of a 1000-base-pair B-DNA segment using 0.34 nm/bp.
24. Write RNA transcribed from template 3'-TACGGA-5'.
25. A coding region specifies 100 amino acids plus one stop codon. Find minimum coding nucleotides.
26. Describe tRNA structure and aminoacylation.
27. Explain initiation, elongation and termination of translation.
28. Describe the lac operon in the absence and presence of lactose.
29. State goals and major outcomes of the Human Genome Project.
30. Explain the significance of rice-genome sequencing.
31. Explain DNA polymorphism as a basis of DNA fingerprinting.

D. Extended practice - 5 marks each

32. Describe evidence establishing DNA as genetic material and its semiconservative replication.
33. Draw and explain DNA replication, including discontinuous synthesis.
34. Trace gene expression from DNA to a processed transcript to protein.
35. Explain lac-operon regulation and compare it with DNA-fingerprinting applications.

ANSWER KEY - Numerical / closed questions

- 1) DNA ligase. 2) 5'→3'. 3) AUG. 4) UAA, UAG, UGA. 5) RNA polymerase II. 6) Lactose; allolactose is the direct inducer. 7) Eight. 8) Cytosine. 21) T20%, G30%, C30%. 22) 260. 23) 340 nm. 24) 5'-AUGCCU-3'. 25) 303.