

Molecular Basis of Inheritance — CBSE Pattern Test 1

Class 12 Biology · 90 minutes · 40 marks · Sections A–D with answer key · Narayan Gurukul Academy

Test 1 — CBSE Pattern (90 minutes, 40 marks)

Class 12 Biology · Molecular Basis of Inheritance · Narayan Gurukul Academy (ClassApna)

General Instructions: (1) This paper has four sections — Section A (1×10), Section B (2×4), Section C (3×4) and Section D (5×2) — total 40 marks. Time allowed: 90 minutes.
(2) All questions are compulsory. No overall choice is given; internal choice, where allowed, is clearly marked.
(3) For MCQ questions choose the single correct option; for VSA answers write a single line.
(4) Take $g = 10 \text{ m/s}^2$. All symbols carry their usual meaning. Use of a calculator is not permitted.

Section A — MCQ & VSA ($10 \times 1 = 10$ marks)

1. In a DNA molecule, adenine pairs with
 - (A) thymine
 - (B) guanine
 - (C) cytosine
 - (D) uracil
2. The distance between two consecutive base pairs in DNA is
 - (A) 0.34 nm
 - (B) 3.4 nm
 - (C) 34 nm
 - (D) 0.034 nm
3. The enzyme that synthesises RNA is
 - (A) RNA polymerase
 - (B) DNA polymerase
 - (C) ligase
 - (D) helicase
4. The start codon is
 - (A) AUG
 - (B) UAA
 - (C) UAG
 - (D) UGA
5. The lac operon is induced by
 - (A) lactose
 - (B) glucose
 - (C) galactose
 - (D) sucrose
6. Semi-conservative replication was proved by
 - (A) Meselson and Stahl
 - (B) Watson and Crick
 - (C) Avery
 - (D) Griffith
7. The Human Genome Project was completed in
 - (A) 2003

- (B) 1990
 - (C) 2000
 - (D) 2010
8. The number of stop codons is
- (A) three
 - (B) two
 - (C) one
 - (D) four
9. What is a codon?
10. What is the central dogma?

Section B — Short Answer I ($4 \times 2 = 8$ marks)

11. Differentiate between a nucleotide and a nucleoside.
12. Which enzyme joins DNA fragments?
13. Name the inducer of the lac operon.
14. What is satellite DNA?

Section C — Short Answer II ($4 \times 3 = 12$ marks)

15. Describe the Watson-Crick model of DNA.
16. Why is DNA a better hereditary material than RNA?
17. Describe the salient features of the genetic code.
18. What are the applications of DNA fingerprinting?

Section D — Long Answers ($2 \times 5 = 10$ marks)

19. (a) Describe the process of DNA replication. (b) Describe the Meselson-Stahl experiment.
20. (a) Explain the lac operon and its regulation. (b) Describe the Human Genome Project and its salient features.

Answer Key (Marking Scheme)

- Q1 — (A) thymine. Q2 — (A) 0.34 nm. Q3 — (A) RNA polymerase. Q4 — (A) AUG. Q5 — (A) lactose. Q6 — (A) Meselson and Stahl. Q7 — (A) 2003. Q8 — (A) three.
- Q9 — A codon is a triplet of bases on mRNA that codes for an amino acid.
- Q10 — The central dogma is $\text{DNA} \rightarrow \text{RNA} \rightarrow \text{protein}$.
- Q11 — A nucleoside = base + sugar; a nucleotide = base + sugar + phosphate.
- Q12 — DNA ligase.
- Q13 — Lactose (allolactose).
- Q14 — Highly repetitive DNA that shows polymorphism and is used in DNA fingerprinting.
- Q15 — Two antiparallel strands form a double helix; $\text{A}=\text{T}$ and $\text{G}\equiv\text{C}$; one turn = 3.4 nm with 10 bp.
- Q16 — DNA is more stable and has thymine instead of uracil; it can be replicated and repaired faithfully.
- Q17 — Triplet, degenerate, non-overlapping, comma-less, unambiguous, nearly universal; AUG start; three stop codons.
- Q18 — Forensics, paternity testing and identification of individuals.

Q19 — (a) Helicase unwinds, polymerase synthesises, ligase joins; semi-conservative. (b) ^{15}N -labelled DNA showed intermediate and light bands, proving semi-conservative replication.

Q20 — (a) The repressor (i gene) blocks the operator; lactose induces the operon to make beta-galactosidase. (b) HGP (1990–2003) sequenced the genome; ~3.1 billion bp, ~30,000 genes.