CLASS XII – BIOLOGY (Code 044)

SET – 4

Section – A (1×16 = 16 Marks)

Q1–12: MCQs (Concept + Numerical Based)

1. In a bisporic embryo sac, the number of nuclei at maturity will be:
A. 4
B. 6
C. 8
D. 16

2. If crossing over occurs between two genes located 20 cM apart, recombination frequency will be approximately:
A. 10%
B. 20%
C. 40%
D. 50%

3. During spermatogenesis, one primary spermatocyte produces:
A. 2 sperms
B. 4 sperms
C. 8 sperms
D. 16 sperms

4. If DNA contains 30% adenine, percentage of cytosine will be:
A. 20%
B. 30%
C. 40%
D. 10%

5. Which factor does NOT disturb Hardy–Weinberg equilibrium?
A. Mutation
B. Migration
C. Random mating
D. Genetic drift

6. A population with age distribution: Pre-reproductive 50%, Reproductive 30%, Post-reproductive 20% indicates:
A. Declining population
B. Stable population

C. Expanding population
D. Zero population growth

7. Stop codons are recognized by:
A. tRNA
B. rRNA
C. Release factors
D. Aminoacyl synthetase

8. If an mRNA has 600 nucleotides (excluding stop codon), number of amino acids formed will be:
A. 200
B. 199
C. 201
D. 600

9. In RNA interference, dsRNA is cleaved by:
A. Ligase
B. Dicer
C. Helicase
D. Polymerase

10. BOD of polluted river water is 18 mg/L. After treatment it becomes 3 mg/L. This indicates:
A. Increased pollution
B. Reduced organic load
C. Increased eutrophication
D. Oxygen depletion

11. Cry genes used in Bt cotton primarily target:
A. Dipterans
B. Coleopterans
C. Lepidopterans
D. Nematodes

12. If allele frequency p = 0.6, q = 0.4, heterozygote frequency under H-W equilibrium is:
A. 0.24
B. 0.36
C. 0.48
D. 0.16

Q13–16: Assertion–Reason (Very Conceptual)

13.
Assertion: Multiple alleles increase genotypic combinations.
Reason: More than two alternative forms of gene exist in population.

14.
Assertion: Secondary immune response is faster.
Reason: Memory cells are formed during primary response.

15.
Assertion: In aquatic ecosystem, biomass pyramid is inverted.
Reason: Phytoplanktons have high turnover rate.

16.
Assertion: Ti plasmid is disarmed before using in rDNA technology.
Reason: Tumour-causing genes are removed.

(Options same as previous sets)

Section – B (2×5 = 10 Marks)

17. Attempt either A or B

A. Explain outbreeding depression and inbreeding depression.
OR
B. Why are IUDs considered effective reversible contraceptives?

18. Explain Meselson and Stahl experiment and its significance.

19. A population of 10,000 individuals has 3600 homozygous recessive individuals.
Calculate:
(i) Frequency of recessive allele
(ii) Frequency of heterozygotes

20. Attempt either A or B

A. Describe essential features of cloning vector.
OR
B. Explain principle of gel electrophoresis.

21. Attempt either A or B

A. Calculate energy available to tertiary consumers if producers fix 1,000,000 kcal.
OR
B. Differentiate between exponential and logistic growth with equations.

Section – C (3×7 = 21 Marks)

22. Advanced Genetics Numerical

In humans, polydactyly (P) is dominant over normal fingers (p). A heterozygous male marries a normal female.

(i) Probability of affected child
(ii) Probability of unaffected daughter
(iii) If 4 children are born, probability exactly 2 affected

23. Linkage Problem (Topper Level)

Two genes A and B are 10 map units apart. A heterozygous female (AB/ab) is test crossed with ab/ab male.

(i) Parental types percentage
(ii) Recombinant types percentage
(iii) Expected phenotypic ratio

24. Explain mechanism of double fertilisation with diagram and mention ploidy at each stage.

25. Explain process of transcription in prokaryotes with diagram and mention role of sigma factor.

26. Describe ecological succession in xerarch habitat.

27. Explain humoral and cell-mediated immunity with flow chart.

28. Population Growth Numerical

Initial population = 200
Growth rate (r) = 0.3 per year

Calculate population after 2 years using exponential growth equation.

Section – D (4×2 = 8 Marks)

29. Case Study – ABO + Rh Incompatibility

Mother: A negative
Father: B positive

A. Possible blood groups of child
B. What is erythroblastosis fetalis?
C. Why does it affect second child more?
D. Preventive measure

30. Case Study – rDNA Technology

A scientist inserts gene into tetracycline resistance gene of pBR322.

A. What is insertional inactivation?
B. How are recombinants identified?
C. Response to ampicillin & tetracycline?
D. Why is ori essential?

Section – E (5×3 = 15 Marks)

31.

A. Explain DNA replication in detail with enzymes involved.
B. Why is lagging strand synthesis discontinuous?

OR

Explain translation process with detailed steps and role of ribosome.

32.

A. Explain Agrobacterium-mediated gene transfer.
B. Describe restriction enzymes and sticky ends.
C. Explain RNAi mechanism in nematode resistance.

OR

Explain PCR with labelled diagram and applications.

33.

Justify with examples:

A. Gause's Competitive Exclusion Principle
B. Resource partitioning
C. Keystone species
D. 10% Law
E. Latitudinal gradient of biodiversity

OR

Explain ecological pyramids with limitations and thermodynamic laws.