SET 6 – FULL ANSWER KEY

Section – A Answers (1×16 = 16 Marks)

1. **C** – 8 nuclei
2. **D** – Fallopian tube
3. **A** – DNA polymerase I
4. **B** – Repressor protein
5. **C** – Hardy–Weinberg equilibrium
6. **B** – Three nucleotides
7. **A** – 0.64
    - $p^2 = (0.8)^2 = 0.64$
8. **B** – Gene silencing
9. **C** – Helper T cells
10. **B** – Suspended solids
11. **C** – Increase in toxin concentration
12. **C** – Thermophilic bacteria
13. **A**
14. **A**
15. **A**
16. **A**

Section – B Answers (2×5 = 10 Marks)

17A. Pollen–Pistil Interaction

• Recognition between pollen and stigma
• Ensures compatible pollen germination
• Prevents self-pollination in self-incompatible plants
• Controls fertilisation

OR

Barrier methods:
• Condoms
• Diaphragm
• Cervical cap

Advantages:
• No hormonal side effects
• Protection from STDs

18. Semi-Conservative Replication

Supported by Meselson and Stahl experiment.

After one generation in N^{14} medium → Hybrid DNA observed.

After two generations → Hybrid + Light DNA bands.

Conclusion: Each daughter DNA has one parental strand.

19. Hardy–Weinberg Numerical

Total population = 5000
Recessive individuals = 125

$q^2 = 125 / 5000$
$= 0.025$

$q = \sqrt{0.025} \approx 0.158$

$p = 1 - 0.158$
≈ 0.842

Carrier frequency = 2pq

$= 2 \times 0.842 \times 0.158$
≈ 0.266

≈ **26.6% carriers**

20A. Cloning Vector Features

• Origin of replication
• Selectable marker
• Unique restriction site

• Small size
• High copy number

OR

PCR:

Steps:

1. Denaturation
2. Annealing
3. Extension

Taq polymerase withstands high temperature.

21A. Energy Transfer

Producers = 100,000 kcal

Primary = 10,000 kcal
Secondary = 1,000 kcal

Section – C Answers (3×7 = 21 Marks)

22. Fertilisation & Implantation

• Ovulation releases oocyte
• Fertilisation in ampulla
• Zygote → Cleavage → Morula → Blastocyst
• Implantation in endometrium

23. Dihybrid Cross (AaBb × AaBb)

Phenotypic ratio = **9:3:3:1**

Probability of aabb = 1/16

Probability of at least one dominant trait =
= 15/16

24. Adaptive Radiation

Evolution of multiple species from common ancestor.

Example: Darwin's finches of Galapagos Islands.

25. Recombinant DNA Technology

Steps:
• Isolation
• Restriction digestion
• Ligation
• Transformation
• Selection

26. Secondary Treatment

• Aeration tank
• Flocs formation
• Activated sludge
• BOD reduction
• Anaerobic sludge digestion

27. Primary vs Secondary Response

Primary → Slow, low antibody
Secondary → Rapid, high antibody due to memory cells

28. Exponential Growth & Doubling Time

Equation:
$Nt = N_0 e^{(rt)}$

Doubling time formula:

$Td = 0.693 / r$

Section – D Answers (4×2 = 8 Marks)

29. Haemophilia Case

Woman genotype = X^HX^h

Cross with normal man (X^HY)

Probability haemophilic son = 1/4

Carrier daughter = 1/4

Males affected more because single X chromosome.

30. Eutrophication Case

Process: Eutrophication

BOD = Oxygen required by microbes

High BOD → Oxygen depletion → Fish death

Prevention:
• Reduce fertiliser use
• Proper sewage treatment

Section – E Answers (5×3 = 15 Marks)

31. Transcription in Prokaryotes

• Initiation (Sigma factor binds promoter)
• Elongation
• Termination

32. Ti Plasmid & RNAi

Ti plasmid transfers gene into plant genome

Restriction enzymes cut DNA

RNAi blocks mRNA → Prevents pest survival

33. Ecology

• Competitive exclusion → Gause
• Resource partitioning → Warblers
• Keystone species → Sea star
• 10% law → Lindeman
• Succession → Gradual species replacement