

SET 3 – FULL ANSWER KEY

Section – A Answers (1×16 = 16 Marks)

1. **B** – Chalazal end
2. **A** – Zona pellucida proteins
3. **B** – One parental & one new strand
4. **D** – lacI
5. **C** – Genetic drift
6. **C** – Stop signal
7. **A** – 0.09
 - $p = 0.7$
 - $q = 1 - 0.7 = 0.3$
 - $aa = q^2 = 0.09$
8. **B** – Creates pores in midgut epithelium
9. **C** – Fungi
10. **B** – Specific palindromic sequences
11. **C** – Both A and B
12. **A** – Coral reefs
13. **A**
14. **A**
15. **C**
16. **A**

Section – B Answers (2×5 = 10 Marks)

17A. Microsporogenesis

- Occurs in anther
- Microspore mother cell (2n) undergoes meiosis
- Forms tetrad of haploid microspores
- Each develops into pollen grain

OR

Condoms provide:

- Prevent sperm entry (contraception)
- Prevent STDs (HIV, Syphilis)

18. Lac Operon

Components:

lacI, Promoter (P), Operator (O), Structural genes (lacZ, lacY, lacA).

In absence of lactose → Repressor binds operator → No transcription.

In presence → Allolactose inactivates repressor → Transcription occurs.

19. Stabilizing vs Directional Selection

Stabilizing

Directional

Favors intermediate

Favors one extreme

Reduces variation

Shifts mean value

Example: Birth weight

Example: Industrial melanism

20A. Cloning Vector Features

- Origin of replication (ori)
- Selectable marker
- Multiple cloning site
- Small size

OR

Insertional inactivation preferred because:

- Clear identification of recombinants
- More accurate than antibiotic resistance screening

21A. Energy Pyramid

Producers = 10,000 kcal

Primary consumers = 1000 kcal

Secondary = 100 kcal

Tertiary = 10 kcal

OR

Pyramid of energy always upright because energy decreases at each trophic level due to heat loss.

Section – C Answers (3×7 = 21 Marks)

22. Oogenesis

- Oogonia (2n)
- Primary oocyte (arrested in Prophase I)
- Secondary oocyte (arrested in Metaphase II)
- Completion after fertilisation

Hormones involved: FSH, LH, Estrogen, Progesterone

23. Widow's Peak Cross

Man = WwEe

Woman = wwEE

Cross:

WwEe × wwEE

Gametes: WE, We, wE, we × we

Phenotypic ratio = 1:1:1:1

Straight hairline & free earlobe = wE

Probability = **1/4**

24. Divergent Evolution

Common ancestor → Different species due to environmental differences.

Example: Forelimbs of mammals.

Homologous organs: Same origin, different function.

25. PCR

Steps:

1. Denaturation
2. Annealing
3. Extension

Taq polymerase works at 72°C and is heat resistant.

26. Eutrophication

Excess nutrients → Algal bloom → Oxygen depletion → Fish death.

27. Primary vs Secondary Response

Primary → Slow, low antibody level

Secondary → Rapid, high antibody level (memory cells)

28. Exponential Growth

Formula:

$$N_t = N_0 e^{(rt)}$$

Given:

$$N_0 = 200$$

$$r = 0.3$$

$$t = 2$$

$$N_t = 200 e^{(0.6)}$$

$$e^{0.6} \approx 1.82$$

$$N_t \approx 200 \times 1.82 = \mathbf{364 \text{ individuals (approx.)}}$$

Section – D Answers (4×2 = 8 Marks)

29. ABO Blood Group

Father = AB (IAIB)

Mother = O (ii)

Children = IAi (A) or IBi (B)

AB group = Universal recipient (no antibodies).

Inheritance = Multiple allelism & codominance.

30. Bt Cotton Resistance

Resistance develops due to natural selection of resistant insects.

Refuge strategy = Plant non-Bt crops nearby.

Cry toxin creates pores in insect gut.

Gene = cry1Ac

Section – E Answers (5×3 = 15 Marks)

31. Transcription in Eukaryotes

Initiation → RNA polymerase II

Elongation

Termination

Post-transcriptional modifications:

- Capping
- Tailing
- Splicing

32. Agrobacterium & RNAi

Ti plasmid transfers gene into plant genome.

Restriction enzymes cut at palindromic sites.

RNAi blocks mRNA translation.

33. Ecology Justification

- Competitive exclusion → Paramecium experiment
- Resource partitioning → Warblers
- Keystone species → Pisaster
- 10% law → Lindeman
- Tropics higher diversity → Stable climate + high productivity