# Bangalore Sahodaya Schools Complex Association Pre-Board Examination I (2024-2025)

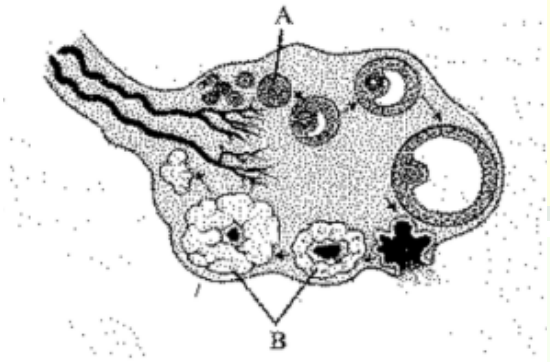
## Class 12 Biology (Code - 044) – Set - 2

**Duration: 3 Hours**

**Maximum Marks: 70**

## Section - A (1 Mark)

**1. The figure shows a section of the human ovary. Select the option which gives the correct identification of either A or B with the function / characteristic feature.**




A. B– corpus luteum – secretes progesterone.
B. A – Tertiary follicle – forms Graafian follicle
C. B – corpus albicans - degenerates
D. A – primary follicle – it is in the growth phase of primary oocyte.
**Ans**: A. B– corpus luteum – secretes progesterone.

**2. A diploid male angiospermic plant is crossed with tetraploid female plant, endosperm in seed will be**

A. Haploid
B. Triploid
C. tetraploid
D. pentaploid
**Ans**: D. pentaploid

BioSmartNotes

**3. A double-stranded DNA having 100,000 bp will have a length of**

A. 10,000 nm
B. 101 nm
C. 3.4 10 $nm^4$
D. 200,000 nm
**Ans**: C. 3.4 10 $nm^4$

**4. Ringworm is caused by**
A. Trichophyton
B. Wuchereria
C. Ascaris
D. Trichoderma
**Ans**: A. Trichophyton

**5. The first husband of Asha had ABO blood type A, and their child had type O. She married, and her second husband had ABO blood type B, and their child had type AB. What is the ABO genotype of Asha, and also name her blood type.**
A. ii – Blood type O
B. $I^Bi$ – Blood type B
C. $I^AI^B$ – Blood type AB
D. $I^Ai$ – Blood type A
**Ans**: D. $I^Ai$ – Blood type A

**6. Biopiracy is**
A. Exploitation of bioresources
B. Patenting bioresources of others
C. Use of bioresources without authorization
D. Both B and C.
**Ans**: D. Both B and C.

**7. Choose the correct statement.**
A. Birds have ZZ–ZW sex determination, where females are ZZ and males are Zw.
B. Worker bees in the bee colony are haploid.
C. Drosophila and grasshoppers show male heterogamy.
D. Grasshopper has 2 ‘x’ chromosomes along with autosomes in males, while Drosophila has 2 ‘x’ chromosomes with autosomes in females.
**Ans**: C. Drosophila and grasshoppers show male heterogamy.

BioSmartNotes

**8. The coding strand of DNA is 5' AATTCAAATTAGG 3'. What is the sequence of mRNA?**
A. 3' TTAAGTTTAATCC 5'
B. 5' AAUUCAAAUUAGG 3'
C. 3' AAUUCAAAUUAGG5'
D. 5'TTAAGTTTAATCC 3'
**Ans**: B. 5' AAUUCAAAUUAGG 3'

**9. ‘Clot buster’ is used for removing clots from blood vessels of patients who have undergone myocardial infarction, leading to heart attack. It is obtained from**

A. Bacteria
B. Virus
C. Slime mould
D. Yeast
**Ans**: A. Bacteria

**10. In the development history of mammalian heart, it is observed that it passes through a two-chambered fish-like heart, three three-chambered frog-like hearts, and finally a four-chambered stage. To which hypothesis can this above-cited statement be approximated?**
A. Hardy–Weinberg law
C. Darwin's Natural Selection
B. Lamarck's principle
D. Biogenetic law
**Ans**: D. Biogenetic law

**11. Identify the DNA segment which is not a palindromic sequence.**
A. 5' - GGATCC - 3'
3' - GGTACC - 5'
B. 5' - CCCGGG - 3'
3' - GGGCCC - 5'
C. 5' - GAATTC - 3'
3' - GGGCCC - 5'
D. 5' - GCGGCCGC - 3'
3' - GGCCGGCG - 5'
**Ans**: A. 5' - GGATCC - 3'
3' - GGTACC - 5'

**12. Select the correct statement from the following:**
A. Methanobacterium is an aerobic bacterium found in rumen of cattle.
B. Biogas, commonly called as gober gas, is pure methane.
C. Activated sludge sediment in settlement tanks of sewage treatment plants is a rich source of aerobic bacteria.
D. Biogas is produced by the activity of aerobic bacteria on animal waste.

**Ans**: C. Activated sludge sediment in settlement tanks of sewage treatment plants is a rich source of aerobic bacteria.

***Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:***

a) Both A and R are true, and R is the correct explanation of A.
b) Both A and R are true, and R is not the correct explanation of A.
c) A is true, but R is false.
d) A is false, but R is true.

**13. Assertion(A): In some species of Asteraceae and Poaceae, seeds are formed without fertilization.**
**Reason (R): Formation of fruit without fertilization leads to parthenocarpy.**
**Ans**: b) Both A and R are true, and R is not the correct explanation of A.

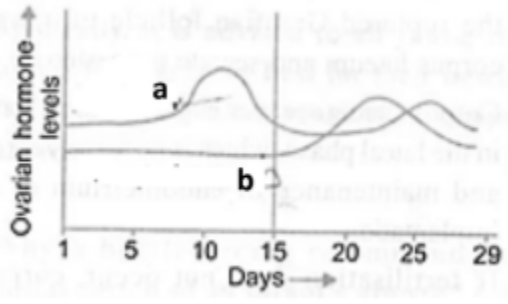
**14. Assertion (A): Gene flow increases genetic variations.**
**Reason (R): The random introduction of new alleles into recipient population and their removal from the donor population affects allele frequency.**
**Ans**: b) Both A and R are true, and R is not the correct explanation of A.

**15. Assertion (A): Nucleopolyhedrovirus is used as a biocontrol agent.**
**Reason (R): It kills insects and pests.**
**Ans**: a) Both A and R are true, and R is the correct explanation of A.

**16. Assertion (A): Phenylketonuria is a recessive hereditary disease caused by body's failure to oxidise an amino acid phenylalanine to tyrosine, because of a defective enzyme.**
**Reason (R): It results in the presence of phenylalanine in urine.**
**Ans**: a) Both A and R are true, and R is the correct explanation of A.

## Section – B (2 Marks)

**17. Attempt either option A or B.**
**A**



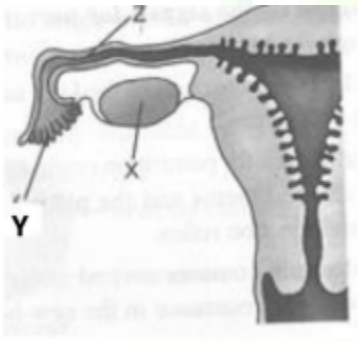

**(i) Identify the ovarian hormones a and b in the above figure. Mention the source of the above hormones.**
**(ii) Name the uterine events that take place according to hormonal levels on: 6 -14 days, 15th day, and 16 -25 days.**

**Ans**:

- (a)
  - (i)
    - a – Estrogen – secreted by follicle cells of the ovary.
    - b – Progesterone- secreted by the corpus luteum of the ovary.
  - (ii)
    - 6- 14 days – follicular phase, endometrium proliferates, estrogen levels reach the peak-trigger LH surge.
    - 15-day - ovulation due to LH surge.
    - 16 – 25 days – development of corpus luteum secretion of progesterone to further increase and maintain endometrium thickness, helping the implantation of the embryo.

**OR**

**B.**




**(i) Identify 'Y' and 'Z' in the above figure and give their functions.**

**(ii) Name the gamete cells that would be present in 'X' if taken from a newborn baby, and it is taken from an adolescent female.**

**Ans**:

- (i)
  - Y- fimbriae – help to collect the ovum after ovulation.
  - Z – Ampullary – isthmus junction – site of fertilization.
- (ii)
  - X – Primary oocytes in newborn.
  - Secondary oocytes in adolescents.

BiosmartNotes

**18. Attempt either option A or B.**

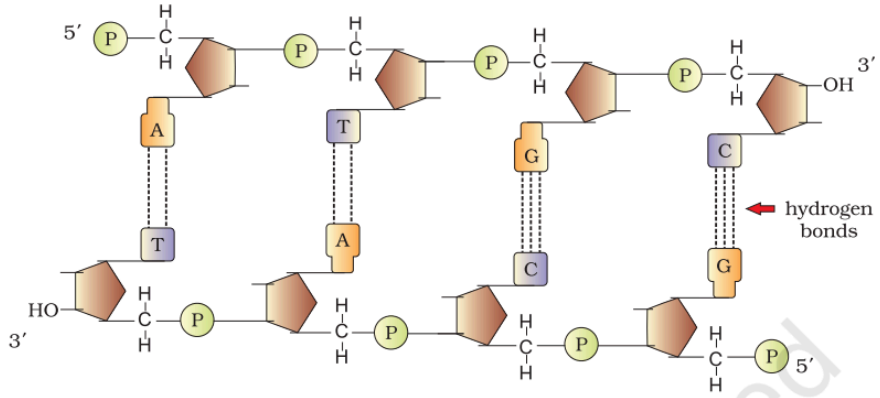
**A.**

**(i) A DNA segment has a total of 1000 nucleotides, out of which 240 are adenine–containing nucleotides. How many pyrimidine bases does this DNA segment possess?**

**(ii) Draw a diagrammatic sketch of a portion of DNA to support your answer.**

**Ans**:

(i) 500 pyrimidine bases,
Given =240 adenine nucleotides = 240 thymine nucleotides (purine nucleotides)
240 + 240 = 480 nucleotides.
1000 – 480 = 520 nucleotides of pyramides, of which 260 would be Guanine, and the remaining 260 be of cytosine.
(ii)




**B. Calculate the number of nucleosomes in**
**(i) Yeast cell with 2.72mm length of DNA.**
**(ii) λ Bacteriophage with 5276 nucleotides in the DNA segment.**
**(iii) E.coli with the length of DNA 1.36mm.**
**Ans**:
(i) Yeast cell - $4x10^4$ Nucleosomes
Length of DNA = Number of base pairs multiplied by the distance between 2 successive base pairs.
$2.72 \times 10^3$ = bp x $0.34 \times 10^{-9}$m
Number of bp = $2.72 \times 10^{-3} / 0.34 \times 10^{-9}$
= $8 \times 10^6$ bp
200 bp = 1 Nucleosome
**$8 \times 10^6$ bp = $4 \times 10^4$ Nucleosomes**

(ii) Zero
(iii) Zero

**19. (a) Explain the property that prevents normal cells from becoming cancerous.**
**(b) All normal cells have an inherent characteristic of becoming cancerous. Explain.**
**Ans**:
(a) Contact inhibition – explanation to be given.
(b) All normal cells have proto-oncogenes, activated – transform into oncogenic cancerous cells.

**20. β-galactosidase enzyme is considered a better selected marker. Justify the statement.**

**Ans**:
Alien DNA is introduced within the coding sequence of the enzyme, □-Galactosidase. This inactivates the gene. Thus, there will be no enzyme formed.
Recombinants do not produce any colour, while non-recombinants turn blue with chromogenic substrate. A better method, as the selection of recombinants with antibiotic-resistant genes as selectable markers, is cumbersome, requiring simultaneous plating on two plates with different antibiotics.

**21. Attempt either option A or B.**
**A. (i) Explain with the help of an example each, how the pyramid of numbers and pyramid of biomass can look inverted. Represent.**
**(ii) How are primary consumers different from primary carnivores?**
**Ans**:

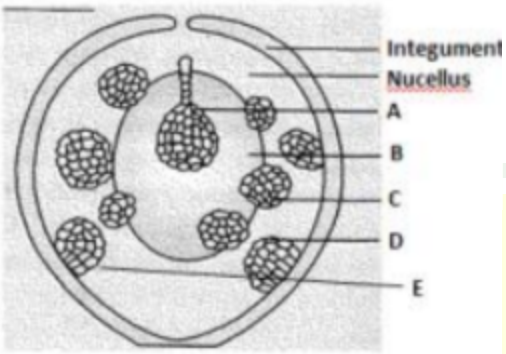
- (i)
- Pyramid of Numbers –
    - Tree ecosystem – A single tree (producer) with many insects feeding (primary consumers).
    - Pyramid of biomass. (in the sea – marine ecosystem) The biomass of phytoplankton is much less compared to that of fish.
- (ii)
    - Primary consumers – occupy 2nd trophic level – herbivores – depend on plants for food.
    - Primary carnivores – occupy the third trophic level – secondary consumers feeding on herbivores.

**OR**
**B. (i) Construct a grazing food chain and a detritus food chain using the following, with five links in each: earthworm, grasshopper, frog, vulture, bird, snake, grass, and decaying plant matter.**
**(ii) Is it possible that a species may occupy more than one level in the same ecosystem at the same time? Explain with an example.**
**Ans**:

- (i)
    - GFC: Grass □grasshopper □ frog □ snake □vulture.
    - DFC: Decaying plant matter □ earthworm □ Bird □ snake □ vulture.
- (ii) Man Primary consumer when feeds on plants (vegetarian) (second trophic level)
- Secondary consumers feed on other animals (Non-vegetarian) (third trophic level).

## SECTION – C (3 Marks)

**22.**




**(a) Name the phenomenon depicted in the above figure.**
**(b) One among the above embryos, A, B, C, D, E, showed a different genetic composition compared to the others. Identify the embryo and give reason/s.**
**(c) What are the advantages/disadvantages of the 2 categories of embryos? Discuss.**
**Ans**:

(a) Polyembryony.
(b) A is a Zygotic embryo. It is formed by fertilization, while the others are formed by apomixis.
(c)
  (i) Polyembryony
    (1) The advantage of zygotic embryo variations is possible.
    (2) Disadvantage: All variations may not be advantageous. Leads to the segregation of characters. It is not suitable to produce hybrid seeds as hybrid characters cannot be maintained in progeny.
  (ii) B, C, D, E – Apomictic embryos.
    (1) Advantage: If hybrids are made into apomicts, no segregation of characters in hybrid progeny. No need to buy hybrid seeds every year.
    (2) Disadvantage: None, as it is used to grow desired hybrid progeny with desired characters.

**23. (a) What are polar bodies? Give significance.**
**(b) Name the cells which give rise to first and 2nd polar bodies. Give their chromosomal complement.**
**(c) How many secondary oocytes would have been released by human ovary**
**(i) If the mother gave birth to identical twins?**
**(ii) Does the answer change if the twins are fraternal?**
**(iii) What would be number of secondary oocytes by the ovary of a rat which gave birth to 8 offspring?**
**Ans**:

(a) Haploid cells formed due to unequal cytokinesis during oogenesis – formed to provide more cytoplasm to the developing haploid secondary oocyte/ootid.

(b)

(i) 1st polar body – primary oocyte (2n)

(ii) 2nd polar body – secondary oocyte (n)

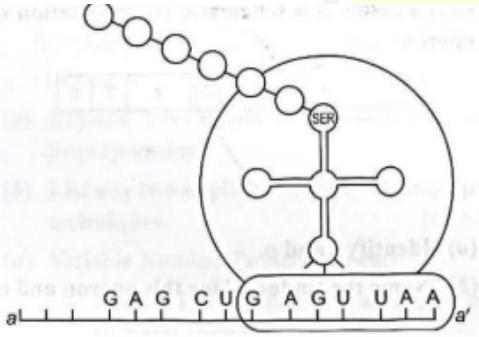
(c)

(i) Only 1 egg

(ii) Yes, 2 eggs

(iii) 8 secondary oocytes

**24.**




**(a) Identify the polarity from a to a', in the above diagram, and mention how many more amino acids are expected to be added to this polypeptide chain. Explain your answer.**
**(b) Mention the DNA sequence coding for serine and the anticodon of tRNA for the same amino acid.**
**(c) Why are some untranslated sequences of bases seen in mRNA coding for a polypeptide? Where exactly are they present on mRNA?**

**Ans**:

(a) a to a' is 5'- 3'. No more amino acids will be added to the polypeptide chain due to the presence of terminator codons.

(b) DNA sequence coding for serine is TCA, and its anticodon is UCA.

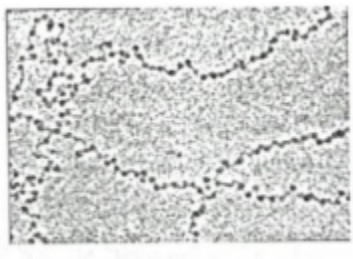
(c)

(i) Untranslated regions are required to regulate translation.

(ii) Present before the initiator codon (5' end) and after the terminator codon (3'end)

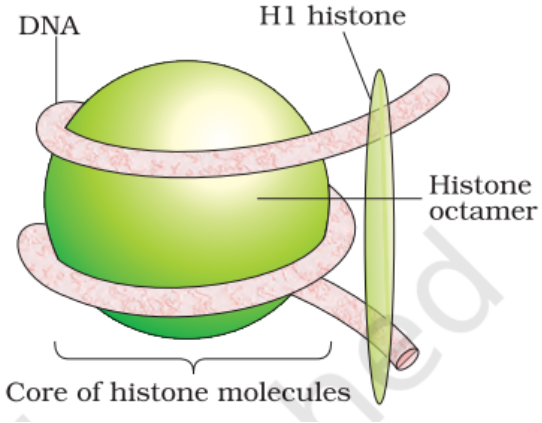
BioSmartNotes

**25.**



**The above figure depicts an electron micrograph picture of "beads on a string".**

**(a) Identify and explain the detailed structure of a bead with the help of a neat labelled diagram.**
**(b) Describe the packaging of "beads on a string" in a eukaryotic cell.**
**Ans**:
(a) Nucleosomes are a set of positively charged proteins called histones, rich in basic amino acids like lysine and arginine. Histones are organised to form a unit of eight molecules, a histone octamer. Negatively charged DNA is wrapped around to form a nucleosome, which contains 200 bp of DNA.




(b) Nucleosomes are seen as beads on a string under an electron microscope, forming chromatin fibres. These chromatin fibres further coil to form chromosomes. Its packaging at higher levels requires NHC, Non-histone chromosomal proteins.

**26. Identify a, b, c, d, e, and f in the table given below: [1⁄2x6=3]**

| **Organism** | **Bioactive molecule** | **Use** |
|---|---|---|
| 1. Monascus purpureus | a | b |
| 2. c | d | Antibiotic |
| 3. e | Cyclosporin A | f |

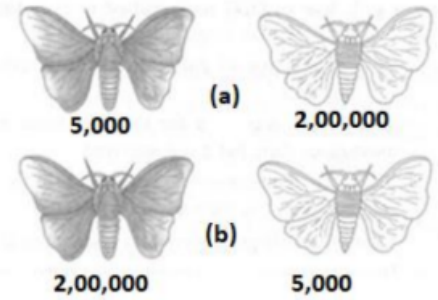
**Ans**:
(a) Statin
(b) Blood cholesterol-lowering agent
(c) *Penicillium notatum*
(d) Penicillin
(e) *Trichoderma polysporum*
(f) Immunosuppressive agent in organ transplant patients.

**27. What are "Cry" proteins? Name an organism that produces it. How did man exploit this protein to his benefit? Give details.**

**Ans**:

Cry proteins are toxic proteins produced by *Bacillus thuringiensis*. It is toxic to various insect groups like Coleoptera, Diptera, and Lepidoptera. The genes encoding the Cry proteins from this bacterium were isolated and incorporated into some crop plants. Crop plants express these proteins in their cells to become insect-resistant. When the pest consumes the protein, secreted in the inactive form, it gets activated by alkaline pH in the gut of the insect pest, creating pores in the alimentary canal, causing the death.

**28.**




**How do these pictures (a) and (b) representing the population of moths, illustrate Darwin's theory of Natural selection in 2 different decades? Explain.**

**Ans**:

(a) Represents the population of black and grey moths before the Industrial Revolution, and (b) represents their population post-Industrial Revolution.

Before the Industrial Revolution, Grey moths survived in large numbers as they were able to blend with the white lichens on the tree barks.

After the Industrial Revolution, Black moths survived in large numbers as the lichens were turned black from the soot. This helps the black moths blend into the background and allows them to survive. This is a perfect example of Natural selection – survival of the fittest.

BioSmartNotes

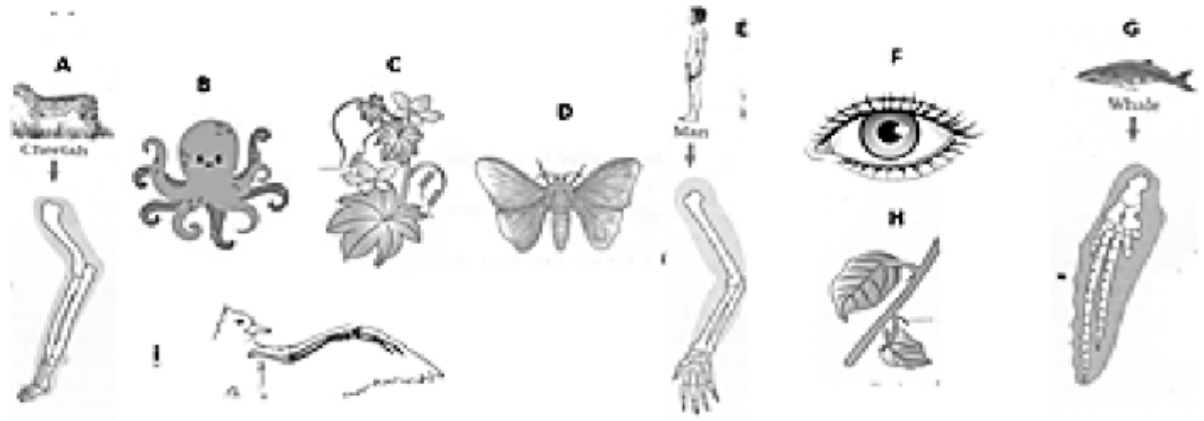
## SECTION – D (4 Marks)

**29. (a) In a species, the weight of newborns ranges from 2 to 5kg. 97% of the newborns with average weight ranging between 3 – 3.5kg survive, whereas 98% of the infants born with weight from 2 to 2.5kg or 4.5 to 5 kg die.**

**Give the graphical representation of the above details, with the number of babies on the Y-axis and the weight of infants on the X-axis.**

**Which type of Natural Selection is operating? Represent.**

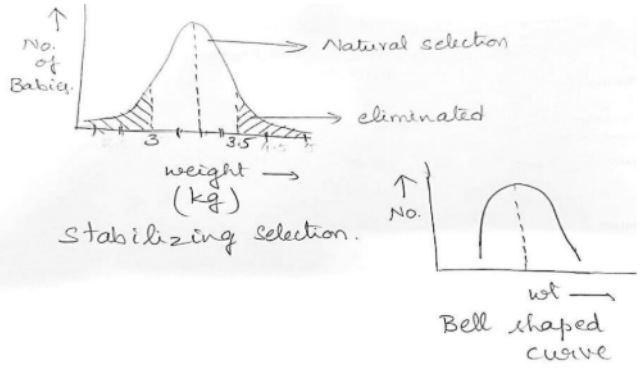
**(b)**




**(1) Observe the above images A to I. Identify and group them into analogous/homologous organs. Explain the reason for your answer.**
**(2) What kind of evolution do they represent? Explain your answer.**
**(c) In a certain population, the frequency of three genotypes is as follows:**

| Genotypes | BB | Bb | bb |
|---|---|---|---|
| Frequency | 22% | 62% | 16% |

**Calculate the likely frequency of B and b alleles.**
**Ans**: (a)




Stabilizing selection – bell-shaped curve as only medium-weight newborns are selected by nature.
(b) fore limbs of man, bird, whale, and cheetah; thorns of Bougainvillea and tendrils of cucurbits are homologous organs. Same origin, perform different functions, divergent evolution.
Wings of a butterfly and bird; eyes of an octopus and human, different origins but perform similar functions –convergent evolution.
(c)

- Frequency of BB: 22%
- Frequency of bb: 16%

- Frequency of Bb: 62% [1]
- Frequency of B = 22 +31 = 53%
- Frequency of b = 16 +31 = 47%

**OR**

**(d) In a population of 100 individuals, 36 belong to genotype AA and 16 to aa. Based on this data, find the frequency of allele A, a, and Aa in the population.**

**Ans**:

(a) $p^2 + 2pq + q^2 = 100$

$p^2 = AA = \frac{36}{100}$

$\therefore \ p = \sqrt{\frac{36}{100}} = 0.6$ = frequency of allele A

$q^2 = aa = \frac{16}{100}$

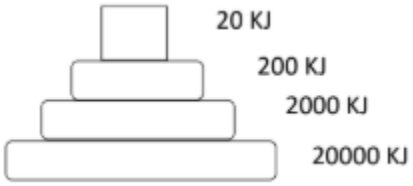
$q = \sqrt{\frac{16}{100}} = 0.4$ = frequency of allele a

$\therefore$ Aa = 2pq = $2 \times 0.6 \times 0.4 = 0.48$ = frequency of heterozygous dominants

**30. A. 20,000 J of energy is trapped by phytoplanktons in a certain patch of the Bay of Bengal. Zoo planktons feed on phytoplanktons, which are further consumed by small fish. The small fish are preyed upon by huge whales in that area.**

- **What would be the amount of energy available to each category of animals indicated in the above food chain? Draw the ecological pyramid.**
- **If the biomass of phytoplanktons was 800Kgm-2, draw the ecological pyramid of biomass and pyramid of energy with respect to the food chain indicated above. Comment on the shapes of pyramids and bring about the comparison.**

**Ans:** Erect pyramid- Pyramid of energy is always upright



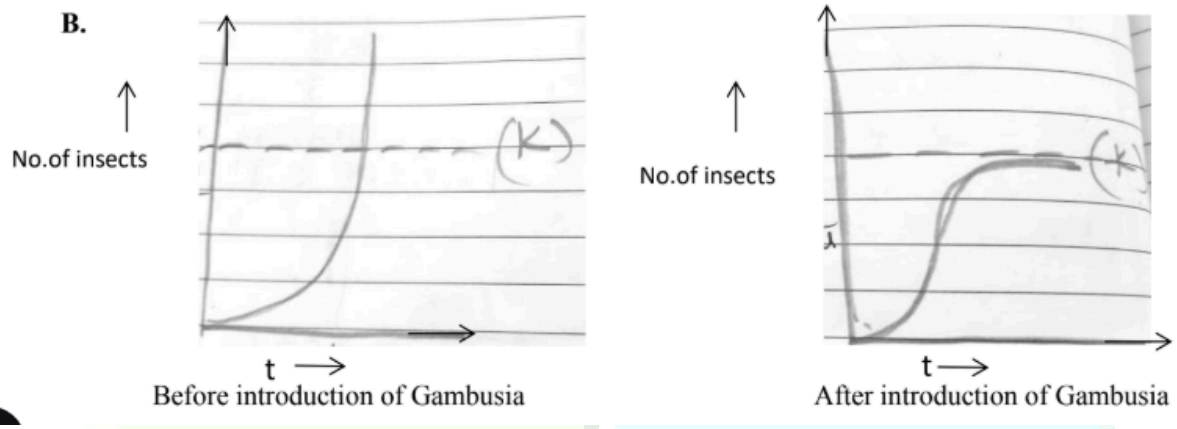

Inverted pyramid – pyramid of biomass in marine ecosystems.

Comparison of pyramids of energy and biomass within the same ecosystem, where one is erect and the other is inverted.

**B. In a village dominated by rice fields, the population of insect species showed an explosive increase in numbers during the rainy season.**
**Following this, Gambusia fish were introduced into water bodies. The number of insect species declined drastically, but not lead to the complete elimination of insects.**

- **Represent the above 2 phenomena in terms of growth curves and bring about the comparison with an explanation.**

**Ans**:




J-shaped curve, exponential growth
S-shaped sigmoid curve, logistic growth
K = carrying capacity.

## SECTION - E (5 Marks)

**31. Attempt either option A or B.**
**A. (i) Why is parturition called a neuroendocrine mechanism? Explain.**
**(ii) Why is it important to feed newborn babies on colostrum?**
**(iii) What is lactational amenorrhoea? Give its significance.**
**(iv)Why are menstrual cycles absent during pregnancy?**
**Ans**:
(i) Parturition is induced by a complex neuroendocrine mechanism that originates from the fully developed foetus and the placenta. It induces mild uterine contractions and triggers the release of oxytocin from the maternal pituitary. This oxytocin acts on the uterine muscle, causing stronger uterine contractions, which in turn stimulate further secretion of oxytocin. This leads to expulsion of the baby out of the uterus through the birth canal.
(ii) Colostrum contains several antibodies, such as IgA antibodies the newborns develop passive immunity.

(iii) The lactational amenorrhea (absence of menstruation) method is based on the fact that ovulation and therefore the cycle do not occur during the period of intense lactation following parturition. Therefore, as long as the mother breastfeeds the child fully, the chances of conception are almost nil.
(iv) During pregnancy corpus luteum produces high levels of progesterone, which prevents/inhibits the maturation of other follicles. There will be no ovulation and therefore no menstrual cycles.

**OR**

**B. (i) What are outbreeding devices? Explain any 3 of them:**
**(ii) What is co-evolution? Explain the phenomenon with the help of pollination in Yucca by the moth.**

**Ans**:

- (i) - Self-incompatibility
    - Dioecious plants
    - Protondry / protogyny
    - Anthers and stigma of a flower are placed in such a way to prevent self-pollination.
    - Physical barriers (herkogamy) (Any 3)
- (ii) The yucca plant and moth cannot complete their life cycles without each other. The moth deposits its eggs in locules of the ovary, the flower gets pollinated by the moth, the larvae of the moth feed on seeds, and serve as food. If either of them evolves without the other, the relationship (mutualism) stops. Both the flower and the moth evolve together to continue the relationship.

**32. Attempt either option A or B.**

**A.**

**(a) With the help of diagrams, show the different steps in the formation of recombinant DNA by the action of the restriction endonuclease enzyme EcoRI.**
**(b) Name and explain the technique that is used for separating the fragments of DNA cut by restriction endonucleases. How can these separated DNA fragments be visualised?**

**Ans**:

(a) Eco RI recognises a palindromic sequence


Cuts DNA strands a little away from the centre of a palindrome between the same bases on both strands, forms sticky ends, overhanging, and DNA ligase joins vector DNA and foreign DNA -
(b) DNA fragments are separated by electrophoresis using an Agarose gel. DNA, which is negatively charged, moves towards the anode (positive). They separate according to their size.

The bright orange coloured bands of DNA in an ethidium bromide-stained gel when exposed to UV light.

**OR**

**B.**

**(a) How has the RNAi technique helped to prevent the infestation of roots in tobacco plants by the nematode *Meloidogyne incognita*?**

**(b) How does r-DNA technology help in detecting the presence of mutant genes in cancer patients?**

**Ans**:

(a) RNA interference (RNAi) method involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA (silencing). The source of this complementary RNA could be from an infection by viruses having RNA genomes or mobile genetic elements (transposons) that replicate via an RNA intermediate.

Using *Agrobacterium* vectors, nematode-specific genes were introduced into the host plant. The introduction of DNA produced both sense and anti-sense RNA in the host cells. These two complementary RNAs form a dsRNA that initiates RNAi, silencing the specific mRNA of the nematode.

(b) A single-stranded DNA or RNA, tagged with a radioactive molecule (probe), is allowed to hybridise to its complementary DNA in a clone of cells, followed by detection using autoradiography. The clone having the mutated gene will hence not appear on the photographic film, because the probe will not have complementarity with the mutated gene.

**33. Attempt either option A or B.**

**A. (i) Explain Gause's competition exclusion principle with the help of suitable example(s).**

**(ii) Differentiate between competition and parasitism with an example each.**

**Ans**:

(a) Gause's 'Competitive Exclusion Principle' states that two closely related species competing for the same resources cannot co-exist indefinitely, and the competitively inferior one will be eliminated eventually. Eg., the Abingdon tortoise in the Galapagos Islands became extinct within a decade after goats were introduced on the island, apparently due to the greater browsing efficiency of the goats. The greater browsing efficiency of the tortoise was reduced by the interfering presence of other species (goat), even though resources were not limited.

(b) Parasitism ( +) – Cuscuta on the shoe flower bush

Competition (+, ) – flamingos and fish competing for zooplankton (food).

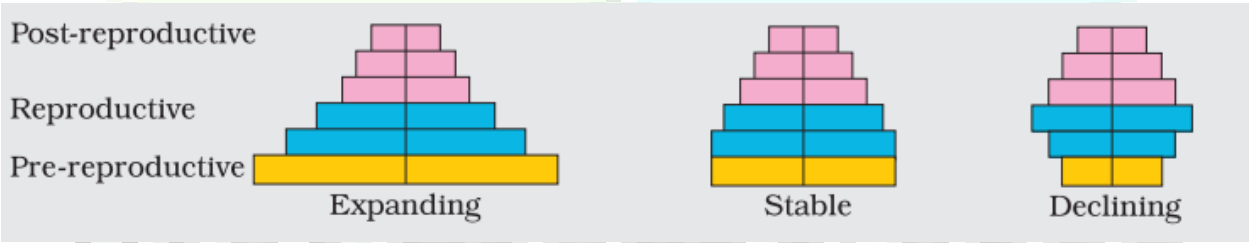
**OR**

**B. (i) Why is predation important and required in a community with rich biodiversity? Explain with suitable examples.**
**(ii) Explain with the help of diagrams the 3 different types of age pyramids represented by human population.**
**Ans**:
Predation – (+, )
(a) (i)

- Predators act as conduits for energy transfer across trophic levels.
- They keep prey populations under control.
- Predators also help in maintaining species diversity in a community by reducing the intensity of competition among competing prey species.
- Help to maintain species diversity by reducing competition.
- Ex: If a predator starfish, Pisaster, is removed, more than 10 species of invertebrates become extinct.
- Ex: Cactus introduced into Australia – spread rapidly – Brought under control by a moth (Predator) introduced.

(b)The three types of age pyramids are expanding, stable, and declining populations.

- The expanding population has the highest number of people in their pre-reproductive stage, followed by reproductive and post-reproductive stages.
- A stable population has an equal number of people in the pre-reproductive and reproductive stages.
- The declining population has fewer people in the pre-reproductive stage, the highest number in the reproductive stage, and fewer in the post-reproductive stage.

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