PRE-MEDICAL : ENTHUSIAST COURSE (ALL PHASE)

जीव विज्ञान
BIOLOGY

Time Allowed : 3 Hour | **Maximum Marks : 70**

निर्धारित समय : 3 घण्टे | **अधिकतम अंक :70**

- Please check that this question paper contain **00** printed pages.
- Please check that this question paper contains **27** questions
- Please write down the serial number of the question before attempting it.
- कृपया जाँच कर लें कि इस प्रश्न–पत्र में मुद्रित पष्ठ **00** हैं।
- कृपया जाँच कर लें कि इस प्रश्न–पत्र में **27** प्रश्न हैं।
- कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, प्रश्न का क्रमांक अवश्य लिखें।

Biology — Total Q. : 27 and Total Marks : 70

There is no overall choice in the question paper. However, internal choices are provided in 2 questions of one mark,1 question of two marks, 2 questions of three marks and all 3 questions of five marks. An examinee is to attempt any one of the questions out of the two given in the question paper with the same question number.

Q. Type	Section	No. of Q.	Q. Numbering	Marks	T Marks
Multiple Choice (Objective)	A	5	1 to 5	1	5
Short Answer - I	B	7	6 to 12	2	14
Short Answer - II	C	9	13 to 21	3	27
Case Based	D	3	22 to 24	3	9
Long Answer	E	3	25 to 27	5	15

जीव विज्ञान — कुल प्रश्न : 27 एवं कुल अंक : 70

प्रश्न पत्र में 1 अंक के दो प्रश्न, 2 अंक के एक प्रश्न, 3 अंक के दो प्रश्न एवं 5 अंक के तीन प्रश्न में विकल्प दिए गये है। इस प्रकार के प्रश्नों में किसी एक प्रश्न को ही हल करना है।

प्रश्न के प्रकार	भाग	कुल प्रश्न	प्रश्न क्रमांक	अंक	कुल अंक
बहु विकल्पीय	A	5	1 to 5	1	5
लघुत्तरात्मक–I	B	7	6 to 12	2	14
लघुत्तरात्मक–II	C	9	13 to 21	3	27
प्रकरण आधारित	D	3	22 to 24	3	9
निबंधात्मक	E	3	25 to 27	5	15

SECTION-A

1. Failure of testes to descend into scrotum is called **[1]**

(A) Archentronism (B) Testinolism

(C) Cryptochidism (D) Copulation

OR

Which one is not a natural methods birth control

(A) Coitus interrupts (B) Tubectomy

(C) To abstain (D) Rhythm period

2. If all the members of a host species die then all its unique parasites also die off, representing: **[1]**

(A) biological control (B) extinction

(C) conservation (D) co-extinction

3. Stanley Cohen and Herbert Boyer worked on which bacteria? **[1]**

(A) Salmonella typhimurium (B) Aspergillusniger

(C) Bacillus subtilis (D) Proteus vulgaris

4. Which of the following disease is caused by virus and transmitted by mosquito? **[1]**

(A) Yellow fever (B) Plague

(C) Typhus (D) Filariasis

OR

The primary and secondary immune response are carried out with the help of two special types of lymphocytes present in our blood called

(A) Lymphocytes and monocytes

(B) T-lymphocytes and A-lymphocytes

(C) B-lymphocytes and M-lymphocytes

(D) B-lymphocytes and T-lymphocytes

5. Which article of the Constitution of India specifies that, "it shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers, and wildlife and to have compassion for living creatures." **[1]**

(A) Article 32 (B) article 48

(C) article 51-A (D) article 52-A

SECTION-B

6. Mention the characteristic feature and a function of zoospore in some algae. **[2]**

OR

If the chromosome number of plant species is 16, what would be the chromosome number and the ploidy level of the

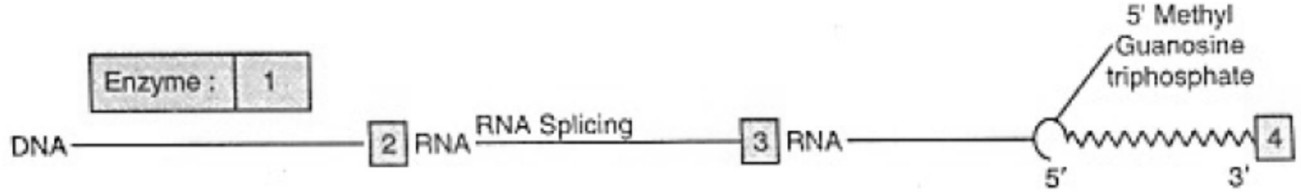
(i) microspore mother cell and

(ii) the endosperm cells?

7. Give any four possible ill effects of contraceptives. **[2]**

8. Due to chromosomal abnormalities, a male child with 47 chromosomes number was born. Name the possible genetic disorder which may be present and write two important symptoms of each. **[2]**

9. Given below is a sequence of steps of transcription in a eukaryotic cell. **[2]**



Fill up the blanks (1, 2, 3, 4) left in the sequence.

10. Explain what is meant by biofortification. **[2]**

11. Write the functions of **[2]**

i. cry IAc gene

ii. RNA interference (RNAi)

12. Differentiate between a detritivores and a decomposer giving an example of each. **[2]**

SECTION-C

13. Draw L.S. of an embryo of grass and label its parts. **[3]**

14. Define the terms **[3]**

i. Porogamy ii. Chalazogamy

iii. Mesogamy iv. Triple fusion

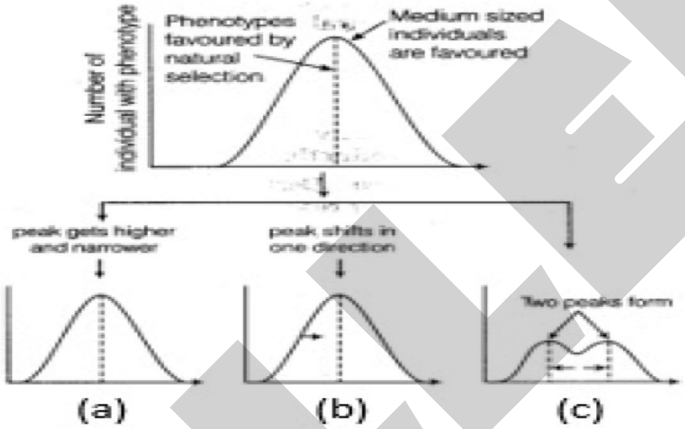
v. Siphonogamy.

15. Work out a cross between true-breeding red and white flowered dog flower plants (snapdragon) up to F2 progeny. Explain the results of F1 and F2-generation. **[3]**

OR

Linkage and crossing over of genes are alternatives of each other. Justify with the help of an example.

16. Observe the diagram given below for the operation of natural selection on different traits and answer the following questions: **[3]**



i. Name A, B, and C mentioned in the above diagram.

ii. Give one example of directional selection.

iii. Write the name of factors affecting the Hardy-Weinberg Equilibrium.

17. Study the mRNA segment given below, which is complete and to be translated into a polypeptide chain and answer the following questions: **[3]**

i. Write codons 'A' and 'B'.

ii. What do they code for?

iii. How is the peptide bond formed between two amino acids in the ribosome?

18. Give the sequence of events followed in **Multiple Ovulation Embryo Transfer Technology Programme** for increasing the herd size in cattle. **[3]**

19. How is a transgenic tobacco plant made resistant to nematode using biotechnology? **[3]**

20. i. Explain the species-area relationship using the graphical representation given below. **[3]**

ii. Explain giving reasons why there is greater biodiversity in tropical regions of the earth.

OR

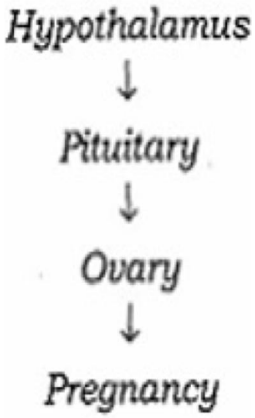
Where are the main centres of biodiversity in Western Ghats? Mention two significance of conservation of biodiversity.

21. i. A recombinant vector with a gene of interest inserted within the gene of α-galactosidase enzyme, is introduced into a bacterium. Explain the method that would help in selection of recombinant colonies from non-recombinant ones. **[3]**

ii. Why is this method of selection referred to as insertional inactivation?

SECTION-D

22. Study the following flow chart and answer the following question: **[3]**

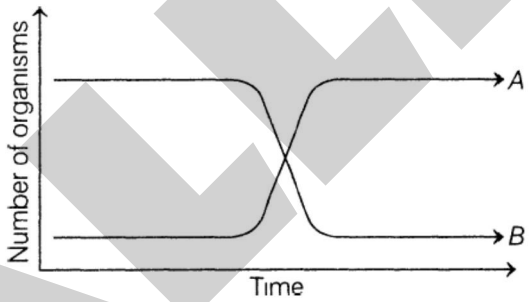


i. Name the hormones involved in each state.

ii. Explain the functions of hormones involved in each state.

iii. Write the name of the placental hormone.

23. Two types of aquatic organisms in a lake show specific growth patterns as shown below, in a brief period of time. The lake is adjacent to an agricultural land extensively supplied with fertilisers. **[3]**



Answer the questions based on the facts given above.

i. Name the organism s depicting the patterns A and B.

ii. State the reason for the growth pattern seen in A.

iii. Write the effects of the growth patterns seen above

24. Observe the following picture of the biogas plant and answer the following questions: **[3]**

i. Why are biogas plants mainly located in rural areas?

ii. Which microbes are employed to produce biogas?

iii. Who developed the technology of biogas production in India?

SECTION-E

25. A particular garden pea plant produces only violet flowers. **[5]**

i. Is it homogenous dominant for the trait or heterozygous?

ii. How would you ensure its genotype? Explain with the help of crosses.

OR

i. Draw a schematic representation of the structure of a transcription unit and show the following in it
   a. The direction in which the transcription occurs
   b. The polarity of the two strands involved
   c. Template strand
   d. Terminator gene

ii. Mention the function of promoter gene in transcription.

26. i. What is inbreeding depression? **[5]**

ii. Explain the importance of 'selection' during inbreeding in cattle.

OR

a. Write the specific name of the genus Plasmodium that causes one of the most serious types of diseases in humans. Name the disease.

b. Describe the events in the life cycle of Plasmodium which take place in the female Anopheles.

c. Explain what happens in the RBCs of the humans when Plasmodium gains entry into them. How does the human body get affected?

27. Explain, biomagnification of DDT in an aquatic food chain. How does it affect the bird population? **[5]**

OR

i. With suitable examples, explain the energy flow through different trophic levels. What does each bar in this pyramid represent?

ii. Write any two limitations of ecological pyramids.

BIOLOGY SOLUTION

SECTION-A

1. (C) Cryptochidism **[1]**

OR

(B) Coitus interrupts

2. (D) co-extinction. **[1]**

3. (A) Salmonella typhimurium **[1]**

4. (A) Yellow fever **[1]**

OR

(D) B-lymphocytes and T-lymphocytes

5. (C) article 51-A **[1]**

SECTION-B

6. Zoospores are microscopic motile structures present in the aquatic algae. Three common features are shared by zoospores. **[2]**

- Zoospore cells are wall-less.
- Endogenous food reserves are used for the locomotion.
- They are capable of responding to environmental signals in order to decide where to locate and where to encyst.

Functions:

- On germination give rise to new plants.
- They help in asexual reproduction.

OR

i. Microspore mother cell = 16 (Diploid)

ii. Endosperm cell = 24 (Triploid)

7. **[2]**

- Nausea is an uneasiness of the stomach that often comes before vomiting.
- Abdominal pain
- Irregular menstrual bleeding
- Breast cancer

8. i. **Autosomal Abnormality:** Down's Syndrome: Trisomy of 21st chromosome. **[2]**

Symptoms:

a. Rounded face

b. Protruding tongue with projecting lower lip.

ii. **Sex-Chromosomal Abnormalities:**

a. Kleinfelter's syndrome. Additional X-chromosome (44 + XXY).

symptoms:

i. Mental retardation

ii. Female like sparse body hairs, long limbs and enlarged breasts (gynecomastia).

b. Supermales: Additional Y-chromosome. (44 + XYY)

Symptoms:

i. Abnormal height, more aggressive

ii. Mental retardation and criminal bent of mind.

9. 1 - RNA polymerase; 2 - hn; 3 -m; 4 - poly A tail. **[2]**

10. Biofortification is the process by which the nutritional quality of food crops is improved through agronomic practices, conventional plant breeding, or modern biotechnology. Biofortification differs from conventional fortification in that biofortification aims to increase nutrient levels in crops during plant growth rather than through manual means during processing of the crops. Biofortification may therefore present a way to reach populations where supplementation and conventional fortification activities may be difficult to implement and/or limited.

Examples of biofortification projects include: **[2]**

- iron-biofortification of rice, beans, sweet potato, cassava and legumes;
- zinc-biofortification of wheat, rice, beans, sweet potato and maize;
- provitamin a carotenoid-biofortification of sweet potato, maize and cassava; and
- amino acid and protein-biofortification of sourghum and cassava.

11. i. cry IAc codes for toxic insecticidal protein as inactive protoxins in *Bacillus thuringinesis.* This toxin kills the cotton bollworm. **[2]**

ii. RNA interference is associated with the silencing of specific mRNA and is a method of cellular defense in eukaryotes.

12. Decomposers decompose substances by a chemical process while detritivores do not. **[2]**

Detritivore is useful in making important nutrient substances.

Detritivore actually eat organic matter but decomposers are known to secrete enzymes for the decaying of dead organic matter.

Detritivore consume detritus to obtain energy.

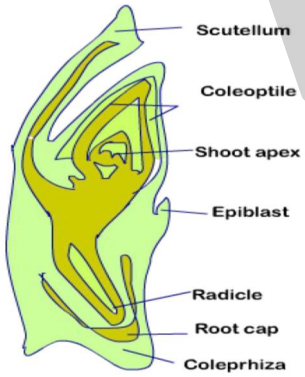
Detritivore is one of the form of decomposers.

Decomposer breaks down substances to through a process of decomposition while detritivore consume the dead or decaying matter.

Most bacterias and fungi are the decomposers but detritivores are in the form of worms, crabs and many more such organisms.

SECTION-C

13. **[3]**



14. i. Porogamy: It is the phenomenon of the entry of the pollen tube into the ovule through micropile. **[3]**

ii. Chalazogamy: It is the phenomenon of the entry of the pollen-tube in the ovule through the chalazal end.

iii. Mesogamy: It is the phenomenon in which the pollen tube enters the ovule through the integuments.

iv. Triple fusion: It involves the fusion of a diploid secondary nucleus (formed by the fusion of two polar nuclei)with one of the two male gametes to form triploid primary endosperm nucleus.

v. Siphonogamy: It is a type of fertilisation in angiosperms in which the male gametes are brought near the egg with the help of pollen tube.

15. In F1-generation -Pink flowered plants obtained. It is due to incomplete dominance. **[3]**

In F2-generation -Alleles of the hybrid (F1) segregate during gamete formation and the parental characters reappear without any change. So, the phenotypic and genotypic ratios of F2-generation are the same.

RR : Rr : rr

1 : 2 : 1

OR

Linkage is the tendency of certain loci or alleles (genes) to be inherited together while crossing over is the segregation of genes. For example, the genes on a chromosome either follow the linkage path or crossing over to form the gametes during gametogenesis in human. Therefore, linkage and crossing over of genes are alternatives of each other.

16. i. (a) - Stabilizing, (b) - Directional and (c) - Disruptive selection. **[3]**

ii. Peppered moths.

iii. Following are the factors affecting the Hardy-Weinberg Equilibrium

a. Gene migration or gene flow

b. Genetic drift

c. Mutation

d. Genetic recombination

e. Natural selection

17. i. A-AUG, B-UAA/UAG/UGA **[3]**

ii. AUG codes for methionine. UAA/UAG/UGA does not code for any amino acid, but brings about termination of polypeptide synthesis.

iii. In the large subunit of ribosome, there are two sites in which subsequent amino acids bind to and come close enough for the formation of peptide bond. It is catalysed by the enzyme called peptidyl transferase.

18. The sequence of events in MOET, are as follow: **[3]**

i. A cow is administered FSH hormone to induce follicular maturation and superovulation i.e., production of 6 - 8 ova in one cycle,

ii. The cow mated with the selected superior bull or artificially inseminated.

iii. The fertilised eggs at 8 - 32 celled stages are recovered and transferred to the surrogate mothers.

iv. High milk yielding breeds of females and high-quality meat-yielding bulls have been bred successfully to increase the herd size in a short time.

19. RNAi takes place in all eukaryotic organisms as a method of cellular defence. This method involves silencing of a specific mRNA due to a complementary dsRNA molecule that builds to and prevents translation of the mRNA. **[3]**

Using Agrobacterium vectors, nematode-specific genes were introduced into the host plant. The introduction of DNA was such that it produces both sense and anti-sense RNA in the host cells. These two RNAs being complementary to each other formed a double-stranded RNA that initiated RNAi and thus silences the specific mRNA of the nematode. As a consequence the parasite could not survive in a transgenic host expressing specific interfering RNA.

20. i. Alexander von Humboldt studied species-area relationship. He observed that within a region, the species richness increased with increasing the area up to a certain limit. **[3]**

ii. Ecologists have discovered that the value of Z lies in the range of 0.1-0.2 regardless of taxonomic group or region. When species-area the relationship is considered for a large area like a whole continent,

regression coefficient Z or slope of the line becomes steeper with Z-values in the range of 0.6-1.2. For example, for fruit-eating birds and mammals in tropical forests of a different continent, the slope is found to be 1.15.

OR

Main centres of biodiversity in Western Ghats are:

- Agasthyamali hills, Silent Valley
- Amambalam Reserve.

Significance of biodiversity conservation

(i) Conservation of biodiversity helps to prevent many species from becoming extinct. Conserved species can be used to restore degraded land, restock depleted populations and reintroduce species into wild to maintain healty ecological balance.

(ii) It provides breeders and genetic engineers with a ready source of genetic material.

This aids in research and cross-breeding program to produce new varieties of species or to fight against diseases.

21. i. The insertion of recombinant DNA within the coding sequence of enzyme agalactosidase results in the inactivation of the enzyme called insertional inactivation. The colonies do not produce a blue colour in the presence of chromogenic substrate and are identified as recombinant colonies whereas non recombinant colonies produce blue colour from the chromogenic substrate, due to the presence of the activated enzyme. **[3]**

ii. The method is referred as "insertional inactivation" because the enzyme - galactosidase produced is inactivated due to insertion of alien DNA within the coding sequence of the enzyme, which acts as a selectable marker to differentiate recombinant colonies from non-recombinant one.

22. i. The hormones involved in each stage are as follows: **[3]**

a. **Hypothalamus-** Gonadotropin-releasing hormone (GnRH)

b. **Pituitary-** FSH and LH

c. **Ovary-** LH

d. **Pregnancy-** Progesterone and Human chorionic gonadotropin (hCG)

ii. The functions of the hormone involved in each stage are as follows:

a. **Hypothalamus:** It releases gonadotropin-releasing hormone (GnRH), which stimulates pituitary.

b. **Pituitary:** After stimulation, it secretes FSH and LH. FSH regulates the functioning of the ovary during follicular phase by stimulating the growth of an ovarian follicle into mature Graafian follicle and secretion of oestrogens from the follicle cells. LH stimulates the mature follicle to rupture and release the ovum(ovulation).

c. **Ovary:** After ovulation LH stimulates the formation of corpus luteum inside the ruptured follicle.

d. **Pregnancy:** Corpus luteum starts the secretion of progesterone and hCG is secreted from the placenta which is essential for the maintenance of pregnancy.

iii. Human chorionic gonadotropin (hCG) hormone is secreted from the placenta.

SECTION-D

23. i. The organisms depicting pattern A are microorganisms, while B depicts zooplanktons or fishes. **[3]**

ii. With the increase in organic matter of lake due to influx of nutrients from agricultural land, the number of microorganisms increases which degrade the organic matter.

iii. From the above growth patterns, it can be concluded that

a. With the increase in microbes in water body the BOD increases, making it unfit for aquatic life.

b. Dissolved oxygen reduces drastically leading to mortality of aquatic organisms, i.e. fishes.

24. i. Because the cattle dung is available in plenty in the rural areas that's why biogas plants mainly located in rural areas. **[3]**

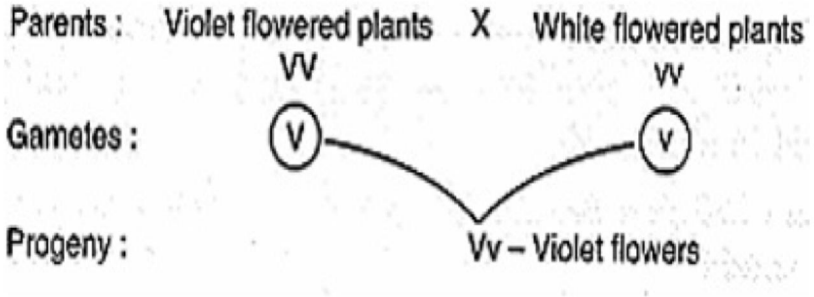
ii. Methanogens.

iii. Khadi and Village Industries Commission (KVIC) and Indian Agricultural Research Institute (IARI) developed the technology of biogas production in India.

25. i. It must be homozygous dominant since it produces only violet flowers. **[5]**

ii. The plant must be crossed with a plant bearing white (recessive) flowers. If the progeny consists of plants, are producing violet flowers, the plant is homozygous dominant. (Cross 1) If the progeny contains violet flowered plants as well as white flowers plants. The given plant is heterozygous. (Cross 2)

a. Cross 1: homozygous dominant



b. Cross 2: Heterozygous

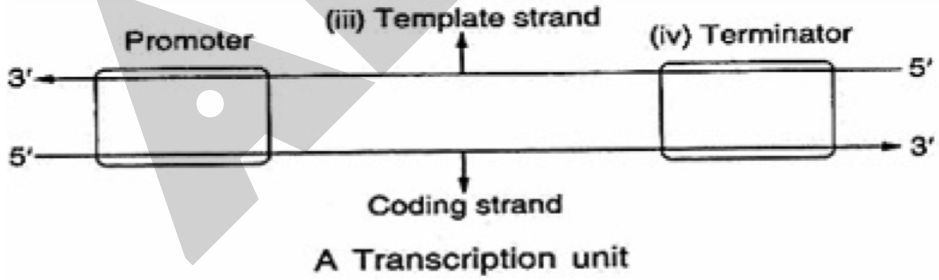
Parents: **Violet flowered plant X White flowered plant**

Vv vv

Gamete	V	v
v	Vv Violet	Vv Whiite

OR

i.



A Transcription unit

(i) 5' ⟶ 3'for (ii), (iii) and (iv) see figure.

ii. Promoter provides the site for the binding of RNA polymerase for transcription, it also defines the coding and template of DNA

SECTION-E

26. i. Inbreeding is the crossing of closely related animals within the same breed for 4-6 generations. The continued inbreeding, however, reduces fertility and even productivity, this is called inbreeding depression. **[5]**

ii. Inbreeding is performed for developing a pure line and to express desirable superior genes.

Importance of 'selection' during inbreeding of cattle is as follows

a. By selection at every step, the productivity of the inbred population is increased.

b. It helps in the accumulation of desired superior genes, so as to obtain more milk per lactation.

c. It helps in eliminating the less desirable genes from cattle population.

d. It helps to eliminate the harmful recessive genes.

OR

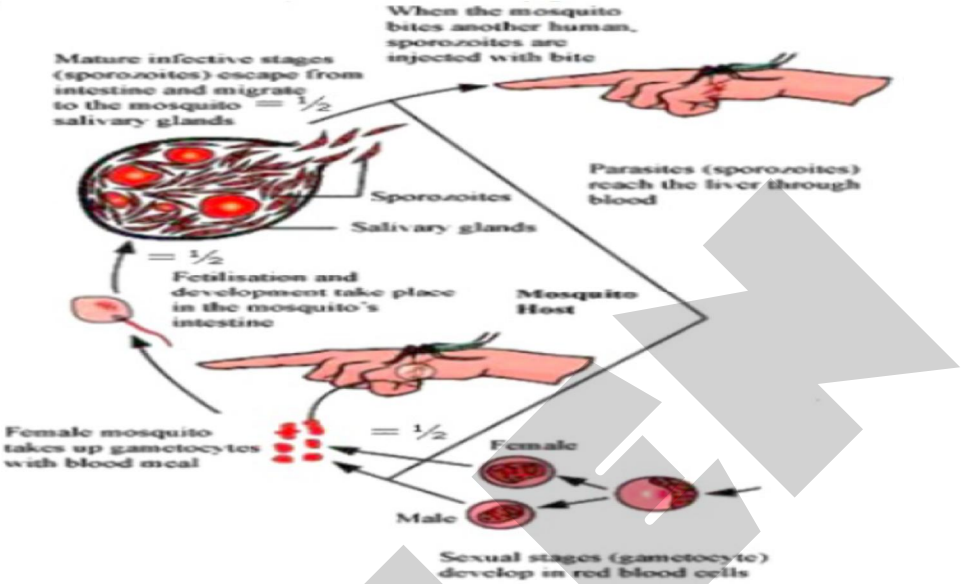
a. *Plasmodium falciparum* causes malignant malaria in humans.

b. The events in the life cycle of Plasmodium which take place in the female Anopheles are as follows:

i. Gametocytes / Male and Female gametes - enter female Anopheles mosquito

ii. Fertilisation and development in the female mosquito gut/stomach.

iii. Sporozoites are transported to the salivary gland.



iv.

c. When Plasmodium gains the entry in the human body then following events are taking place inside the body

i The parasite multiplies asexually in RBC

ii. RBC rupture

iii. Release toxic haemozoin

iv. Chill and fever recurring every 3 - 4 days

v. Parasites enter fresh RBC and repeat the cycle.

27. Biomagnification is a continuous increase in the concentration of chemicals in successive trophic levels in a food chain. For example, regular DDT sprays for a few years results in a drastic decline in the population of fish-eating birds. **[5]**

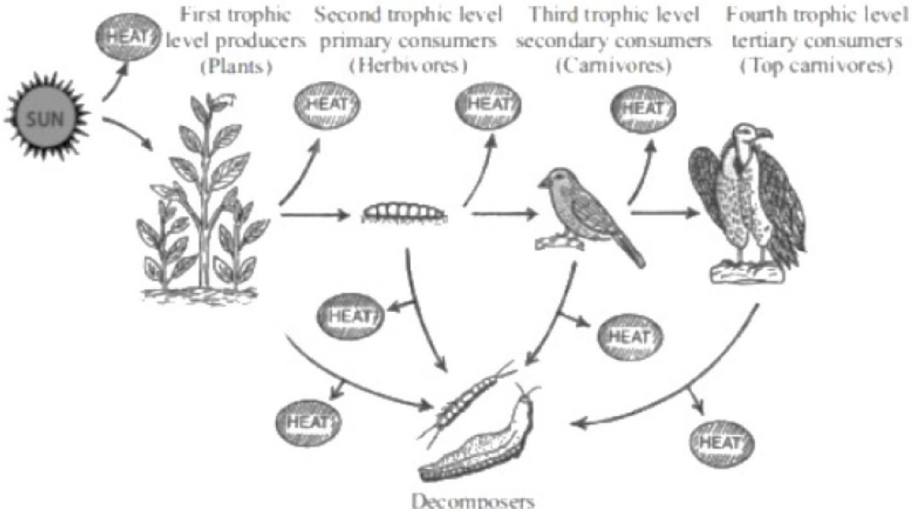
There was 1000 times increase in the concentration of DDT in phytoplankton as compared to water, in zooplankton as compared to phytoplankton, in different fish as compared to zooplankton and more FFT in fish-eating birds as compared to fish.

Higher amounts of pesticide disturb calcium metabolism of birds resulting in thinning of eggshells and their premature breaking that kills the embryos. Thus, causing a decline in the population.

OR

i. The energy flows unidirectionally from the first trophic level (producers) to last trophic level (consumers) and as the energy flows from one trophic level to another, some energy is always lost as heat into the surrounding environment. So, the amount of energy flowing decreases at each successive trophic level. This can

ii. be explained with the help of a diagram of a grazing food chain.



The pyramid of energy is always upright and each bar in the pyramid indicates the amount of energy present at each trophic level in a given time or per unit area.

ii. The limitations of ecological pyramids are

a. It does not consider the same single species operating at two or more trophic levels.

b. It assumes simple food chains that do not exist m nature and do not accommodate food web.