

Solved Paper 2014

BIOLOGY

Time : 3 Hours

Class-XII

Max. Marks : 70

General Instructions :

- (i) There are a total of 30 questions and four sections in the question paper. All questions are compulsory.
- (ii) Section A contains question number 1 to 8, very short answer type questions of 1 mark each.
- (iii) Section B contains question number 9 to 18, short answer type-I questions of 2 marks each.
- (iv) Section C contains question number 19 to 27, short answer type-II questions of 3 marks each.
- (v) Section D contains question number 28 to 30, long answer type questions of 5 marks each .
- (vi) There is no overall choice in the question paper, however, an internal choice is provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks. In these questions, an examinee is to attempt any one of the two given alternatives.

Delhi Set I

Code No. 2/1/1

SECTION - A

- * 1. Write the name of the organisms that is referred to as the 'Terror of Bengal'. 1
- 2. What are 'true breeding lines' that are used to study inheritance pattern of traits in plants ? 1
- Ans. True breeding lines are those plants that have been generated through repeated self-pollination and have become homozygous for a particular trait. The trait is passed on to progenies if bred with another true breeding plant.
- 3. Name any two types of cells which act as a 'cellular barriers' to provide innate immunity in humans. 1
- Ans. Types of leucocytes like neutrophils, monocytes and natural killer cells (lymphocytes)
- 4. Mention the type of host cells suitable for the gene guns to introduce an alien DNA. 1
- Ans. Plant cells.
- 5. How is 'stratification' represented in a forest ecosystem ? 1
- Ans. Stratification is the vertical distribution of species, at different levels. Trees occupy vertical strata, shrubs the second layer and herbs / grasses occupy the bottom layers.
- * 6. Give an example of an organisms that enters 'diapause' and why ? 1
- 7. Identify 'a' and 'b' in the figure given below representing proportionate number of major vertebrate taxa. 1

	Tt (tall)	×	tt (dwarf)
	Ⓓ		Ⓣ
Ⓣ	Tt (tall)	tt (dwarf)	
Ⓣ	Tt (tall)	tt (dwarf)	

- Ans. (a) Mammals
(b) Amphibians

- * 8. State the cause of Accelerated Eutrophication. 1

SECTION - B

- * 9. Why do algae and fungi shift to sexual mode of reproduction just before the onset of adverse conditions ? 2
- 10. A cross was carried out between two pea plants showing the contrasting traits of height of the plants. The result of the cross showed 50% parental characters.
 - (i) Work out the cross with the help of a Punnett square.
 - (ii) Name the type of the cross carried out. 2

Ans. (i) $Tt \times tt$.

	Tt (tall)	×	tt (dwarf)
	Ⓓ		Ⓣ
Ⓣ	Tt (tall)	tt (dwarf)	
Ⓣ	Tt (tall)	tt (dwarf)	

- (ii) Test cross

11. How does the gene I control ABO blood groups in humans ? Write the effect the gene has on the structure of red blood cells. 2

Ans. In humans, the ABO blood groups are controlled by a gene called I. It has three alleles, namely I^A , I^B and i . A person possesses any two of the three alleles. I^A and I^B are dominant over allele i . But I^A and I^B are co-dominant as they express themselves equally and independently when present together. These three alleles yield six different combinations which give four type of blood groups. The allele pair $I^A I^A$ or $I^A i$ yield blood group A, $I^B I^B$ or $I^B i$ the blood group B, $I^A I^B$ is blood group AB, and ii is blood group O.

The plasma membrane of red blood cells has sugar polymers that protrude out from its surface and the kind of sugar is regulated by the gene I of ABO blood group. The alleles I^A and I^B produce A and B types of sugar, while i does not produce any sugar.

12. (i) Name the scientist who suggested that the genetic code should be made of a combination of three nucleotides.

(ii) Explain basis on which he arrived at this conclusion. 2

Ans. (i) George Gamow

(ii) A permutation combination of 43 ($4 \times 4 \times 4$) would generate 64 codons; generating many more codons than required. So, the codon need to be a triplet. Hence, in order to code for all the 20 amino acids, the code should be made up of three nucleotides.

*** 13. State the disadvantage of inbreeding among cattle. How can it be overcome ?** 2

14. Explain with the help of a suitable example the naming of a restriction endonuclease. 2

Ans. EcoRI.

Eco stands for the genus and species of the prokaryotic cell from which the enzyme was isolated i.e., *E. coli* R stands for strain.

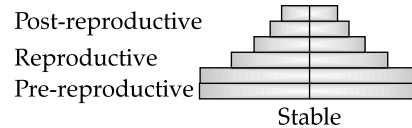
'I' following the names indicate the order in which enzyme was isolated.

15. State how has *Agrobacterium* is a bacterium been made a useful cloning vector to transfer DNA to plant cells. 2

Ans. The tumor inducing (Ti) plasmid of *Agrobacterium tumefaciens* is modified into a cloning vector which is not pathogenic to the plants but is able to use the mechanisms to deliver genes of our interest into plants. The Ti plasmid integrates a segment of its DNA, termed T-DNA into the chromosomal DNA of its host plant cells.

16. Construct an age pyramid which reflects a stable growth status of human population. 2

Ans.



17. Apart from being a part of the food chain, predators play other important roles. Mention any two such roles supported by examples. 2

Ans. (a) Predators keep prey populations under control.

Example: The prickly pear cactus introduced into Australia in the early 1920's caused havoc by spreading. Finally, the invasive cactus was brought under control only after a cactus-feeding predator (a moth) was introduced into the country.

(b) Predators maintain species diversity in a community, by reducing the intensity of competition among competing prey species.

Example: The starfish *Pisaster* is a predator in the rocky intertidal communities of the American Pacific Coast. In an experiment, when all the starfishes were removed from an enclosed intertidal area, more than 10 species of invertebrates became extinct within a year, due to interspecific competition.

18. How are 'sticky ends' formed on a DNA strand? Why are they so called ? 2

Ans. Restriction enzymes cut the strands of the DNA, a little away from the centre of the palindromic sites, but between the same two bases on opposite strands. This leaves single stranded portions at the ends. On each strands overhanging stretches are formed.

They are called 'sticky ends' because the stickiness of the ends facilitates the action of the enzyme DNA ligase to form hydrogen bonds with their complementary cut counterparts.

SECTION - C

19. Explain any three advantages the seeds offer to angiosperms. 3

Ans. Advantages of Seeds:

(i) The pollination and fertilisation processes are independent of water while the seed formation is more dependable.

(ii) Seeds have better adaptive strategies for dispersal to new habitats and help the species to colonise in other areas.

(iii) The hard seed coat protects the young embryo.

(iii) As seeds are the products of sexual reproduction, they generate new genetic combinations leading to variations.

(iv) The dehydration and dormancy of mature seeds are crucial for the storage of seeds. It can be used as food throughout the year and also to raise a crop in the next season. **(Any three)**

20. Name and explain the role of the inner and middle walls of the human uterus. 3

Ans. The middle wall is thick layer of smooth muscle, called myometrium.

Role: It exhibits strong contraction during delivery of the baby

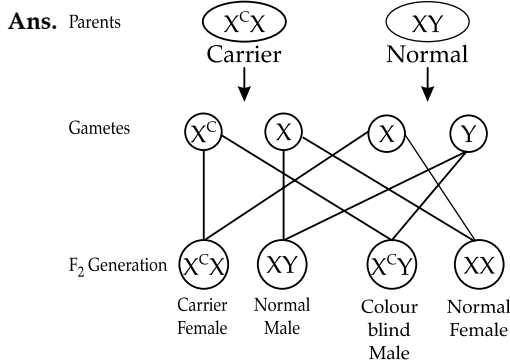
The inner wall is glandular layer, called endometrium.

Role: It undergoes cyclic changes during the menstrual cycle.

21. A colour-blind child is born to a normal couple. Work out a cross to show how it is possible. Mention the sex of this child. 3

OR

Mendel published his work on inheritance of characters in 1865, but it remained unrecognised till 1900. Give three reasons for the delay in accepting this work. 3



Hence, sex of the colour -blind child is male.

OR

Mendel's work remained unrecognized till 1900 because,

- (a) Communication was not easy.
- (b) His mathematical approach was new and unacceptable.
- (c) The concept of genes (factors) as stable and discrete units was not accepted. (Mendel could not explain the continuous variation seen in nature).
- (d) Mendel could not provide any physical proof for the existence of factors. (Any three)

22. Women are often blamed for producing female children. Consequently, they are ill-treated and ostracized. How will you address this issue scientifically if you were to conduct an awareness programme to highlight the values involved? 3

Ans. Scientifically it will be explained that:

- Human has 23 pairs of chromosomes in which 22 pairs are autosomes and 1 pair is sex chromosomes.
- A pair of X-chromosomes (XX) is present in the female whereas X and Y chromosomes are present in male.
- During spermatogenesis, the males produce two types of gametes, 50 % with X-chromosome and 50 % with Y-chromosome

- Females produce only ovum with an X-chromosome.
- There is an equal probability of fertilization of the ovum with the sperm carrying either X or Y chromosome.
- The sperm determines whether the offspring is male child or female child.
- So, female is not responsible for sex determination of child infact, male is responsible for producing female children.

* 23. (a) Name the tropical sugar cane variety grown in South India. How has it helped in improving the sugar cane quality grown in North India? 3

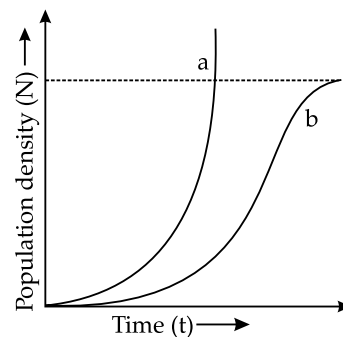
(b) Identify 'a', 'b' and 'c' in the following table:

No.	Crop	Variety	Insect Pests
1.	Brassica	Pusa Gaurav	(a)
2.	Flat been	Pusa Sem 2 Pusa Sem 3	(b)
3.	(c)	Pusa Sawani Pusa A-4	Shoot and fruit borer

* 24. Why are beehives kept in a crop field during flowering period? Name any two crop fields where this is practised. [3]

* 25. How did the process of RNA interference help to control the nematode from infecting roots of tobacco plants? Explain. 3

26. Study the graph given below and answer the questions that follow: 3



- (i) Write the status of food and space in the curves (a) and (b).
- (ii) In the absence of predators, which one of the two curves would appropriately depict the prey population?
- (iii) Time has been shown on X-axis and there is a parallel dotted line above it. Give the significance of this dotted line.

Ans. (i) (a) Unlimited food and space.

(b) Limited food and space.

(ii) Curve a

(iii) The dotted line represents carrying capacity / a given habitat has enough resources to support maximum possible number - beyond which no further growth is possible.

27. (i) What is primary productivity? Why does it vary in different types of ecosystems?

(ii) State the relation between gross and net primary productivity. 3

Ans. (i) Primary productivity: It refers to the amount of biomass or organic matter produced per unit area over a time period by the plants during photosynthesis.

It depends upon – plant species inhabiting a particular area, environmental factors, availability of nutrients, photosynthetic capacity of plants. Since no two ecosystem are exactly similar, their primary productivity would also be different.

(ii) $GPP - R = NPP$ where,
 NPP = Net Primary Productivity
 GPP = Gross Primary Productivity
 R = Respiration Losses

SECTION - D

28. (a) Coconut palm is monoecious, while date palm is dioecious. Why are they so called ?

(b) Draw a labelled diagram of sectional view of a mature embryo sac of an angiosperm. 5

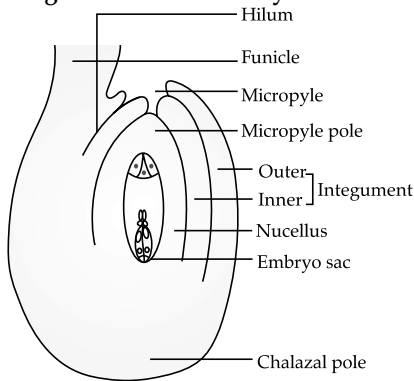
OR

(a) How is 'oogenesis' markedly different from 'spermatogenesis' with respect to the growth till puberty in the humans ?

(b) Draw a sectional view of human ovary and label the different follicular stages, ovum and Corpus luteum.

Ans. (a) Coconut plant produces unisexual male and female flowers on the same plant so it is called monoecious while date palm produces unisexual male and female flowers on separate plants.

(b) **Diagram of mature embryo sac of an angiosperm:**



OR

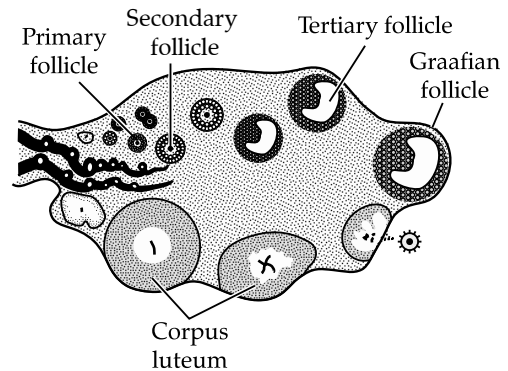
(a)

Spermatogenesis	Oogenesis
1. Male gametes (sperms) are formed from the sperm mother cells.	Female gametes (oocytes) from the oogonia.
2. Each primary spermatocyte gives four Sperms, after the second mitotic division.	Each primary oocyte gives only one ovum. Polar bodies are formed.

3. It begins at puberty.

It begins at embryonic stage and suspended at the time of birth. The remaining part takes place only after puberty.

(b) **A sectional view of human ovary:**



29. (a) Explain the process of DNA replication with the help of a schematic diagram.

(b) In which phase of the cell cycle does replication occur in Eukaryotes ? What would happen if cell-division is not followed after DNA replication ? 5

OR

(a) Explain Darwinian theory of evolution with the help of one suitable example. State the two key concept of theory.

(b) Mention any three characteristics of Neanderthal man that lived in near east and central Asia. 5

Ans. (a) (i) The process of DNA replication begins at a point called the origin of replication (ori), to form a replication fork.

(ii) The separated strands act as templates for the synthesis of new strands.

(iii) DNA replicates in the 5' → 3' direction.

(iv) dNTPs (Deoxyribonucleotide triphosphate) act as substrate and also provide energy for the polymerization of nucleotides.

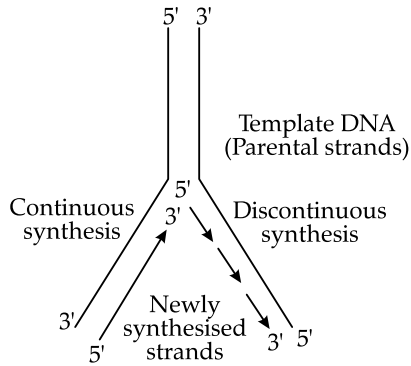
(v) DNA polymerase is an enzyme that assembles a new DNA strand that is complementary to the template strand.

(iv) DNA polymerase continues to move along the template strand and add new nucleotides to the growing or complementary strand until the entire genome is replicated.

(v) The DNA polymerase forms one new strand (leading strand) in a continuous stretch in the 5' → 3' direction (continuous synthesis).

(vi) The other new strand is formed in small stretches (Okazaki fragments) in the 5' → 3' direction (discontinuous synthesis).

(vii) The Okazaki fragments are then joined together to form a new strand by an enzyme, DNA ligase. This new strand is called the lagging strand. The function of DNA ligase is to join two nucleotides. During the DNA replication process, it joins Okazaki fragments together to form the complete DNA strand .



(b) DNA replication takes place in S-phase (Synthetic phase) of the cell cycle in eukaryotes. If this replication of DNA is not followed by cell division the DNA contents of the cell will get doubled i.e., duplicate set of DNA will be formed. This will result in autopolyploidy.

OR

(a) Darwinian theory of evolution:

- (i) According to Darwin, evolution took place by natural selection.
- (ii) The number of life forms depends upon the life span of the organisms and their ability to multiply.
- (iii) Another aspect of natural selection is the survival of the fittest, in which nature selects the individuals that are most fit to adapt to their environment.
- (iv) Darwin also observed that variations are inheritable and the species that fit to survive the most, leaves more offsprings. Hence, the population's characteristics change, giving rise to the evolution of new life forms.

An example of such selection is the antibiotic resistance in bacteria. When a bacterial population was grown on an agar plate containing antibiotic penicillin, the colonies that were sensitive to penicillin died, whereas one or a few bacterial colonies that were resistant to penicillin survived. This is because these bacteria had undergone chance mutation, which resulted in the evolution of a gene that made them resistant to penicillin drug. Hence the resistant bacteria multiplied quickly compared with the non-resistant (sensitive)

bacteria, thereby increasing their number. Hence, the advantage of an organism over the other helps in the struggle for existence.

The two key concepts of the theory are:

- (1) **Branching descent:** According to this concept, various species have come into existence from a common ancestor.
 - (2) **Natural selection:** According to this concept, nature selects the individuals that are most fit to adapt to their environment.
- (b) **Characteristics of Neanderthal man:**
- (i) They possess a brain capacity of 1300 – 1600 cc.
 - (ii) They were short but very strong with outward-curved thigh bones.
 - (iii) They used hides to protect their body. They buried their dead.
30. * (a) Name the technology that has helped scientists to propagate on a large scale the desired crops in a short duration. List the steps carried out to propagate the crops by the said technique.

* (b) how are somatic hybrids obtained ? 5

OR

- (a) Cancer is one of the most dreaded diseases of humans. Explain 'Contact inhibition' and 'Metastasis' with respect to the disease.
- (b) Name the group of genes which have been identified in normal cells that could lead to cancer and how they do so ?
- (c) Name any two techniques which are useful to detect cancers of internal organs.
- (d) Why are cancer patients often given α -interferon as part of the treatment ? 5

Ans. (a) Normal cells show a property called contact inhibition by virtue of which contact with other cells inhibits their uncontrolled growth. Cancer cells appears to have lost this property.

Tumour cells sloughed from malignant tumours reach distant sites, through blood and wherever they get lodged in the body, they start a new tumour there. This property is called metastasis.

- (b) Proto oncogenes. When activated under certain condition could lead to oncogenic transformation of the cells.
- (c) Biopsy / radiography / CT / MRI.
- (d) It activates immune system, destroys tumour

Delhi Set II

Code No. 2/1/2

Note: Except for the following questions, all the remaining questions have been asked in previous set.

SECTION - A

4. Name the two intermediate hosts which the human liver fluke depends on to complete its life cycle so as to facilitate parasitization of its primary host. 1

Ans. Terrestrial snail and fish are the two intermediate hosts on which the human liver fluke depends to complete its life cycle so as to facilitate parasitization of its primary host.

7. Mention how does DNA polymorphism arise in a population. 1

Ans. The mutations accumulate generation after generation and cause DNA polymorphism in a population.

SECTION - B

9. Name the organic materials the exine and intine of an angiosperm pollen grain are made up of. Explain the role of exine. 2

Ans. Exine is made up of sporopollenin.

Intine is made up of cellulose and pectin.

Role of exine:

- (i) Exine has sporopollenin, which can withstand high temperature, strong acids, alkalis and enzymes. Hence, it acts as a shield and protects the pollen grain from getting damaged.
- (ii) Exine does not form a continuous layer around the pollen grain. It is absent in certain sections at germ pores, where sporopollenin is absent. Germ pores, serves as an outlet for the formation of pollen tube.

* 13. How can healthy potato plants be obtained from a desired potato variety which is viral infected? Explain. 2

15. What is Biopiracy? State the initiative taken by the Indian Parliament towards it. 2

Ans. Biopiracy refers to the use of bio-resources by multinational companies and other organizations without proper authorisation from the countries and people concerned without any payment.

Indian Parliament has passed the second amendment of the Patent Bill, which deals with patent terms, emergency provisions and research and development initiatives.

18. Write the role of 'Ori' and 'restriction' site in a cloning vector pBR322. 2

Ans. **Ori:** It is a genetic sequence that acts as the initiation site for replication of DNA. Any fragment of DNA, when linked to the ori region, can be initiated to replicate.

Restriction site: It is the recognition site for restriction enzymes (such as *EcoRI*, *HindIII*, *PvuI* and *Bam HI*). Restriction or Recognition sites are the genetic sequences, generally palindromic sequences, from where the restriction enzymes cut the DNA.

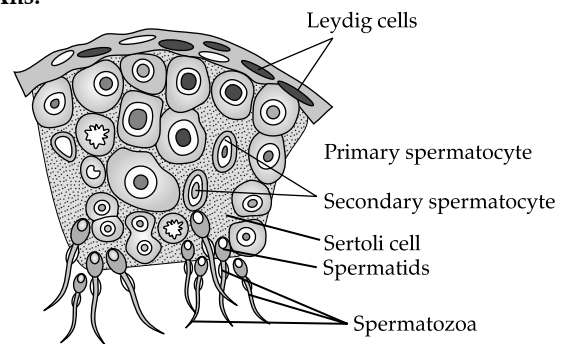
SECTION - C

* 20. A cross between a normal couple resulted in a son who was haemophilic and a normal daughter. In course of time, when the daughter was married to a normal man, to their surprise, the grandson was also haemophilic.

- (a) Represent this cross in the form of a pedigree chart. Give the genotypes of the daughter and her husband.
- (b) Write the conclusion you draw of the inheritance pattern of this disease. 3

22. Draw a labelled diagram of the sectional view of a human seminiferous tubule. (six parts to be labelled) 3

Ans.

**SECTION - D**

30. Explain the ovarian and uterine events that occur during a menstrual cycle in a human female, under the influence of Pituitary and Ovarian hormones respectively. 5

OR

- (a) Why does endosperm development precede embryo development in angiosperm seeds? State the role of endosperm in mature albuminous seeds.
- (b) Describe with the help of three labelled diagrams the different embryonic stages that include mature embryo of dicot plants. 5

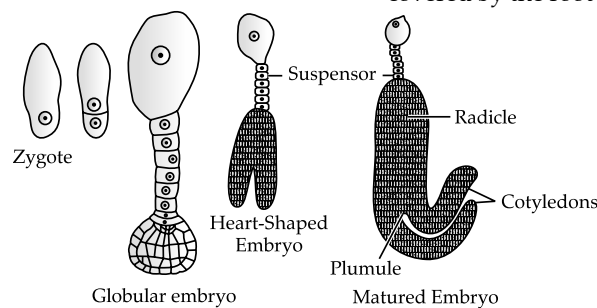
Ans. Menstrual cycle is the reproductive cycle in all primates and begins at puberty (menarche). In human females, menstruation occurs once in 28 to 29 days. The cycle of events starting from one menstrual cycle, one ovum is released (ovulation). The cycle starts with the menstrual flow (3 to 5 days), caused due to the breakdown of the endometrium of the uterus. Blood vessels in liquid state are discharged, but this occurs only when the ovum is not fertilised.

It is followed by the follicular phase where the primary follicles mature into Graafian follicles. This causes the regeneration of the endometrium. These changes are brought about by ovarian and pituitary hormones. In this phase, the release of gonadotropins (LH and FSH) increases. This causes follicular growth and the growing follicles produce oestrogen. The LH and FSH are at their peak in the middle of the cycle (14th day) and cause the rupture of the Graafian follicles to release ovum. This phase is called the ovulatory phase. The remains of the Graafian follicles get converted into the corpus luteum, which secretes progesterone for the maintenance of the endometrium. In the absence of fertilisation, the corpus luteum degenerates, thereby causing the disintegration of the endometrium and the start of a new cycle.

OR

Endosperm development precedes embryo development. The triploid primary endosperm nucleus (PEN) undergoes repeated mitotic divisions, without cytokinesis. At this stage of development, the endosperm is called free-nuclear endosperm. The cells of the endosperm store food materials, which are later used by the developing embryo.

The endosperm may be completely utilized by the developing embryo before the maturation of seeds as in pea, bean, groundnut etc. in non-albuminous or non-endospermic seeds. In albuminous or endospermic seeds, a portion of endospermic may remain in the mature seeds. e.g., castor.



Stages in embryo development in a dicot showing zygote and primary endosperm nucleus

(b) The embryo develops at the micropylar end of the embryo sac where the zygote is situated. The zygote divides into a larger cell called suspensor cell towards the micropylar end and a smaller cell called embryonal cell towards antipodal cells. The suspensor cell divides mitotically to form 6-10 celled structure called suspensor. The last suspensor cell is called hypophysis that forms radicle tip. The zygote divides mitotically and gives rise first to the pro-embryo, then to the globular and heart-shaped mature embryo. A typical dicot embryo consists of an embryonal axis and two cotyledons. The portion of the embryonal axis above the level of cotyledons is called epicotyl. It contains the plumule (shoot tip). The portion below the axis is called hypocotyl. It contains the radicle (root tip). The root tip is covered by the root cap.

Delhi Set III

Code No. 2/1/3

Note: Except for the following questions, all the remaining questions have been asked in previous set.

SECTION - A

3. How is repetitive satellite DNA separated from bulk genomic DNA for various genetic experiments? **1**

Ans. Density gradient centrifugation.

* 5. Name the Green House gases that contribute to total global warming. **1**

SECTION - B

12. What is gene therapy? Name the first clinical case where it was used? **2**

Ans. Gene therapy is the method of inserting genes into an individual cell or tissue to cure various genetic disorders. It is used to replace a defective gene with a functional one.

The first gene therapy method was used to cure the adenosine deaminase deficiency.

15. Why does Bt toxin not kill the bacterium that produces it, but kill the insect that ingests it? **2**

Ans. Crystals of Bt toxin produced by some bacteria do not kill the bacteria themselves because toxin protein exists as inactive protoxin in the host, but once the insect ingests the inactive toxin, it is

converted into active form of toxin, due to alkaline pH of the gut which solubilises the crystals, causing death of the insect.

17. Identify the following pairs as homologous or analogous organs:

- (i) Sweet potato and potato
- (ii) Eye of octopus and eye of mammals
- (iii) Thorns of *Bougainvillea* and tendrils of Cucurbits
- (iv) Fore limbs of bat and whale **2**

Ans. (i) Analogous (Sweet potato is modified root and Potato is modified stem).

(ii) Analogous (Eyes of Octopus is retina from skin and mammals retina from the embryonic brain).

(iii) Homologous

(iv) Homologous

18. List the post-fertilisation events in angiosperms **2**

Ans. (i) The development of endosperm and embryo

(ii) The maturation of ovule(s) into seed(s) and ovary into fruit

SECTION - C

21. What are Methanogens? Name the animals they are present in and the role they play there. **3**

Ans. Methanogens are group of bacteria which grow anaerobically on cellulosic material and produces large amount of methane. Present in cattle (rumen).

They help in:

- (a) Breaking down of cellulose.
- (b) Digestion of cellulose part of food, thereby releasing methane, CO₂ and H₂.

27. There are many animals that have become extinct in the wild but continue to be maintained in Zoological parks.

- (i) What type of biodiversity conservation is observed in this case ?
- (ii) Explain any other two ways that help in this type of conservation. 3

Ans. (i) It is an example of ex-situ conservation (off-site conservation). In this approach, threatened plants and animals are taken out of their natural habitat and placed into suitable settings and given special care.

(ii) Cryopreservation and tissue culture are two ways that help in ex-situ conservation. In cryopreservation, gametes of threatened species are preserved in viable and fertile conditions at subzero temperatures, which helps in preserving these cells for longer periods. In tissue culture, plants are propagated from a small mass of tissue called callus.

SECTION - D

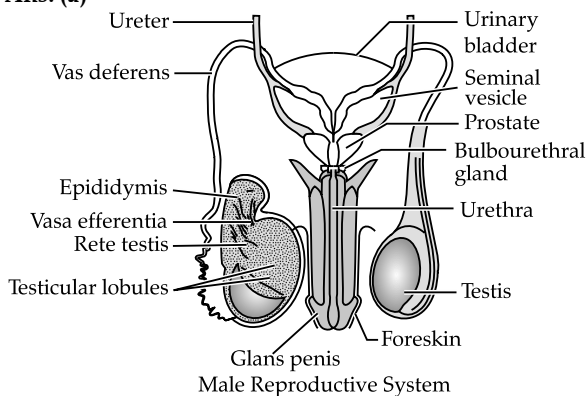
29. (a) Draw a labelled diagrammatic view of human male reproductive system.

- (b) Differentiate between:
 - (i) Vas deferens and vasa efferentia
 - (ii) Spermatogenesis and spermiogenesis 5

OR

- (a) Explain the phenomenon of double fertilization.
- (b) Draw a labelled diagram of a typical anatropous ovule. 5

Ans. (a)



(b) (i)

S.No.	Vas deferens	Vasa efferentia
(i)	They are long and curved tubes.	They are short and straight tubes.
(ii)	They develop from cauda epididymis.	They develop from rete testis.
(iii)	They are broader and muscular.	They are narrower and delicate.
(iv)	They conduct sperm through muscular activity.	Sperm conduction takes place by ciliary current,

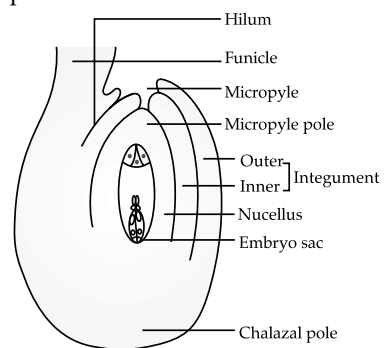
(ii) Spermatogenesis is a process of formation of haploid spermatozoa from germinal cells while spermiogenesis is a process of differentiation of spermatozoa into a spermatid. Here, a spermatid forms a single spermatozoon.

OR

(a) After entering one of the synergids, the pollen tube releases the two male gametes into the cytoplasm of the synergid. One of the male gametes moves towards the egg cell and fuses with its nucleus thus completing the syngamy. This results in the formation of a diploid cell, the zygote. The other male gamete moves towards the two polar nuclei located in the central cell and fuses with them to produce a triploid primary endosperm nucleus (PEN).

As this involves the fusion of three haploid nuclei, it is termed triple fusion. Since two types of fusions, syngamy and triple fusion take place in an embryo sac, the phenomenon is termed double fertilisation.

(b)



A diagrammatic view of typical anatropous ovule

Outside Delhi Set I

Code No. 2/1/1

SECTION - A

1. Name the part of the flower which the tassels of the corn-cob represent. 1

Ans. The tassels of corn cob are stamens so, they represent the male reproductive parts.

2. Mention any two contrasting traits with respect to seeds in pea plant that were studied by Mendel. 1

Ans. The two contrasting traits with respect to seeds in pea plant that were studied by Mendel.

- (i) Seed shape - Round and wrinkled
- (ii) Seed colour- Yellow and green.

3. Why is secondary immune response more intense than the primary immune response in human ? 1

Ans. During the first encounter of a pathogen; our body produces a primary response in low intensity however, body will have memory of the first encounter of antibodies developed during primary immune response; hence, the second encounter with the same pathogen produces a secondary (anamnestic) response in high intensity.

4. Why is it not possible for an alien DNA to become part of a chromosome anywhere along its length and replicate normally ? 1

Ans. Alien DNA must be linked to ori / origin of replication site to start replication.

5. State the role of C peptide in human insulin. 1

Ans. C-peptide is an extra stretch of polypeptide. It makes the insulin inactive.

6. Name the enzymes that are used for the isolation of DNA from bacterial and fungal cells for recombinant DNA technology. 1

Ans. The enzyme used from bacterial cells and fungal cells are lysozyme and chitinase, respectively.

7. State Gause's Competitive Exclusion Principle. 1

Ans. Gause's 'Competitive Exclusion Principle states that 'two closely related species competing for the indefinitely and the competitively inferior one will be eliminated eventually'.

8. Name the type of association that the genus *Glomus* exhibits with higher plants. 1

Ans. Fungi *Glomus*, form symbiotic association (mycorrhiza) with higher plants.

SECTION - B

9. Why are the human testes located outside the abdominal cavity ? Name the pouch in which they are present. 2

Ans. Testes are located outside the abdominal cavity within a sac called scrotal sac or scrotum. Scrotum keeps the testes temperature at 2°C lower than the body temperature. The lower temperature is required for proper functioning of testes and for spermatogenesis.

10. In Snapdragon, a cross between true-breeding red flowered (RR) plants and true-breeding white flowered (rr) plants showed a progeny of plants with all pink flowers.

(a) The appearance of pink flowers is not known as blending. Why ?

(b) What is this phenomenon known as ? 2

Ans. (a) The appearance of pink flowers is not blending because of none of the alleles exert full dominance and the offspring resemble a mixture of the two phenotypes.

(b) This phenomenon is known as incomplete dominance.

11. With the help of one example, explain the phenomena of co-dominance and multiple allelism in human population. 2

Ans. ABO blood group in human being is an example of multiple allelism.

Three alleles for the gene I i.e. I^A, I^B, i .

When I^A and I^B , are present together the blood group is AB.

Both A and B are expressed and is called co-dominance.

12. Write the scientific name of the fruit-fly. Why did Morgan prefer to work with fruit-flies for his experiments ? State any three reasons. 2

OR

Linkage and crossing-over of genes are alternative of each other. Justify with the help of an example. 2

Ans. *Drosophila melanogaster*

Morgan preferred to work with fruit flies because of the following reasons:

- (a) It can be grown on simple synthetic medium.
- (b) It can complete its life cycle within two weeks i.e., it has short life cycle.
- (c) Single mating produce more progenies.
- (d) It shows dimorphism and many heritable variations.
- (e) It is easy to handle. (Any three)

OR

In *Drosophila*, a yellow bodied white eyed female was crossed with brown bodied red eyed male, F1 progeny were produced and intercrossed.

The F2 phenotypic ratio of *Drosophila* deviated significantly from Mendel's 9 : 3 : 3 : 1. The genes for eye colour & body colour are closely located on the 'X' chromosome showing linkage & therefore inherited together, recombinants were formed due to crossing over but at low percentage.

13. List the symptoms of Ascariasis. How does a healthy person acquire this infection ? 2

Ans. **Symptoms:** Internal bleeding, muscular pain, fever, anaemia and blockage of intestinal passage.

A healthy person acquire this infection through soil, water, vegetables, fruits, etc., contaminated with faeces, containing eggs of parasites.

14. Explain the significant role of the genus *Nucleopolyhedrovirus* in an ecological sensitive area. 2

Ans. *Nucleopolyhedrovirus* are good biocontrol agents. They can be used in an ecological sensitive area because they:

- (a) control only species specific pests,
- (b) do not affect non target organisms so, beneficial insects are conserved.
- (c) aid in IPM problems
- (d) have no negative impact on plants or other animals.

15. How does a restriction nucleases function ? Explain. 2

Ans. They are of two types of restriction nucleases: endonuclease and exonuclease. Exonucleases

remove nucleotides from the ends of the DNA. Endonucleases make cuts at specific positions within the DNA.

16. How have transgenic animals proved to be beneficial in: 2

(a) Production of biological products,

(b) Chemical safety testing.

Ans. (a) Production of biological products: Transgenic animals are used to produce useful biological products by introducing genes which codes for a particular product. Examples : Human protein (a-1-antitrypsin)

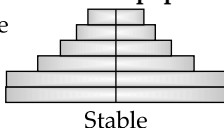
(b) Chemical Safety Testing: Transgenic animals are made to carry genes which make them more sensitive to toxic substances than non-transgenic animals. Then they are exposed to the toxic substances and the effects studied. It gives immediate results.

17. Describe the mutual relationship between fig tree and wasp and comment on the phenomenon that operates in their relationship. 2

Ans. The relationship between fig tree and wasp is mutualistic co-evolution. The fig species is pollinated only by its 'partner' wasp species and no other species. The female wasp pollinates the fig inflorescence while searching for suitable egg-laying sites in fruits. The fig offers the wasp some developing seeds, as food for the wasp larvae.

18. Construct an age pyramid which reflects an expanding growth status of human population. 2

Ans. Post-reproductive
Reproductive
Pre-reproductive



Stable

SECTION - C

19. Make a list of any three outbreeding devices that flowering plants have developed and explain how they help to encourage cross-pollination? 3

OR

Why are angiosperm anther called dithecous? Describe the structure of its microsporangium. 3

Ans. Flowering plants have developed many devices to discourage self-pollination and to encourage cross-pollination. Such out-breeding devices are as follows:

22. Identify 'a', 'b', 'c', 'd', 'e', and 'f' in the table given below: 3

No.	Syndrome	Cause	Characteristics of affected individuals	Sex Male/Female/Both
1.	Down's	Trisomy of 21	'a' (i) (ii)	'b'
2.	'c'	XXY	Overall masculine development	'd'
3.	Turner's	45 with XO	'e' (i) (ii)	'f'

(i) Avoiding synchronisation: In some species, pollen release and stigma receptivity are not synchronised. Either the pollen is released before the stigma becomes receptive or stigma becomes receptive before the release of pollen. It prevents autogamy.

(ii) Arrangement of anther and stigma at different positions: In some species, the arrangement of anther and stigma at different positions prevents autogamy.

(iii) Self-incompatibility: It is a genetic mechanism that prevents pollen of one flower from germinating on the stigma of the same flower.

OR

Angiosperm anthers are called dithecous because its anthers are bilobed that is, each lobe has two theca.

Structure of Microsporangium:

(i) Microsporangium is surrounded by four wall layers named as epidermis, endothecium, middle layer and tapetum.

(ii) In young anther, a group of compactly arranged homogenous cells called sporogenous tissue occupies the center of each microsporangium which produce microspores/pollen grains.

20. If implementation of better techniques and new strategies are required to provide more efficient care and assistance to people, then why is there a statutory ban on amniocentesis? Write the use of this technique and give reason to justify the ban. 3

Ans. Amniocentesis is a prenatal diagnostic technique that is used to determine the sex and metabolic disorders of the developing foetus in the mother's uterus through the observation of the chromosomal pattern. This method was developed so as to determine any kind of genetic disorder present in the foetus.

There is statutory ban on amniocentesis to check increasing female foeticides because this test can be used for determining the sex of the foetus.

*** 21. Why is pedigree analysis done in the study of human genetics? State the conclusions that can be drawn from it.** 3

Ans. (a) Short statured / small round head / furrowed tongue / partially open mouth / palm is broad / physical development retarded / psychomotor development retarded / mental development retarded. **(Any two)**

(b) Both / male and female

(c) Klinefelter's syndrome

(d) Male

(e) Sterile ovaries / rudimentary ovaries, lack of secondary sexual characters.

(f) Female

23. Community service department of your school plans a visit to a slum area near the school with an objective to educate the slum dwellers with respect to health and hygiene.

(a) Why is there a need to organise such visits ?

(b) Write the steps you will highlight, as a member of this department, in your interaction with them to enable them to lead a healthy life. 3

Ans. (a) There is a need to organize visits to slums to educate and raise awareness about importance of hygiene among the people living there.

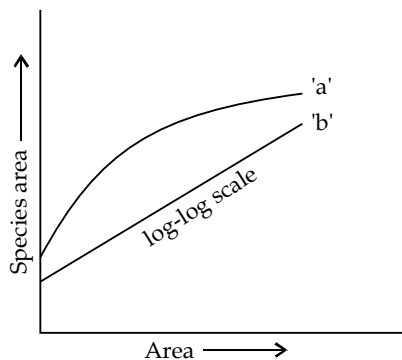
(b) The steps to be highlighted while interacting with the slum people to enable them to lead a healthy life are:

(1) Personal hygiene: Cleanliness, Keeping the body clean, balanced diet, Use clean drinking water, food etc, Regular exercise, etc.

(2) Public hygiene: Proper disposal of wastes and excreta, Periodic cleaning and disinfection of water reservoirs and tanks, Awareness about the disease and their effect, etc

(3) Methods to Control Breeding Places: Avoid stagnation of water, Regular cleaning of household cooler, Use of mosquito nets, Spraying insecticides in ditches, drainage and swamps, etc.

24. The following graph shows the species-area relationship. Answer the following questions as directed. 3



(a) Name the naturalist who studied the kind of relationship shown in the graph. Write the observations made by him.

(b) Write the situations as discovered by the ecologists when the value of 'Z' (slope of the line) lies between (i) 0.1 and 0.2 (ii) 0.6 and 1.2.

What does 'Z' stand for ?

(c) When would the slope of the line 'b' become steeper ?

Ans. (a) Alexander Von Humboldt.

Observations: Within a region, species richness increases with increasing explored area but only up to a limit. Relationship between species richness and area for a wide variety of taxa turns out to be rectangular hyperbola.

(b) (i) The slopes of regression lines are similar / unaffected distribution in an area / normal range.

(ii) The slope of regression is steeper when we analyse the species area relationship among very large areas like entire continent.
Z (slope of the line) is regression coefficient.

(c) The slope of the line 'b' become steeper when extremely large areas are studied for species-area relationship.

25. Name and describe the technique that helps in separating the DNA fragments formed by the use of restriction endonuclease. 3

Ans. The technique is Gel electrophoresis.

Since, DNA fragments are negatively charged, they move towards anode, under the influence of an electric field. With the help of the gel electrophoresis technique, DNA fragments get separated according to size through the pores of agarose gel.

*** 26. State the function of a reservoir in a nutrient cycle. Explain the simplified model of carbon cycle in nature.** 3

27. Since the origin of life on Earth, there were five episodes of mass extinction of species. 3

(i) How is the 'Sixth Extinction', Presently in progress, different from the previous episodes ?

(ii) Who is mainly responsible for the 'Sixth Extinction'?

(iii) List any four points that can help to overcome this disaster.

Ans. (i) The rates are faster / accelerated / current species extinction rate are estimated to be 100-1000 times faster than in the pre-human times.

(ii) Human activities.

(iii) (a) Preventing habitat loss and fragmentation.

(b) Checking over exploitation.

(c) Preventing alien species invasion.

(d) Preventing co-extinction.

(e) Conservation / Preservation of species.

(Any four)

SECTION - D

28. (a) Where does fertilization occur in humans ? Explain the events that occur during this process.
- (b) A couple where both husband and wife are producing functional gametes, but the wife is still unable to conceive, is seeking medical aid. Describe any one method that you can suggest to this couple to become happy parents. 5

OR

- (a) Explain the different ways apomictic seeds can develop. Give an example of each.
- (b) Mention one advantage of apomictic seeds to farmers.
- (c) Draw a labelled mature stage of a dicotyledonous embryo. 5

Ans. (a) Fertilisation occurs in Ampullary- isthmus junction of the fallopian tube.

The events that occur during fertilisation are:

- On the 14th day of menstrual cycle, ovulation occurs.
- This secondary oocyte is caught by fimbriae and it starts moving up the fallopian tube.
- In the meantime, sperm which has been deposited in vagina will start moving up and reach the fallopian tube.
- The two gametes meet at ampullary isthmus junction and fuse together.
- After entry of sperm, secondary oocyte completes its meiosis II, changes into ovum and fuse with the sperm pronuclei leading to zygote formation thereby completing the process of fertilization.

(b) Methods (IVF/ZIFT/AI):

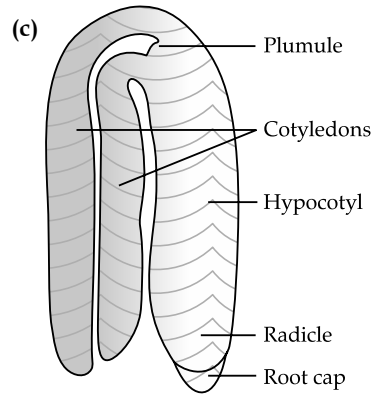
IVF: Ova from wife and sperm from the husband is collected. It is induced to form zygote under laboratory conditions.

ZIFT: Zygote or early embryo are then transferred to the fallopian tube (ZIFT) or into uterus (IUT) to complete further development.

AI: Semen collected from the husband is artificially introduced either into the vagina or into the uterus (IUI) of the wife. (Any one)

OR

- (a) There are several ways of development of apomictic seeds. In some species, the diploid egg cell is formed without reduction division and develops into the embryo without fertilisation. More often, as in many Citrus and Mango varieties some of the nucellar cells surrounding the embryo sac start dividing, protrude into the embryo sac and develop into the embryos. It produces diploid embryo sac through mitotic division.
- (b) Desired traits can be maintained without losing superiority of hybrids over parents. Farmers can replant these seeds year after year.



29. (a) Describe the various steps of Griffith's experiment that led to the conclusion of the 'Transforming Principle'.

(b) How did the chemical nature of the 'Transforming Principle' get established ? 5

OR

Describe how the *lac* operon operates, both in the presence and absence of inducer in *E.coli*.

Ans. (a) Griffith's experiment: Griffith used mice and *Streptococcus pneumoniae* for his experiment.

Streptococcus pneumoniae has two strains:

- Smooth (S) strain (virulent):** It has a polysaccharide mucus coat and can cause pneumonia.
- Rough (R) strain (Non-virulent):** It has no mucous coat and therefore does not cause pneumonia.

To test for the trait of pathogenicity, Griffith injected mice with mixes of the two strains:

- S-strain → Inject into mice → Mice die
- R-strain → Inject into mice → Mice live
- S-strain (Heat killed) → Inject into mice → Mice live
- S-strain (Heat killed) + R-strain (live) → Inject into mice → Mice die

He concluded that some 'transforming principle', transferred from heat-killed S-strain to R-strain. It enabled R-strain to synthesize smooth polysaccharide coat and become virulent. This must be due to the transfer of some genetic material.

(b) Oswald Avery, Colin Macleod and McCarty worked to determine the biochemical nature of 'transforming principle' in Griffith's experiment. They purified biochemicals (proteins, DNA, RNA etc.) from the heat-killed S cells to see which ones could transform live R cells into S cells.

They discovered that:

- Digestion of protein and RNA (using Proteases and RNases) did not affect transformation. So

the transforming substance was not a protein or RNA.

- (ii) Digestion of DNA with DNase inhibited transformation. It means that DNA caused transformation of R cells to S cells i.e., DNA was the transforming substance. Therefore they concluded that DNA is the hereditary material.

OR

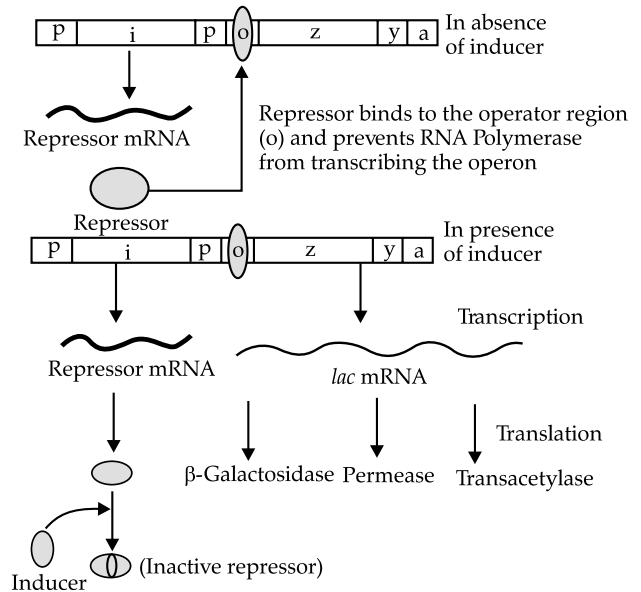
In lac operon, lactose acts as an inducer. The lactose is transported into the E. coli cells by the action of permease.

(a) In the presence of lactose (inducer):

Lactose (inducer) binds with repressor protein and inactivates it. So repressor protein cannot bind to operator gene. The operator gene becomes free and induces the RNA polymerase to bind with promoter gene. Hence, three structural genes express their product and respective enzymes are produced. These enzymes act on lactose so that lactose is metabolized into glucose and galactose.

(b) In the absence of lactose (inducer):

When the level of inducer decreases as it is completely metabolised by enzymes, it causes synthesis of repressor from repressor gene. The repressor binds to the operator gene and blocks RNA polymerase from transcribing the operon. Hence, the transcription is stopped. This type of regulation is known as negative regulation.



5

- * 30. With advancements in genetics, molecular biology and tissue culture, new traits have been incorporated into crop plants.

Explain the main steps in breeding a new genetic variety of a crop. 5

OR

- (a) State the objective of animal breeding.
- (b) List the importance and limitations of inbreeding. How can the limitations be overcome?
- (c) Give an example of new breed each of cattle and poultry. 5

Outside Delhi Set II

Code No. 2/1/2

Note: Except for the following questions, all the remaining questions have been asked in previous set.

SECTION - A

- 1. Why is *Gambusia* introduced into drains and ponds? 1

Ans. *Gambusia* fish are introduced into drains and ponds to kill the larvae of mosquitoes.

- 7. Why are analogous structures a result of convergent evolution? 1

Ans. Analogous structures are a result of convergent evolution because they are not anatomically similar in structures though they perform similar functions.

- * 8. Name the vegetative propagules in the following:

- (a) Agave 1
- (b) Bryophyllum 1

SECTION - B

- 11. State the difference between the structural gene in a Transcription Unit of Prokaryotes and Eukaryotes. 2

Ans.

	Prokaryotes	Eukaryotes
(i)	Polycistronic	Monocistronic
(ii)	No split genes/ No interrupted coding sequences	Split genes / interrupted coding sequences exon and intron

- 13. Write the location and function of the following in human testes:

- (a) Sertoli Cells
- (b) Leydig Cells 2

Ans. (a) Sertoli cells are present in the seminiferous tubules of the testis.

They provide nutrition to the germ cells.

(b) Leydig cells are located in the interstitial spaces between the seminiferous tubules.

They synthesise and secrete androgens in man.

SECTION - C

21. A woman has certain queries as listed below, before starting with contraceptive pills. Answer them. 3

(a) What do contraceptive pills contain and how do they act as contraceptive ?

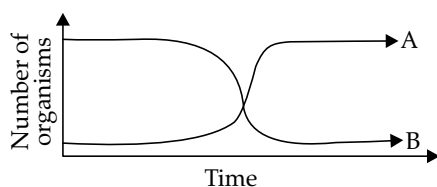
(b) What schedule should be followed for taking these pills ?

Ans. (a) Contraceptive pills contain hormones either progestogens or progestogen-estrogen combinations.

The contraceptives pills inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent or retard entry of sperms.

(b) Pills have to be taken daily for a period of 21 days preferably within the first five days of menstrual cycle. After a gap of 7 days, (during which menstruation occurs) it has to be repeated in the same pattern till the female desires to prevent conception. $1\frac{1}{2}+1\frac{1}{2}$

* 24. 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 fertilizers. 3



26. Explain, giving three reasons, why tropics show greatest levels of species diversity. 3

Ans. Tropics show greatest levels of species diversity because:

- They had more evolutionary time.
- Relatively constant environment (less seasonal).
- They receive more solar energy which contributes to greater productivity.

SECTION - D

28. Describe the Hershey and Chase experiment. Write the conclusion drawn by the scientists after their experiment. 5

Ans. Hershey and Chase made two preparations of bacteriophage - In one, proteins were labelled with ^{35}S by putting in a medium containing radioactive sulphur (^{35}S). In the second, DNA was labelled with ^{32}P by putting in a medium containing radioactive Phosphorous (^{32}P).

These preparations were used separately to infect *E. coli*. After infection, the *E. coli* cells were gently agitated in a blender to separate the phage particles from the bacteria. Then the culture was centrifuged. Heavier bacterial cells were formed as a pellet at the bottom. Lighter viral components outside the bacterial cells remained in the supernatant.

They found that,

- Supernatant contains viral protein labelled with ^{35}S , that is, the viral protein had not entered the bacterial cells.
- The bacterial pellet contains radioactive ^{32}P . This shows that viral DNA labelled with ^{32}P had entered the bacterial cells. This proves that DNA is the genetic material.

Outside Delhi Set III**Code No. 2/1/3**

Note: Except for the following questions, all the remaining questions have been asked in previous set.

SECTION - A

2. Name the stage of cell division where segregation of an independent pair of chromosomes occurs. 1

Ans. Anaphase-1 of Meiosis-1.

* 3. Write an alternate source of protein for animal and human nutrition. 1

4. Give an example of a plant which came into India as a contaminant and is a cause of pollen allergy. 1

Ans. Parthenium, also known as carrot grass or congress grass a invasive species in India, which is the major cause of allergy in India.

SECTION - B

16. Explain the two factors responsible for conferring stability to double helix structure of DNA. 2

Ans. Factors conferring stability to Double Helical Structure of DNA are: 2

- Complementarity of the two strands of DNA due to complementary nitrogenous bases which form strong hydrogen bonds with each other. Adenine forms two hydrogen bonds with thymine and cytosine form 3 hydrogen bonds with guanine.
- The base pairs are stacked with their planes one over the other in the double helical structure which provides extra stability. Also, DNA is less reactive due to absence of reactive —OH group at 2' carbon. Evolution of a process of repairs which prevents their degradation and presence of thymine instead of uracil being more stable as nitrogenous base also provide stability to double helical structure of DNA.

18. Write the effect of the high concentration of L.H. on a mature Graafian follicle. 2

Ans. The high concentration of LH causes the rupturing of Graafian follicle and ovulation, that is, release of ovum into the fallopian tube.

SECTION - C

24. (a) Explain adaptive radiation with the help of suitable example.

(b) Cite an example where more than one adaptive radiations have occurred in an isolated geographical area. Name the type of evolution your example depicts and state why it is so named.

3

Ans. (a) Darwin during his journey to Galapagos Islands observed that there were many varieties of small black birds later called Darwin's finches.

(i) All the varieties he conjectured, evolved on the island itself.

(ii) From the original seed-eating features, many other forms with altered beaks arose, enabling them to become insectivorous and vegetarian finches.

This process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats) is called adaptive radiation.

(b) Australian marsupials and placental mammals. A number of marsupials, each different from the other evolved from an ancestral stock, but all within the Australian island continent. Placental mammals in Australia also exhibit adaptive radiation in evolving into varieties of such placental mammals, each of which appears to be 'similar' to a corresponding marsupial (e.g., Placental wolf and Tasmanian wolf).

Convergent evolution: This is because, more than one adaptive radiation has occurred in isolated geographical area

25. (a) Name any two copper releasing IUDs.

(b) Explain how do they act as effective contraceptives in human females.

3

Ans. (a) Cu-T, and Multiload 375 are copper releasing IUDs.

(b) The Copper-releasing iIUD's prevents pregnancy in the following ways:

(i) By increasing phagocytosis of sperms within the uterus.

(ii) By suppressing sperm motility and thereby the fertilizing ability.

(iii) By making the uterus unsuitable for implantation.

(iv) By making the cervix hostile to sperms.

* 27. (a) State how the constant internal environment is beneficial to organisms.

(b) Explain any two alternatives by which organisms can overcome stressful external conditions.

3

SECTION - D

28. Explain the process of sewage water treatment before it can be discharged into natural water bodies. Why is this treatment essential.

5

OR

Explain the process of replication of a retrovirus after it gains entry into the human body.

5

Ans. Sewage treatment involves the following phases:

(i) **Primary Treatment:** In this, physical particles like debris and soil, sand, silt etc., are removed by: (a) sequential filtration (b) sedimentation. The substances that settle down forms primary sludge and the effluent is primary effluent.

(ii) **Secondary Treatment:** Biological treatment in which primary effluent is passed to large aeration tanks and is constantly agitated and supplied with air/O₂. This causes the vigorous growth of flocs or association of useful aerobic bacteria and fungal filaments into a mesh-like structure. In this process, the microbes use up organic matter in the polluted water and hence reduce the BOD (Biological Oxygen Demand). Once the BOD is significantly reduced, it is allowed to pass to a settling tank where flocs are allowed to settle down. This sediment is called activated sludge. A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum.

The water treatment is essential because when the large amount of sewage water enters into natural bodies; like, ocean, sea, river, etc, it reduces the amount of free oxygen this causes suffocation for aquatic fauna thereby killing aquatic life. Moreover, some microbes are fatal for life hence, human health and the environment are mainly affected by the direct disposal of industrial and human effluents into natural resources without any treatment.

OR

After getting into the body of the person, the virus enters into macrophages where RNA genome of the virus replicates to form viral DNA with the help of the enzyme reverse transcriptase. This viral DNA gets incorporated into host cell's DNA and directs the infected cells to produce virus particles. The macrophages continue to produce virus and acts like a HIV factory. Simultaneously, HIV enters into helper T-lymphocytes (TH), replicates and produce progeny viruses. The progeny viruses released in the blood attack other helper T-lymphocytes. This is repeated leading to a progressive decrease in the number of helper T-lymphocytes in the body of the infected person. During this period, the person suffers from bouts of fever, diarrhoea and weight loss. Due to decrease in the number of helper T-lymphocytes, the person starts suffering from infections. The patient becomes so immunodeficient that he/she is unable to protect himself/herself against infections.

