CLASS XII (2019-20)
BIOLOGY (044)
SAMPLE PAPER-1

Time : 3 Hours **Maximum Marks : 70**

General Instructions :

- There are a total of 27 questions and five sections in the question paper. All questions are compulsory.
- Section A contains question numbers 1 to 5, multiple choice questions of one mark each.
- Section B contains question numbers 6 to 12, short answer type I questions of two marks each.
- Section C contains question numbers 13 to 21, short answer type II questions of three marks each.
- Section D contains question numbers 22 to 24, case-based short answer type questions of three marks each.
- Section E contains question numbers 25 to 27, long answer type questions of five marks each.
- There is no overall choice in the question paper. However, internal choices are provided in two questions of one mark, one question of two marks, two questions of three marks and all three 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.

Section A

1. In majority of sexually reproducing organisms, the gametes are [1]

(a) isogametes (b) homogametes

(c) hemigametes (d) heterogametes

Ans : (d) heterogametes

or

Autogamy is defined as the

(a) transfer of pollen grains from the anther to the stigma of the same flower

(b) transfer of pollen grains from the anther to the stigma of the different flower

(c) maturation of anther and stigma at different times

(d) dehiscence of anther and release of pollen grains

Ans : (a) transfer of pollen grains from the anther to the stigma of the same flower

2. Activated sludge should have the ability to settle quickly so that it can [1]

(a) be rapidly pumped back from sedimentation tank to aeration tank

(b) be discarded and anaerobically digested

(c) absorb colloidal organic matter

(d) absorb pathogenic bacteria present in waste water while sinking to the bottom of the settling tank

Ans : (a) be rapidly pumped back from sedimentation tank to aeration tank

or

AIDS is caused by HIV. Among the following, which are the modes of transmission of HIV ?

(i) Transfusion of contaminated blood

(ii) Shaking hands with infected people

(iii) Sexual contact with infected people

(iv) Sharing of food with infected people

Choose the correct answer from the options given below

(a) (ii) and (iv) (b) (i) and (iii)

(c) (ii) and (iii) (d) (i) and (ii)

Ans : (b) (i) and (iii)

3. A bacterial cell was transformed with a recombinant DNA that was generated using a human gene. However, the transformed cell did not produce the desired protein. Reason could be [1]

(a) human protein is formed but degraded by bacteria

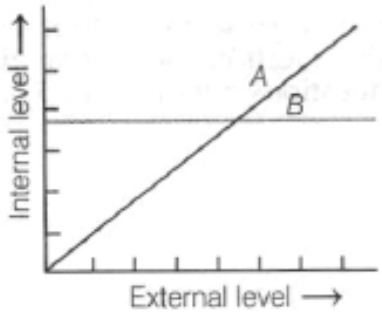
(b) human gene may have intron which bacteria cannot process

(c) amino acid codons for humans and bacteria are different

(d) All of the above

Ans : (b) human gene may have intron which bacteria cannot process

4. Identify organisms A and B that are shown in the diagram of organismic response below [1]



(a) Organism A- Conformer; Organism B- Regulator

(b) Organism A- Regulator; Organism B- Partial regulator

(c) Organism A- Conformer; Organism B- Partial regulator

(d) Organism A- Partial regulator; Organism B - Conformer

Ans : (a) Organism A- Conformer; Organism B - Regulator

5. An antibiotic resistance gene in a vector usually helps in the selection of [1]

(a) recombinant cells (b) competent cells

(c) transformed cells (d) None of these

Ans : (c) transformed cells

Section B

6. A lake near a village is suffering from heavy mortality of fishes within the last few days. Consider the following reasons for this. [2]

I. Lots of urea and phosphate fertilisers were used in the crops in the vicinity.

II. The area was sprayed with DDT by an aircraft.

III. The lake water turned green and stinky.

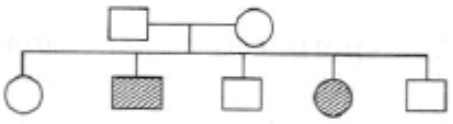
IV. Phytoplankton populations in the lake declined initially thereby greatly reducing photosynthesis.

Which of the above given reasons can be reconciled together to explain the main cause of fish mortality in the lake?

Ans :

Statements I and III are the most probable reasons of fish mortality in the lake. Due to continuous addition of phosphate, nitrate and urea rich agricultural run offs, the lake become nutrient enriched. Such water bodies are highly productive and support a dense growth of plants and algae. The extensive increase of algal growth imparts a distinct green colour to the water body (algal bloom). These blooms cause deterioration of the water quality leading to fish mortality.

7. The pedigree chart given below shows a particular trait which is absent in parents but present in the next generation irrespective of sexes. Draw your conclusion on the basis of the pedigree. [2]



Ans :

The pedigree chart shows that the trait is autosome-linked and recessive in nature. But, the parents are carriers (i.e. heterozygous) hence, among the offspring, only few show the trait irrespective of sex. The other offspring are either normal or carrier.

8. Sterilisation techniques are generally considered as the full proof contraceptive method with least side effects. Then, why couples keep this as the last option for contraception? [2]

Ans :

Surgical methods or sterilisation techniques are generally opted by the male or female partners as a terminal method to prevent any further pregnancies. This method is used as a last option for contraception because

(i) it is almost irreversible.

(ii) it involves surgical procedure which many are unwilling to undergo.

9. A haploid organism produces gametes by mitosis. Does that mean, meiosis never occurs in such organisms? Explain. [2]

Ans :

In haploid organisms, gametes are produced by mitotic division. In such organisms, meiosis occurs during the development of zygote. It is the only diploid stage (formed by the fusion of two haploid gametes) in the life cycle of a haploid organism that can undergo meiosis. Thus, meiosis may also occur in such organisms.

or

Human placenta acts as a structural and functional unit between the foetus and maternal body. Explain the statement by giving any two basic functions it performs.

Ans :

Human placenta acts as a structural and functional unit between the foetus and maternal body. It forms an intimate vascular connection between them and performs many important functions. Some of them are as follows

(i) It facilitates the supply of oxygen and nutrients to the embryo.

(ii) It secretes hormones that are necessary to maintain pregnancy, e.g. hCG, hPL, oestrogen, progesterone, etc.

10. 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 sticky single-stranded position at the ends. These overhanging stretches are called sticky ends. These are named so because they form hydrogen bonds with their complementary cut counterparts.

11. Suggest why only about 1% of the genetic information gets transcribed into functional RNA sequences in most of the mammalian cells. [2]

Ans :

Only about 1% of genetic information is transcribed into functional RNA sequences because most of the DNA is 'junk', i.e. the DNA which does not code for any protein or RNA. Also, some sequences of DNA bases only code as non-sense codes, while some are introns that code for certain unused sequences of mRNA. As only some genes get switched on in a cell, the amount of DNA involved is very little.

12. Due to improper functioning, thymus gland was removed from the body of a 15-year-old person. Can you predict the effects that will be observed in the immune functions of this individual? [2]

Ans :

Thymus is the primary lymphoid organ. In thymus gland, immature lymphocytes differentiate into antigen-sensitive lymphocytes. If thymus gland is removed from the body of a person, his immune system will become weak. As a result, the individual's body becomes prone to most infectious diseases.

Section C

13. Students while performing the experiment were given two different vectors for two different bacterial colonies that were cultured in a chromogenic substrate. They observed that the bacterial colonies with cloning vector A were colourless while those with cloning vector 'B' were blue in colour. Explain the phenomenon and the procedure behind the change in colour. [3]

Ans :

Students were working to differentiate recombinants and non-recombinants on the basis of their ability to produce colour in the presence of a chromogenic substrate.

During this method, a recombinant DNA is inserted in the coding sequence of an enzyme 3-galactosidase. This results in the inactivation of the enzyme (insertional inactivation). If the plasmid in the bacterium does not have an insert, it gives blue coloured B colonies. The presence of insert causes insertional inactivation and therefore, colourless A colonies are produced. These are marked as recombinant colonies.

or

A mixture of fragmented DNA was electrophoresed in an agarose gel. After staining the agarose gel with ethidium bromide, no DNA bands were observed. What could be the reason?

Ans :

After staining the agarose gel with ethidium bromide, no DNA bands were observed during electrophoresis, it could be due to the following reasons

(i) DNA sample that was loaded on the gel may have got contaminated with nuclease (exo or endo both) so that it got completely degraded.

(ii) Electrodes were put in such an orientation in the gel assembly that anode is towards the wells (where DNA sample is loaded). Since, DNA molecules are negatively charged they move towards anode and hence, move out of the gel instead of moving into the matrix of gel.

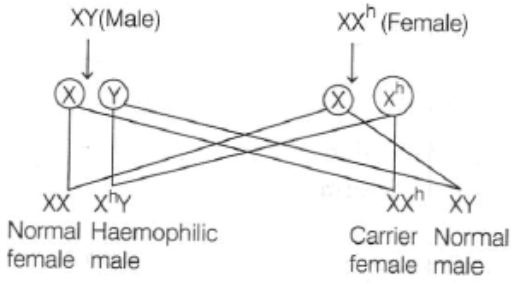
(iii) Ethidium bromide was not added at all or was not added in sufficient concentration and so, DNA was not visible.

14. A non-haemophilic couple was informed by doctor that there is a possibility of a haemophilic child to be born to them. Suggest and substantiate the basis on which doctor conveyed this information. Also, identify the genotype of parents. [3]

Ans :

The doctor conveyed this information on the basis of pedigree analysis. It is a strong tool through which inheritance of a specific trait, abnormality or disease can be traced.

Since, both the parents are non-haemophilic, the genotype of both will be XY (father) and XX^h (mother, carrier of disease). Their probability of having a diseased child can be predicted with the help of the following cross



Thus, there is 25% chance of having a haemophilic child (male).

or

In pea plants, the colour of the flower is either violet or white, whereas human skin colour shows many gradations. Explain giving reason, how it is possible.

Ans :

In pea plants, the colour of the flower is either violet or white because this trait is controlled by a single gene having two alleles, one of which (violet) is dominant over the other (white). In the presence of dominant allele, the flowers will be of violet colour and in the presence of both recessive alleles, flowers will be of white colour.

Whereas, human skin colour is the type of inheritance that is controlled by one or more genes, in which dominant alleles have cumulative effect. Each dominant allele expresses a part of the trait and the full trait is shown only when all dominant alleles are present. The quantity of human skin pigment melanin determines human skin colour which depends upon the presence of number of dominant alleles. So, the human skin colour shows many gradations.

15. (i) List any two conditions on which the development of a diploid cell depends.

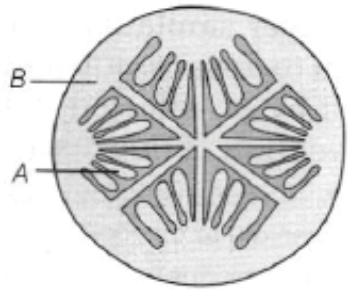
(ii) If the number of chromosomes present in the meiocyte of a plant is 24, then workout the number of chromosomes in the gamete and zygote of this plant. [3]

Ans :

(i) Zygote, a diploid cell is formed as a result of fusion of male and female gametes. Its development depends on the following two main conditions
(a) Type of life cycle of the organism.
(b) Environment to which it is exposed.

(ii) If the number of chromosomes present in meiocyte (2n) is 24, then the number of chromosomes in gamete will be (n)=12 and number of chromosomes in zygote (2n) will be 24.

16. Refer to the diagram given below and answer the questions that follows. [3]



(i) Label the parts A and B.
(ii) Which parts of flower develop into seed and fruit?
(iii) What is the function of both the labelled parts?

Ans :

(i) The part A is seed and B is pericarp.
(ii) The parts of flower which develop into seed and fruit are ovule and ovary, respectively.
(iii) The seed germinate to produce new plants while pericarp is protective in function. It protects the young seed.

17. (i) Female reproductive organs and associated functions are given below in column I and column II. Fill in the blanks. [3]

Column I	Column II
Ovaries	Ovulation
Oviduct	(i)
(ii)	Pregnancy
Vagina	(iii)

(ii) State the function of the following
(a) Acrosome
(b) Sperm tail

Ans :

Column I	Column II
Ovaries	Ovulation
Oviduct	Fertilisation
Uterus	Pregnancy
Vagina	Birth

(ii) (a) Acrosome It contains hydrolytic enzymes required to dissolve the membranes of the ovum for fertilisation.
(b) Sperm tail It helps in the movement of sperm in the female genital tract for fertilisation.

18. When Ankit was diagnosed with AIDS, his colleagues wanted him to leave the workplace due to the fear of spread of AIDS. However, his boss was against their decision. He called a counsellor to setup a meeting with people to clear their misconceptions. [3]

(i) Give the expanded form and causative agent of AIDS.
(ii) How does transmission of AIDS occur?
(iii) According to your view, demand of Ankit's colleagues is valid or not? Provide plausible reasons for the same.

Ans :

(i) AIDS is Acquired Immuno Deficiency Syndrome. It is caused by Human Immunodeficiency Virus (HIV).
(ii) HIV gets transmitted by sexual contact with infected person, by sharing of infected needles, by transfusion of contaminated blood and from infected mother to her child through placenta.
(iii) No, demand of Ankit's colleagues is not valid. AIDS does not spread by handshake, hugs, sharing of food and other articles.

19. Entamoeba histolytica is a protozoan parasite which causes amoebic dysentery in man. This parasite occurs worldwide wherever sanitation and hygiene are poor. Comment on the transmission of this parasite from its reservoir to a host. Also, identify the symptoms of this disease which will be displayed by an affected individual. What will be your advice for measures to be adopted for prevention of this disease? [3]

Ans :

Transmission: The disease causing parasite is transmitted by mechanical vectors like houseflies, cockroaches, etc., from the faeces of the infected person (reservoir) to the food and contaminate them.
Symptoms: The patient passes out blood and mucus with stools. He also experiences griping pain in the abdomen (cramps) along with fever, constipation, etc.
Preventive measures
(i) Maintain cleanliness in public and at personal level.
(ii) Practice hygiene like washing hands before eating, keeping food covered, etc.
(iii) Proper medication or vaccination should be taken for treatment and prophylaxis.

20. Appraise yourself with the measures that Indian government has taken to control the vehicular air pollution in Delhi and other cities of India such as introduction of CNG and other alternate fuels, EURO norms, emission regulations, etc. Can you compile in your own words, some of the positive outcomes of these regulations on the environment? [3]

Ans :

Measures to control air pollution and their positive outcomes are as follows
(i) Switching over the public transport and other vehicles to CNG. Since, CNG burns efficiently without leaving unburnt residues behind, it resulted in reduced use of diesel and petrol, decreased level of vehicular exhausts containing harmful gases.
(ii) Use of catalytic converters, electrostatic precipitators and other control devices in vehicles. Automobiles, thermal power plants, etc., are major causes of atmospheric pollution. Introducing catalytic converters in vehicles reduces the emissions of poisonous gases like

CO, NO_2, etc. Electrostatic precipitators help in controlling particulate matters emitted from thermal power plants.

(iii) Compulsory and regular check-up of pollution emission of vehicles and enforcement of Euro norms (which specify emission levels in vehicles). As a result of these changes, the level of air pollution in Delhi NCR have reduced considerably.

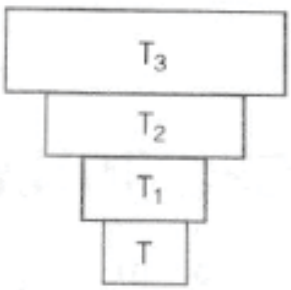
21. New species are evolving in a short time scale of months or few years rather than the million years due to increasing anthropogenic actions. Create a situation using an example to predict the outcome of these actions on the evolutionary process. [3]

Ans :

Human activities, i.e. anthropogenic actions have enhanced evolution. As a result, new species of living beings are evolving in a very short span of time. For example, excessive or overuse of DDT as a fertiliser in crops resulted in evolution of DDT resistant mosquitoes. When DDT was used first time, many mosquitoes died, but a few survived. These mosquitoes showed resistance and reproduced in the presence of DDT. Offspring produced by these mosquitoes evolved as a new species which were increasingly resistant to DDT. Hence, DDT as a pesticide was not effective on newly evolved mosquito population.

Section D

22. The diagrammatic illustration of connection between different trophic levels is given alongside. [3]



(i) Identify the type of ecological pyramid and explain what do the base and the apex of this pyramid indicate?

(ii) Give examples of such type of ecological pyramids with respect to number and biomass.

Ans :

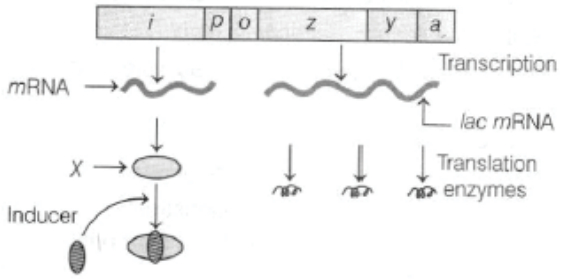
(i) The given pyramid is an inverted ecological pyramid. The base and the apex of this pyramid producers (first trophic level) and tertiary level consumers, respectively.

(ii) Examples of such ecological pyramids are as follows

(a) Pyramid of number in a tree ecosystem.

(b) Pyramid of biomass in a pond ecosystem

23. Study the figure given below and answer the following questions. [3]



(i) Identify the molecule 'X' synthesised by 'i' gene. How does this molecule get inactivated?

(ii) Identify the structural gene that codes for β-galactosidase.

(iii) When does the transcription of this gene get stopped?

Ans :

(i) Molecule 'X' synthesised by 'I' gene is a repressor protein. It gets inactivated on combining with an inducer molecule.

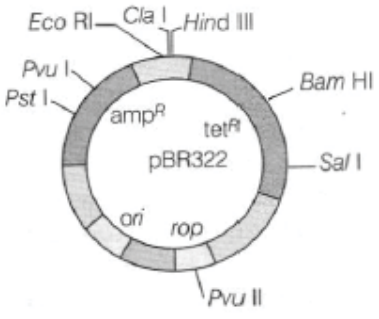
(ii) 'z' gene codes for β-galactosidase.

(iii) Transcription of gene stops in the following conditions

(a) When substrate lactose is not available.

(b) When energy source, i.e. glucose is available to the cells.

24.



With reference to the above diagram of E.coli cloning vector pBR322, answer the following

questions. [3]

(i) In E.coli cloning vector pBR322, a foreign gene segment is to be introduced into the amp^R region. From the restriction enzymes given below, which one you would probably use and why? Barn H1, Sal I, Pvu II, Eco RI.

(ii) Highlight the reasons for why could not you choose the other remaining restriction enzymes for your work.

(iii) How will the insertion of this enzyme aid in RDT process?

Ans :

(i) Restriction enzyme Eco RI would be used, because the restriction site for this enzyme is present in our target site, i.e. amp^R region.

(ii) Other enzymes like Barn H1, Sal I and Pvu II cannot be used because their restriction site is not present in amp^R region but in tet^R region.

(iii) The insertion of foreign DNA fragment will inactivate the ampicillin resistance gene in the vector. As a result, the recombinant plasmid will become ampicillin sensitive.

Section E

25. (i) Typhoid and pneumonia are bacterial diseases that infect human beings. Mention their causative agents and symptoms. Also, mention the way in which both the pathogens infect the human body. [5]

(ii) Give one viral disease and also mention its causative agent and vector.

Ans :

(i) Typhoid and pneumonia are bacterial diseases that infect human beings.

Typhoid : It is a disease caused by bacterium, Salmonella typhi.

Way of entry: It enters the small intestine through contaminated water and food and migrates to other organs of the body through blood.

Symptoms: Its symptoms include

- High fever (39-40°C)
- Weakness
- Stomach pain
- Constipation
- Headache
- Loss of appetite
- Death may also occur in serious cases

Pneumonia: It is caused by the bacterium Streptococcus pneumoniae and Haemophilus influenzae. It infects alveoli of lungs.

Way of entry: It enters the body by inhaling the droplets released by an infected person and also by sharing glasses and utensils with an infected person.

Symptoms

- It includes fever, chills, cough and headache.
- In severe cases, lips and finger nail may turn greyish to bluish in colour.

(ii) Chikungunya is a viral disease. Its causative agent is chikungunya virus. It is transmitted by the bite of Aedes aegyptii.

or

What is an antibody? Give its structure and mention its different types.

Ans :

An antibody is a type of protein molecule produced by the B-lymphocytes in response to exposure to an antigen. It has four peptide chains. Out of these chains, the two smaller ones are called as Light (L) chains and the two longer ones are called as Heavy (H) chains. So, it is designated as H_2L_2. Antibody-mediated response is called as humoral immune response.

The structure of an antibody molecule is as follows

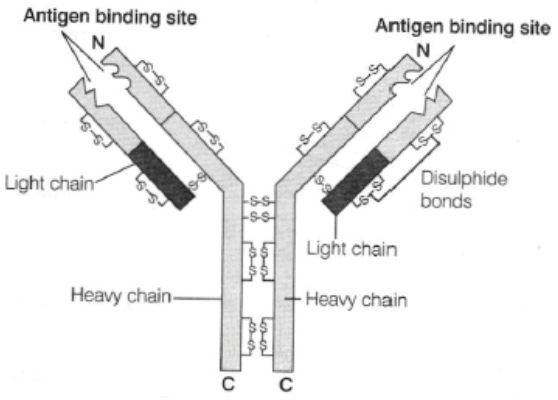


Figure: Structure of an Antibody

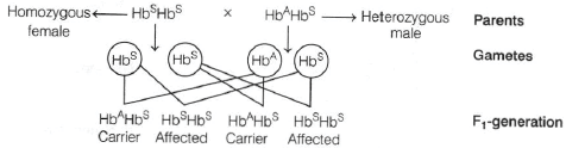
The different types of antibodies produced in the body are IgG, IgM, IgA, IgE and IgD. IgG protects the developing foetus by providing natural passive immunity. IgM provides immune response to complex organisms like virus and bacteria. IgA is a component of colostrum and provides passive

immunity. IgE acts as a mediator in allergic response and IgD activates B-cells to secrete antibodies.

26. A single mutant allele is responsible for the abnormal form of haemoglobin (i.e. Hb^S). If it is present in a homozygous state (Hb^S Hb^S), person develops sickle-cell anaemia, but if the allele is found in heterozygous state (Hb^AHb^S), the person only shows few symptoms for the disease. On the basis of the above situation, work out a cross for a condition in which a woman, who is homozygous for allele marries a male who is heterozygous for the allele. Assess the probability of having a normal or a diseased child for each of her pregnancies. Also, analyse the advantage that is conferred by the heterozygous condition of gene Hb^S. [5]

Ans :

Cross between homozygous female and heterozygous male is as follows



From the cross, it is clear that 50% offspring are homozygous for the Hb^S allele, whereas 50% are heterozygous for both Hb^S and Hb^A alleles.

Above cross shows that a child has equal probability of developing into a diseased child or a carrier with some symptoms of the disease. Therefore, the woman has 50% risk of giving birth to a diseased child, everytime she conceives.

The person with heterozygous condition (Hb^AHb^S) for sickle-cell anaemia does not develop sickle-cell anaemia and malaria, Due to abnormal shape of haemoglobin, the malarial parasite is not able to survive and complete its life cycle.

Hence, in this case, the heterozygous individuals have more chances of survival, which is an advantage with respect to the homozygous individuals.

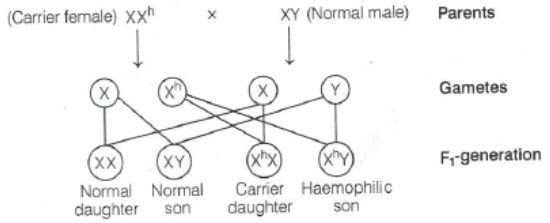
or

Haemophilia and colour blindness are sex-linked recessive disorders determined by the alteration or mutation in the single gene. Evaluate the pattern of inheritance of both disorders in human beings with the help of a cross. Also, predict the type of inheritance shown by these disorders.

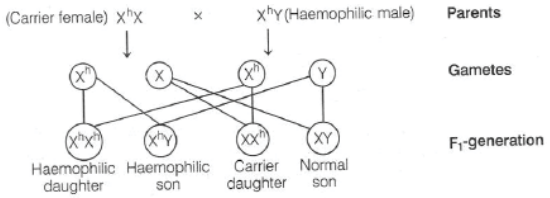
Ans :

Haemophilia, a blood clotting disorder is majorly transmitted from an unaffected carrier female to 50% of the male offspring. The gene for haemophilia is located on the X-chromosome. The possibility of female becoming haemophilic is extremely rare.

Condition I



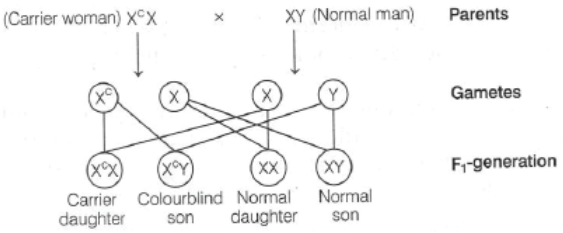
Condition II



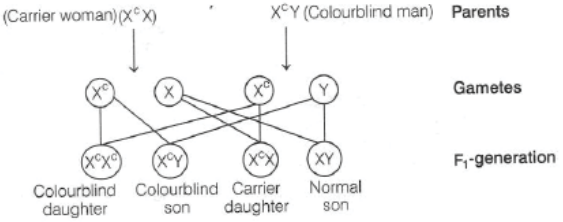
This indicates that for a female to become haemophilic, the gene should be in a homozygous condition, i.e. mother of such female should be carrier and father should be haemophilic.

Colour blindness is the inability to distinguish among some or all colours. In this disorder, mutant forms of genes change the light absorbing capacity of sensory receptors inside the eyes. This trait is mainly common in men, but heterozygous woman may also show symptoms and pass the disorder to some of her sons.

Condition I



Condition I



This cross shows that female can be colourblind only in homozygous condition.

Both of these disorders show criss-cross

inheritance, i.e. transmission of disease occurs from father to daughters and from mother to her sons.

27. Given below is the type of global biodiversity representing the proportionate number of species of major taxa of plants. Observe it carefully and answer the questions that follows. [5]

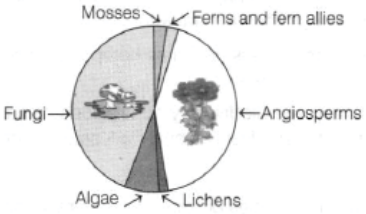


Figure: Representation of Global Biodiversity of Major Taxa of Plants

(i) Identify the most endangered group of plants among all categories.
(ii) What may be the reason behind such less population of mosses and ferns?
(iii) Name the most advanced and the most primitive group of plants in the biodiversity given above.
(iv) Fungi, inspite of being heterotroph are able to sustain themselves as a large population. Explain.

Ans :

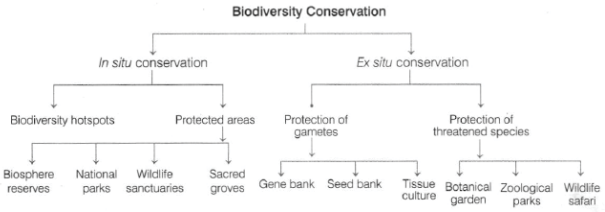
(i) Lichens are the most endangered plants among the given categories.
(ii) Population of mosses and ferns is less may be due to the following reasons
  (a) **Habitat loss:** Destruction of habitat (i.e. moist and shady environment as in forests) is the most important cause of extinction of mosses and ferns. It could be due to urbanisation.
  (b) **Overexploitation:** Humans are always dependent on nature for food and shelter. However, when human needs turn into greed, it leads to the overexploitation of natural resources. Many species of mosses and ferns are also used for various purposes. Their overexploitation has led to a decrease in their number.
  (c) **Environmental pollution:** Many ferns and mosses cannot grow in very polluted environment. Thus, environmental pollution is also responsible for their less number.
  (d) **Expansion of agriculture:** In the last few years, due to the expansion of agriculture, land available for natural vegetation is very less. It is also a major cause for the less number of ferns and mosses.
(iii) Angiosperms are the most advanced and algae are the most primitive group of plants in the given biodiversity.
(iv) Fungi are heterotrophic in nature due to lack of chlorophyll. They are able to sustain themselves as a large population because of their ability to reproduce both asexually and sexually.

or

With the help of a flowchart, explain what are the various major approaches to conserve biodiversity.

Ans :

The major approaches to conserve biodiversity can be ex situ or in situ. These are given in the following flowchart



In situ Conservation

It involves the protection of species in their natural habitats.

(i) Biodiversity hotspots are the regions of high levels of species richness and high degree of endemism (that is species confined to that region and not found anywhere else).
  The total number of biodiversity hotspots is 34. Three hotspots, which cover India are Western Ghats/Sri Lanka, Indo-Burma region and Eastern Himalayas.
(ii) Protected areas are ecologically and biodiversity rich regions. India has 18 Biosphere Reserves, 90 National Parks and 449 Wildlife Sanctuaries. The first National Park setup in India was Jim Corbett National Park.

Ex situ Conservation

It involves the conservation of selected species outside their natural habitats.

(i) **Protection of gametes** can be done by storing material in the places where

stocks remain viable for a longer period of time without harming their genetic variability.

(ii) **Protection of threatened species** comes under the category of off-site collections of various wild and domesticated species. India has around 800 parks where animals which have become extinct in wild are maintained and has around 1500 botanical gardens to collect, cultivate and display different varieties of plant