SAMPLE QUESTION PAPER

BLUE PRINT

Time Allowed : 3 hours **Maximum Marks :** 70

S. No.		Chapter	VSA /Case based/ AR (1 mark)	SA-I (2 marks)	SA-II (3 marks)	LA (5 marks)	Total	
1.	Unit-VI	Sexual Reproduction in Flowering Plants	3(3)	–	–	–	**3(3)**	**14**
2.		Human Reproduction	1(1)	–	1(3)	1+1*(5)	**3(9)**	
3.		Reproductive Health	–	1(2)	–	–	**1(2)**	
4.	Unit-VII	Principles of Inheritance and Variation	2(2)	1+1*(2)	1+1*(3)	1+1*(5)	**5(12)**	**18**
5.		Molecular Basis of Inheritance	3(6)	–	–	–	**3(6)**	
6.	Unit-VIII	Human Health and Diseases	–	–	–	1(5)	**1(5)**	**14**
7.		Microbes in Human Welfare	–	3(6)	1(3)	1*	**4(9)**	
8.	Unit-IX	Biotechnology : Principles and Processes	2(2)	2+1*(4)	–	–	**4(6)**	**12**
9.		Biotechnology and Its Applications	1(1)	1(2)	1(3)	–	**3(6)**	
10.	Unit-X	Organisms and Populations	3(6)	–	1(3)	–	**4(9)**	**12**
11.		Biodiversity and Conservation	1+1*(1)	1(2)	–	–	**2(3)**	
		Total	**16(22)**	**9(18)**	**5(15)**	**3(15)**	**33(70)**	

*It is a choice based question.

Subject Code : **044**

BIOLOGY

Time allowed : 3 hours ***Maximum marks : 70***

General Instructions :

(i) All questions are compulsory.

(ii) The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.

(iii) Section-A has 14 questions of 1 mark each and 02 case-based questions. Section-B has 9 questions of 2 marks each. Section-C has 5 questions of 3 marks each and Section-D has 3 questions of 5 marks each.

(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

(v) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION - A

1. Differentiate between xenogamy and geitonogamy.

2. What is pericarp? Mention its function.

3. State from where do the signals for parturition originate in human females.

4. State the functions of ribozyme and release factor in protein synthesis respectively.

5. In a dihybrid cross, when would the proportion of parental gene combinations be much higher than non-parental types, as experimentally shown by Morgan and his group?

6. A male honeybee has 16 chromosomes whereas its female has 32 chromosomes. Give one reason.

7. Write the full form of VNTR. How is VNTR different from 'Probe'?

8. What type of cut ends are formed when both the strands of DNA molecule is cleaved at exactly the same nucleotide position?

9. State the role of transposons in silencing of *m*RNA in eukaryotic cells.

10. How do seed bearing plants tide over dry and hot weather conditions?

11. **Assertion :** Entomophily is specific and directional.

Reason : Entomophilous flowers produce fewer pollen grains.

(a) Both assertion and reason are true, and reason is the correct explanation of assertion.

(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

12. **Assertion :** Restriction enzymes recognises palindromic sequences in DNA and cuts them.

Reason : Sticky ends facilitate the actions of restriction enzyme.

(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

13. **Assertion :** The rate of extinction of organisms have increased in recent years.

Reason : Human activities like deforestation, industrialisation, etc., have destroyed the natural habitat of plants and animals.

(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

OR

Assertion : Species diversity decreases as we ascend towards high mountains.

Reason : Due to increase in temperature, no seasonal variability occurs in high mountains.

(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

14. **Assertion :** 'Competitive Exclusion Principle' applies to those species who compete for the same resources for their survival.

Reason : Intraspecific competition is more severe.

(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

15. **Read the following and answer any four questions from 15(i) to 15(v) given below:**

Human body needs specific protein at times for performing specific functions. Within the cell nucleus, when the protein is needed, an enzyme called RNA polymerase relax the DNA strand and split it along the gene where the code for the needed protein is located. From that point, the enzyme reads the DNA and creates a complementary chemical mirror of the needed section in a process called transcription. The product of this process is a strand of messenger RNA (*m*RNA), which contains the instructions to fabricate the protein needed. The *m*RNA got transferred to cytoplasm where it directs the synthesis of protein. Eukaryotic DNA is very long and it contain non-coding intervening sequences between the coding sequences called exons. During transcription both exons and introns are transcribed in the form of *hn*RNA which further undergoes modifications to produce a fully functional *m*RNA.

(i) The eukaryotic transcription occurs in

(a) nucleus
(b) cytoplasm
(c) ribosomes
(d) none of these.

(ii) Which of the following types of RNA contains information coded from DNA?

(a) *r*RNA (b) *m*RNA

(c) *t*RNA (d) all of these

(iii) The expressed sequences of eukaryotic pre-m*RNA*s are known as

(a) introns (b) exons

(c) SnRNA (d) hnRNA.

(iv) During transcription in eukaryote, the DNA segments transcribed to make RNA molecule. This RNA molecule has

(a) introns only (b) exons only

(c) both exons and introns (d) none of these.

(v) **Assertion:** In all living organisms, transcription occurs in the nucleus but translation occurs in the cytoplasm.

Reason: The ribosomes and amino acids are available in nucleus only.

(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

16. Read the following and answer any four questions from 16(i) to 16(v) given below:

In India, the biodiversity of different regions is entirely different due to many regional variations in climatic conditions. Many factors like location , altitude , distance from the sea, regional variation in pattern of winds, temperature and rainfall affects the flora and fauna of the region. The organisms cope up with their environment by making certain physiological adjustments such as dormancy, behavioural adjustments like temporary migration of Siberian crane etc. These morphological, physiological, behavioural responses are also actually, their adaptations that enables the organism to survive and reproduce in its habitat which can be permanent or temporary.

In desert areas, the water availability is very low therefore plants and animals reduce their water usage by making some morphological, physiological, anatomical and behavioural changes. *E.g.*, Kangaroo rat and *Opuntia*.

(i) Kangaroo rat fulfils its water requirement through its internal fat oxidation. It is a type of _____ adaptation.

(a) morphological (b) anatomical

(c) physiological (d) behavioural

(ii) In *Opuntia* plant, _____ performs photosynthesis.

(a) leaves (b) spines

(c) stem (d) whole plant

(iii) The biodiversity of a locality is affected by_____.

(a) global climate (b) regional climate

(c) monsoon (d) all of these

(iv) Migration of birds Siberian crane to Bharatpur occurs in

(a) summer (b) winter

(c) rainy season (d) autumn.

(v) Study the given figure.

Identify the habitat of plant as per its morphological features.

(a) Sea
(b) Desert
(c) Mountains
(d) None of these

SECTION - B

17. **(a)** Name an IUD that you would recommend to promote the cervix hostility to the sperms.

(b) State one reason why breast-feeding the baby acts as a natural contraceptive for the mother.

18. **(a)** What is the physical basis of heredity?

(b) What would be the phenotype of a plant that had a genotype for height is Tt?

OR

Name a disorder a human suffers from as a result of monosomy of the sex chromosome. Give the karyotype and write the symptoms.

19. Identify the blank spaces a, b, c and d in the given table.

Type of microbe	Scientific name	Product	Medical application
Fungus	a	Cyclosporin A	b
c	*Monascus purpureus*	Statin	d

20. What is elution? Explain the role of UV-light and ethidium bromide during gel electrophoresis of DNA fragments.

OR

(a) Name the natural source of agarose. Mention one role of agarose in biotechnology.

(b) How can retroviruses be used efficiently in biotechnology experiments inspite of their disease causing ability?

21. List the basic steps for genetically modifying an organism.

22. What are transgenic plants? Explain any two disadvantages of transgenic plants.

23. Taking one example each of habitat loss and fragmentation, explain how are the two responsible for biodiversity loss.

24. Explain the process of secondary treatment given to the primary effluent up to the point it shows significant change in the level of biological oxygen demand (BOD) in it.

25. Name the enzyme produced by *Streptococcus* bacterium. Explain its importance in medical sciences.

SECTION - C

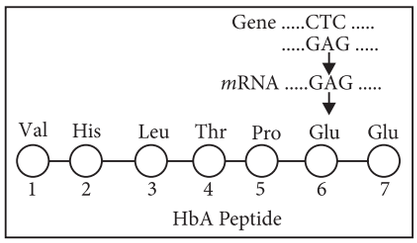
26. Draw the following diagrams related to human reproduction and label them.

(i) The zygote after the first cleavage division.

(ii) Morula stage

(iii) Blastocyst stage (sectional view)

27. Given below is the representation of a relevant part of amino acid composition of the β-chain of haemoglobin, related to the shape of human red blood cells.



(i) Is this representation of the sequence of amino acids indicating a normal human or a sufferer from a certain blood related genetic disease? Give reason in support of your answer.

(ii) Why is the disease referred to as Mendelian disorder? Explain.

OR

Name the kind of diseases/disorders and any two symptoms that are likely to occur in humans if

(i) Mutation in the gene that codes for an enzyme phenylalanine hydroxylase occurs.

(ii) The karyotype is XXY.

28. **(a)** Organic farmers prefer biological control of diseases and pests to the use of chemicals for the same purpose. Justify.

(b) Give an example of a bacterium, a fungus and an insect that are used as biocontrol agents.

29. Why do lepidopterans die when they feed on Bt cotton plant? Explain how does it happen.

30. In certain seasons we sweat profusely while in some other season we shiver. Explain.

SECTION - D

31. **(a)** Arrange the following hormones in sequence of their secretion in a pregnant woman.

hCG; LH; FSH; Relaxin

(b) Mention their source and the function they perform.

OR

(a) When and how does placenta develop in human female?

(b) How is the placenta connected to the embryo?

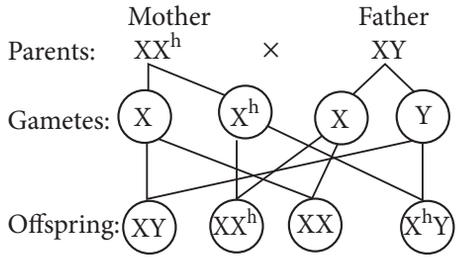
(c) Placenta acts as an endocrine gland. Explain.

32. Describe the asexual and sexual phases of life cycle of *Plasmodium* that causes malaria in humans.

OR

Name the site of nitrogen fixation in legumes. List and describe the biochemical components at this site.

33. Consider the given cross and answer the following questions.



(i) Identify the type of disease depicted by the given cross. Also name the type of inheritance shown.

(ii) In the given cross, what would be the probability of having a carrier and diseased offspring?

(iii) Name any other disease which shows same type of inheritance pattern.

OR

(a) Name four types of chromosomal aberration.

(b) Briefly describe two intrachromosomal aberration.

(c) Name two chromosomal aberrations that represent interchromosomal aberration. Draw diagrammatic representation of these two interchromosomal aberration.

SOLUTIONS

1. Differences between xenogamy and geitonogamy are as follows:

	Xenogamy	Geitonogamy
(i)	It is pollination between two flowers of different plants.	It is pollination between two flowers of the same plant.
(ii)	The flowers are genetically different.	The flowers are genetically similar.
(iii)	It is genetically cross pollination.	It is genetically self pollination.

2. Pericarp is the covering of fruit that develops from ovary wall. It protects the fruit and also helps in its dispersal.

3. The signals for parturition originate from the fully developed fetus and the placenta induce mild uterine contractions called fetal ejection reflex.

4. Ribozyme (catalytic RNA) is present in ribosome and joins the amino acids together by peptide bond formation to form protein chains. Release factor (RF) is GTP dependent. It binds to the stop codon, terminates translation and release the complete polypeptide from the ribosome.

5. When the genes involved are linked, the proportion of parental gene combinations would be much higher than non-parental types in a dihybrid cross.

6. In honeybees an unfertilised egg develops into a male and a fertilised egg develops into a female. Therefore, the female is diploid (2n), and the male is haploid (n).

7. VNTR stands for Variable Number of Tandem Repeats.
VNTRs are short nucleotide repeats in DNA that are specific to each individual and vary in number from person to person. DNA probes, are radioactive, have repeated base sequence complementary to VNTRs.

8. Blunt ends are formed when both the strands of DNA molecule is cleaved at exactly the same nucleotide position.

9. Transposons also called as jumping genes, are the source of complementary dsRNA molecule that binds to and prevents translation of mRNA (silencing).

10. Mesophytic seed bearing plants sometimes have to face hot and dry weather conditions. They survive such adverse conditions by forming underground perennating structures such as corms, rhizomes, tubers, etc. Xerophytic plants on the other hand have to face hot and dry conditions throughout the year. They show various adaptations like sunken stomata, fleshy organs, leaves reduced to spines, extensive root system, etc.

11. (b)

12. (c) : The sticky ends facilitate the action of the enzyme DNA ligase.

13. (c)

OR

(c) : A decrease in species diversity occurs as we ascend towards a high mountain due to drop in temperature and greater seasonal variability.

14. (b)

15. (i) (a) : Transcription takes place in the membrane-bounded nucleus.

(ii) (b) : Through the process of transcription, a strand of messenger RNA (*m*RNA) is made which contains the instructions to fabricate the protein needed.

(iii) (b) : Eukaryotic DNA contain non-coding intervening sequences called introns between the coding sequences (exons). During transcription both exons and introns are transcribed in the form of *hn*RNA which further undergoes modifications to produce a fully functional *m*RNA.

(iv) (c)

(v) (d) : In eukaryotes, transcription and translation take place in different cellular compartments : transcription takes place in the membrane-bounded nucleus, whereas translation takes place outside the nucleus in the cytoplasm. In prokaryotes, the two processes are closely coupled. The ribosomes and amino acids are available in cytoplasm to carry out the process of translation.

16. (i) (c) : It is a type of physiological adaptation as there is no morphological, anatomical or behavioural change is seen.

(ii) (c) : In *Opuntia*, leaves reduced to spines to lessen the water loss and the photosynthesis is performed by green flattened stem.

(iii) (d) : All the changes occurring in global, regional climate or monsoon pattern affects the organism and therefore the organisms cope up with their environment by making certain physiological adjustments such as dormancy, behavioural adjustments like temporary migration of Siberian crane etc.

(iv) (b) : Siberian Crane migrate from Western Siberia to Bharatpur, Rajasthan, India- approximately 4,000 km - during winters.

(v) (b) : The plants shown in figure is a xerophytic plant of deserts. The stem is thickened, flattened and green to perform photosynthesis whereas the leaves are reduced to spines.

17. (a) Progestasert is a hormone releasing IUD (intrauterine contraceptive device) which makes the cervix hostile to the sperms.
(b) Ovulation, and therefore the menstrual cycle, does not occur during intense lactation period (following parturition). Therefore, breast feeding the baby act as a natural contraceptive for the mother but that too upto a maximum period of six months.

18. (a) According to Mendel, inheritance is controlled by paired factors, now known as genes. These genes are physical basis of heredity.
(b) The phenotype of the plant will be tall.

OR

Turner's syndrome is a disorder caused due to the absence of one of X chromosomes (monosomy). Where, the individual has 22 pairs of autosomes and XO sex chromosomes, *i.e.*, 45 chromosomes. So, the karyotype will be 44 +XO.
Symptoms : (i) Sterile females
(ii) Rudimentary ovaries
(iii) Lack of secondary sexual characters
(iv) Webbed neck and broad chest
(v) Underdeveloped breasts.

19. a = *Trichoderma polysporum*
b = Organ transplant in patients
c = Yeast
d = Maintains blood cholesterol

20. After gel electrophoresis, the separated bands of DNA are cut out from the agarose gel and extracted from the gel piece. This process is called as elution (removal of adsorbent). These purified DNA fragments are used in constructing recombinant DNA by linking them with cloning vectors. In gel electrophoresis, the separated DNA fragments can be seen after staining the DNA with a compound known as ethidium bromide (EtBr) followed by exposure to UV radiation as bright orange coloured bands.

OR

(a) Agarose is commonly used as matrix in agarose gel electrophoresis. It is a natural polymer and is extracted from sea weeds. In recombinant DNA technology, agarose gel electrophoresis is used to separate DNA fragments according to their size.
(b) Retroviruses are first disarmed (disease causing gene is removed/inactivated), this disarmed virus do not cause disease and hence are used to transfer desirable genes into host cells. So, inspite of them being disease causing, they (disarmed retrovirus) can be used efficiently in biotechnology experiments.

21. There are three basic steps for genetically modifying an organism :
(i) identification of DNA with desirable genes;
(ii) introduction of the identified DNA into the host;
(iii) maintenance of introduced DNA in the host and transfer of DNA into its progeny.

22. The plants in which foreign genes have been introduced through genetic engineering are called transgenic plants.
Following are the disadvantages of transgenic plants :
(i) Gene transfer to non-target species : Transgenic crop plants can cross breed with weeds, resulting in the transfer of transgene. These "super weeds" can then be difficult to eradicate. Other non-transgenic crops can also get the transgenes by cross breed.
(ii) Allergies : The transgenic food may cause toxicity or produce allergies to human beings. The enzyme produced by the antibiotic resistance gene can cause allergies, because it is a foreign protein.

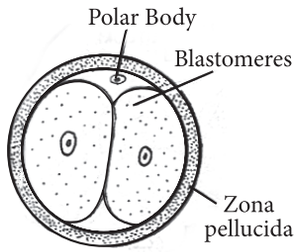
23. Loss of habitat through filling wet lands, ploughing grasslands, cutting down trees, burning a forest and clearing some area of vegetation results in annihilation of plants, microorganisms and forcing out of animals which in alien land die out after sometime. Habitat loss deprives plants and animals of their homes and they get killed.
Fragmentation of habitat, *e.g.*, forest land surrounded by crop lands, orchards, urban areas, etc. disrupts complex interaction amongst species, destruction of species in cleared regions, annihilation of species restricted to deeper undisturbed parts of forest and decreased biodiversity in the habitat fragments.

24. During secondary treatment, the primary effluent is taken to aeration tanks. A large number of aerobic heterotrophic microbes grow in the aeration tank. They form flocs which are masses of bacteria held together by slime and fungal filaments to form mesh like structures. The microbes digest a lot of organic matter, converting it into microbial biomass and

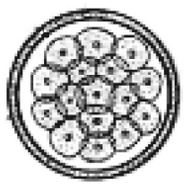
releasing a lot of minerals. As a result the BOD of the waste matter is reduced to 10-15% of raw sewage, it is passed into settling tank.

25. Streptokinase (Tissue Plasminogen Activator or TPA) is an enzyme obtained from cultures of some haemolytic bacterium *Streptococcus* which is modified genetically to function as clot buster. It has fibrinolytic effect hence, it helps in clearing blood clots inside the blood vessels through dissolution of intravascular fibrin.

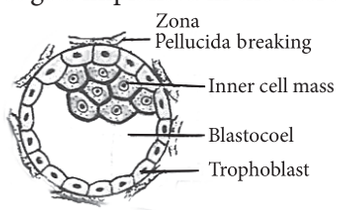
26. (i) The diagram of zygote after first cleavage division is as follows:



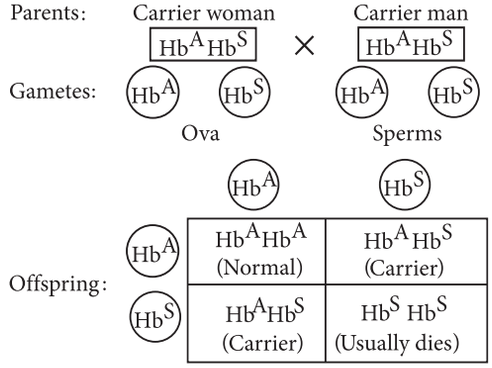
(ii) The diagram of morula stage is as follows:



(iii) Blastocyst gets implanted in the uterus.



27. (i) Yes, this representation indicates a normal human because Hb^A is a normal peptide with glutamic acid at the sixth position of beta globin chain.
For example, in case of sickle cell anaemia the glutamic acid is replaced by valine due to substitution of T by A in the second position of the triplet codon CTC which is changed to CAC.
(ii) The disease is called Mendelian disorder because it is transmitted to the offspring as per Mendelian principles. For example, sickle cell anaemia is a blood related Mendelian disorder. The gene for sickle-celled erythrocytes is represented by Hb^S while that of normal erythrocytes is written as Hb^A. The homozygotes for the two types are Hb^S Hb^S and Hb^A Hb^A. The heterozygotes are written as Hb^A Hb^S. When two sickle cell heterozygotes marry they produce three types of children: homozygous normal, heterozygous carrier and homozygous sickle celled in the ratio of 1 : 2 :1. However, homozygous sickle-celled individuals (Hb^S Hb^S) die in childhood (before reproductive age) due to acute anaemia. Therefore, a ratio of one normal to two carriers is obtained.



OR

(i) Phenylketonuria is an inborn, autosomal recessive metabolic disorder in which the individual lacks the enzyme phenylalanine hydroxylase that converts the amino acid phenylalanine into tyrosine in liver. Lack of this enzyme is due to the abnormal autosomal recessive gene on chromosome 12. This is due to substitution.
Two symptoms of this disorder are :
(a) Mental retardation due to accumulation of phenylalanine and phenylpyruvate in brain.
(b) Decreased pigmentation of hair and skin and eczema.
(ii) Klinefelter's syndrome occurs due to the trisomy of sex (X) chromosome. The individual has 47 chromosomes (44 + XXY).
Two symptoms of this disorder are :
(a) Undeveloped testes and development of feminine characters like enlarged breasts, feminine pitched voice.
(b) Mental retardation.

28. (a) Chemical pesticides used in agricultural fields are toxic and they kill even useful organisms along with harmful ones, harm human beings and animals, pollute soil, water and crop plants. It is estimated that despite the use of chemical pesticides 30% of the agricultural produce is lost to pathogens and pests because these continue to develop resistance against various pesticides. Now, organic farmers prefer biological control of diseases and pests to the use of chemicals. Biopesticides are the biological agents that control the growth of weeds, insects and pathogens in an agricultural field. They have targeted actions and are harmless to the crop plants, other beneficial field animals and humans. In organic farming, pests and pathogens are not eradicated but kept at manageable levels by a system of checks and balances as operating in ecosystem. An organic farmer holds the view that

eradicating pests is undesirable because without them the beneficial predatory and parasitic organisms which depend upon them for food would also be annihilated.
(b) Bacterium as a biocontrol agent : *Bacillus thuringiensis* is effective against the cabbage looper.
Fungi as a biocontrol agent : *Trichoderma* found in root ecosystem exerts biocontrol over several plant pathogens.
Insect as a biocontrol agent : Lady bird beetle and dragonflies feeds on aphids and prey upon mosquitoes, respectively.

29. Two genes *cry*IAc and *cry*IIAb control cotton bollworms. These two genes were isolated from *Bacillus thuringiensis* and incorporated into cotton plant. The genetically modified plant is called Bt cotton as it contains Bt toxin genes. The bacterium *Bacillus thuringiensis* produces Bt toxin proteins as inactive protoxins. When the insect larvae ingest any plant part, toxin becomes active in the alkaline pH of the gut and kills the insect pests. That is how Bt cotton attains resistance against bollworm.

30. Human beings are able to maintain a constant body temperature at about ~37°C.
(i) During summers the external temperature may rise upto 45°C. Humans begin to sweat profusely when external temperature rises above 37°C. Cooling of the body occurs as sweat evaporates.
(ii) During winter, when external temperature is low, our body inadvertently starts shivering. It is an exercise that raises body temperature.

31. (a) The sequence of secretion of the given hormones in a pregnant woman is :
FSH → LH → hCG → Relaxin
(b) Sources and functions of hormones are :

Hormone	Source	Function
FSH	Anterior lobe of pituitary	Stimulates the growth of ovarian follicles and secretion of estrogen in females.
LH	Anterior lobe of pituitary	Induces ovulation and stimulates corpus luteum to secrete progesterone.
hCG	Chorionic cells of placenta	Stimulates and maintains the corpus luteum to secrete progesterone.
Relaxin	Ovary	Soften the ligaments that hold the pubic symphysis together for dilation of cervix.

OR

(a) Placenta develops after implantation of embryo in the uterus of human female.
After implantation, finger-like projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood. The chorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between developing embryo (foetus) and maternal body called placenta, which facilitates the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory waste materials produced by the embryo.
(b) An umbilical cord connects placenta to the embryo.
(c) The placenta acts as an endocrine gland and secretes the following hormones :
(i) Human chorionic gonadotropin (hCG)
(ii) Human chorionic somatomammotropin (hCS)
(iii) Progesterone (iv) Estrogen (v) Relaxin
(vi) Chorionic thyrotropin and (vii) Chorionic corticotropin
The hCG stimulates and maintains the corpus luteum to secrete progesterone until the end of pregnancy. The hCS stimulates the growth of the mammary glands during pregnancy. Relaxin facilitates parturition (act of birth) by softening the connective tissues of the pubic symphysis. The level of hormones like estrogen, progesterone, etc. are increased in maternal blood during pregnancy. Increased production of these hormones is necessary for supporting the fetal growth, metabolic changes in mother and maintenance of pregnancy.

32. Malaria is caused by the toxins produced in the human body by malarial parasite *Plasmodium*. Life cycle of *Plasmodium* requires two hosts for completion.
Life cycle of *Plasmodium* in man (asexual phase): The infective stage of *Plasmodium* is sporozoite. When the mosquito bites man, sporozoites present in the salivary gland of female *Anopheles* mosquito are injected into the blood of the man. The parasites initially multiply within the liver cells and then attack the red blood cells (RBCs) resulting in their rupture. The rupture of RBCs is associated with release of a toxic substance, haemozoin, which is responsible for the chill and high fever recurring every three to four days. The released parasites from the ruptured RBCs infect new RBCs and develop into gametocytes (male and female). When a female *Anopheles* mosquito sucks the blood of an infected human host, it receives RBCs containing gametocytes.
Life cycle of *Plasmodium* in mosquito (sexual phase): The gametocytes come out of the RBCs into the

lumen (cavity) of the stomach of the mosquito. Inside the stomach of the mosquito, the male and female gametocytes fuse (fertilise) to form zygote called oocyst. The nucleus of oocyst divides first by meiosis and subsequently by mitosis, forming large number of small haploid nuclei. At the same time, spindle shaped bodies called sporozoites are formed. When mature oocysts rupture, the sporozoites are liberated into the haemocoel (body cavity filled with blood) of the mosquito. Being motile, the sporozoites move to different organs in the body cavity of the mosquito, but many of them penetrate the salivary glands. The mosquito now becomes infective. When the female *Anopheles* mosquito bites a healthy person, the sporozoites are injected in his/her blood along with saliva. These sporozoites start the cycle again in human body.

OR

Symbiotic nitrogen fixation is carried out by bacteria frequently found in the root nodules of leguminous plants. The different components and their role in symbiotic nitrogen fixation are as follows:-

(i) *Rhizobium* : They are symbiotic nitrogen fixing bacteria commonly present in root nodules of leguminous plants and carry out conversion of atmospheric nitrogen into nitrogenous salts to make it available for absorption by plants.

(ii) Lectin : Lectins are the key proteins involved in the *Rhizobium*-legume symbiotic association. Bauer (1981) proposed that these lectins interact selectively with microbial cell carbohydrates (or glycoproteins) found in the capsule of bacteria and serve as determinants of recognition or host specificity.

(iii) Tryptophan : Leguminous plants release tryptophan in the soil which is absorbed by *Rhizobium* and is metabolised to produce IAA.

(iv) Root hair curling factor : The rhizobia produce another characteristic substance called root hair curling factor that causes deformation and twisting of root hairs.

(v) Leghaemoglobin : The nodule contains a pink coloured leghaemoglobin pigment which like true haemoglobin combines with oxygen and CO_2 and gets readily oxidised into brown form with a trivalent iron.

(vi) Nitrogenase : Process of nitrogen fixation, involves reduction of atmospheric nitrogen to ammonia (NH_3) by the enzyme nitrogenase. Nitrogenase is made up of two protein components, one containing iron and molybdenum, known as Mo-Fe protein or molybdo-ferredoxin (component I) and the other containing only iron called Fe-protein or azoferredoxin. Nitrogenase is extremely sensitive to oxygen. The enzyme remains active under anaerobic conditions. The leghaemoglobin binds with oxygen and protect nitrogenase from O_2 inactivation. At the same time it is able to make O_2 available to bacteroids for ATP production, required for nitrogen fixation.

33. (i) The above cross shows the inheritance of haemophilia, which is a sex-linked recessive disorder. It shows criss-cross type of inheritance.

(ii) In the given cross, the ratio of carrier and diseased offspring would be 1 : 1. If the carrier female (XX^h) marries a normal male (XY), four types of children are produced as given by the cross (XX, XX^h, X^hY, XY). In other words, 50% boys as well as 50% girls receive the gene for haemophilia through the X^h chromosome of their mother. However, the defect does not appear in the girls because of the presence of the allele for normal blood clotting is found on one of the X-chromosome (XX^h). Therefore, the girls remain carrier. 50% of the males who receive the defective gene for haemophilia (X^hY) suffer from the disease as the Y-chromosome does not carry any allele for it.

(iii) Colourblindness is another sex-linked recessive disorder, that shows criss-cross inheritance.

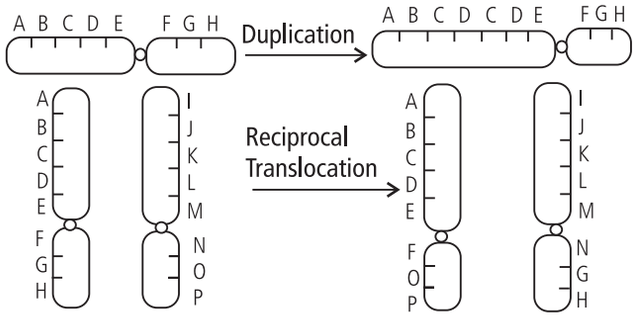
OR

(a) Deletion, duplication, inversion and reciprocal translocation are types of chromosomal aberration.

(b) Deletion and inversion are intrachromosomal aberration. Deletion is the loss of an intercalary segment of a chromosome which is produced by a double break in the chromosome followed by the union of remaining parts, *e.g.*, ABCDEFGH/ABCFGH (segment DE is missing).

In chromosomal aberration inversion part of the chromosome segment gets inverted by 180°. For example, chromosome ABCDEFGH develops inversion in the part CDE to form ABEDCFGH.

(c) Reciprocal translocation and duplication represent interchromosomal aberrations.



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