

Class-XII Session 2022-23  
Subject - Biology (044)  
Sample Question Paper - 22  
With Solution

Ch. No.	Title	Marks Per Unit	Section-A	Section-B	Section-C	Section-D	Section-E	Total Marks
			(1 marks)	(2 marks)	(3 marks)	(4 marks)	(5 marks)	
			MCC & A/R Ques. No.	VSA Ques. No.	SA Ques. No.	Case based Ques. No.	LA Ques. No.	
1	Reproduction in organisms	16	2(Q2, 5)					2
2	Sexual Reproduction in Flowering Plants		1(Q13)	1(Q21)			1(Q32)	8
3	Human Reproduction		1(Q14)		1(Q22)			4
4	Reproductive Health		2(Q3, 6)					2
5	Principles of Inheritance and Variation	20	2(Q15, 12)		1(Q23)			5
6	Molecular Basis of Inheritance			1(Q18)	1(Q28)		1(Q33)	10
7	Evolution		2(Q9, 11)		1(Q27)			5
8	Human Health and Disease		1(Q16)		1(Q24)	1(Q29)		8
9	Strategies for enhancement in food production	12	2(Q8, 10)					2
10	Microbes in Human Welfare			1(Q20)				2
11	Biotechnology-Principles and Processes	12	2(Q1, 7)	1(Q19)		1(Q30)		8
12	Biotechnology and its Application		1(Q4)		1(Q25)			4
13	Organisms and Populations	10		1(Q17)				2
14	Ecosystem							0
15	Biodiversity and conservation				1(Q26)		1(Q31)	8
16	Environmental issues							0
Total Marks (Total Questions)			16(16)	10(5)	21(7)	8(2)	15(3)	70(33)

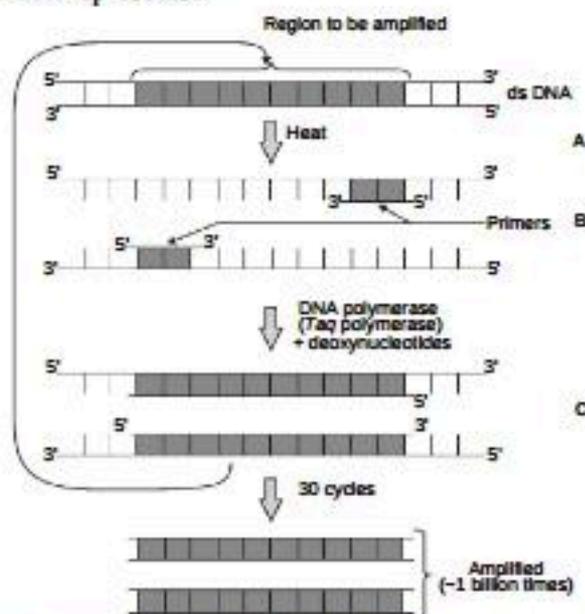
NOTE: The number given inside the bracket denotes question number, ask in the sample paper, while the number given outside the bracket are the number of questions from that particular chapter.

### General Instructions

1. All questions are compulsory.
2. The question paper has five sections and 33 questions. All questions are compulsory.
3. Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section–C has 7 questions of 3 marks each; Section–D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
4. 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.
5. Wherever necessary, neat and properly labeled diagrams should be drawn.

### SECTION-A

1. Gel electrophoresis is used for
  - (a) construction of recombinant DNA by joining with cloning vectors
  - (b) isolation of DNA molecules
  - (c) cutting DNA into fragments
  - (d) separation of DNA fragments according to their size.
2. Meiosis is observed in all except
  - (a) human egg
  - (b) blue-green algae
  - (c) equisetum
  - (d) dicot plant
3. Progesterone and LNG-20 are
  - (a) implants
  - (b) copper releasing IUDs
  - (c) non-medicated IUDs
  - (d) hormone releasing IUDs
4. The first clinical gene therapy was given in 1990 to a 4 years old girl with enzyme deficiency of
  - (a) adenosine deaminase (ADA)
  - (b) tyrosine oxidase
  - (c) monoamine oxidase
  - (d) glutamate dehydrogenase
5. Which one of the plants using 'Foliar adventitious buds' as method for vegetative propagation?
  - (a) Banana
  - (b) Ginger
  - (c) Bryophyllum
  - (d) Colocasia
6. Which of the following is traditional method of contraception?
  - (a) Implantation
  - (b) Lactational amenorrhoea
  - (c) Condoms
  - (d) Sterilization
7. The figure given below shows three steps (A, B, C) of Polymerase Chain Reaction (PCR). Select the option giving correct identification together with what it represents?



- (a) B - Denaturation at a temperature of about 98°C separating the two DNA strands.
  - (b) A - Denaturation at a temperature of about 50°C.
  - (c) C - Extension in the presence of heat stable DNA polymerase.
  - (d) A - Annealing with two sets of primers.
8. Hisardale is a new breed of sheep developed in Punjab by one of the breeding techniques in which superior male of one breed is mated with superior females of another breed. Identify the breeding technique from the option given below.
    - (a) Inbreeding
    - (b) Out crossing
    - (c) Out breeding
    - (d) Cross breeding

9. The term living fossil refers to a  
 (a) life like fossil well preserved in amber. (b) fossil formed from a living animal.  
 (c) living animal which is about to be fossilized. (d) living organism showing some very primitive characters.
10. Artificial breeding of cattle is brought about by  
 (a) artificial insemination (b) super ovulation and embryo transplantation  
 (c) MOET (d) all of these
11. Fossil remains of Archaeopteryx indicates that:  
 (a) It was a flying reptile from Triassic (b) It was a flying reptile from Permian  
 (c) Reptiles gave rise to birds during Permian (d) Reptiles gave rise to birds during Jurassic
12. In a dihybrid cross, If you get 9 : 3 : 3 : 1 ratio it denotes that  
 (a) The alleles of two genes are interacting with each other (b) It is a multigenic inheritance  
 (c) It is a case of multiple allelism (d) The alleles of two genes are segregating independently

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

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

13. **Assertion :** Groundnut and pea are non-endospermic.  
**Reason :** They does not synthesise endosperm.
14. **Assertion :** Head of sperm consists of acrosome.  
**Reason :** Acrosome contains spiral row of mitochondria.
15. **Assertion :** The genetic complement of an organism is called genotype.  
**Reason :** Genotype is the type of hereditary properties of an organism.
16. **Assertion :** *Escherichia coli*, *Shigella sp.* and *Salmonella sp.* are all responsible for diarrhoeal diseases.  
**Reason :** Dehydration is common to all types of diarrhoeal diseases and adequate supply of fluids and electrolytes should be ensured.

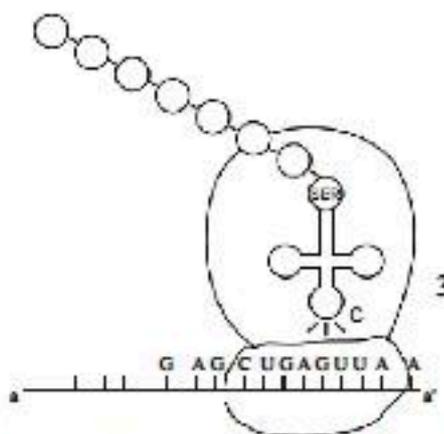
### SECTION-B

17. Explain diagrammatically the age structure of expanding, stable and declining population.

OR

What does S-shaped pattern of population growth represented? How is J-shaped pattern different from it? Explain with the help of graph.

18. (a) Identify the polarity from a to a' in the given diagram and mention how many more amino acids are expected to be added to this polypeptide chain.

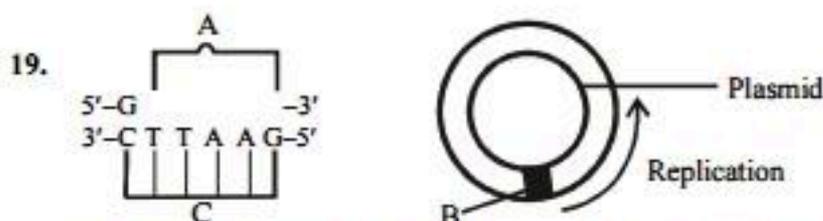


- (b) Mention the DNA sequence coding for serine and the anticodon of tRNA for the same amino acid.  
 (c) Why are some untranslated sequence of bases seen in mRNA coding for a polypeptide? Where exactly are they present on mRNA?

OR

A synthetically prepared mRNA contains repetitive AU sequences. The mRNA was incubated with mammalian cell extract which contains ribosomes, tRNAs and all the factors required for protein synthesis.

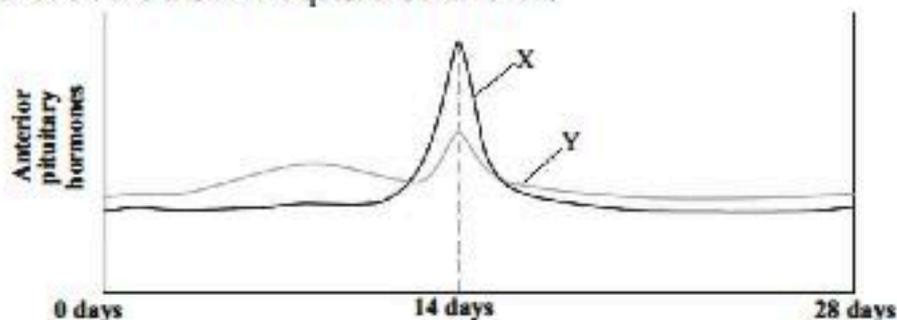
- (a) Assuming no initiation codon is required for protein synthesis, peptides synthesised from this mRNA will most likely to have how many amino acids?  
 (b) Justify your answer by drawing the peptide chain.



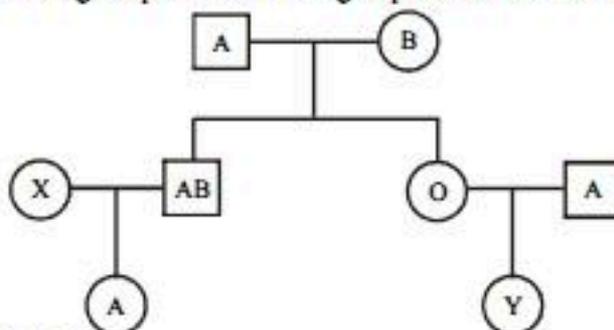
- Identify terms 'A' and 'B' illustrations in the following given figure.
  - Write the term given to 'A' and 'C' and why?
  - Expand PCR. Mention its importance in biotechnology.
20. (a) Why do farmers prefer biofertilisers to chemical fertilisers these days? Explain.  
 (b) How do *Anabaena* and *Mycorrhiza* act as biofertilisers?
21. What is polyembryony? Give two reasons of polyembryony.

### SECTION-C

22. Study the graph given below and answer the questions that follow.

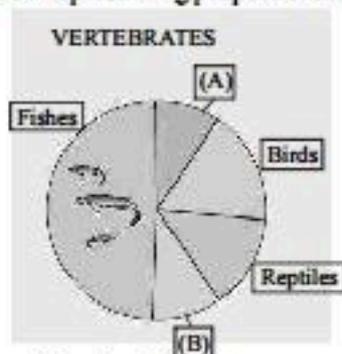


- Name the hormones 'X' and 'Y'.
  - Identify the ovarian phases during menstrual cycle.
    - 5th day to 12th day of the cycle.
    - 14th day of the cycle.
    - 16th day to 25th day of the cycle.
  - Explain the ovarian event (i) under the influence of hormones 'X' and 'Y'.
23. Study the given pedigree chart showing the pattern of blood group inheritance in a family.

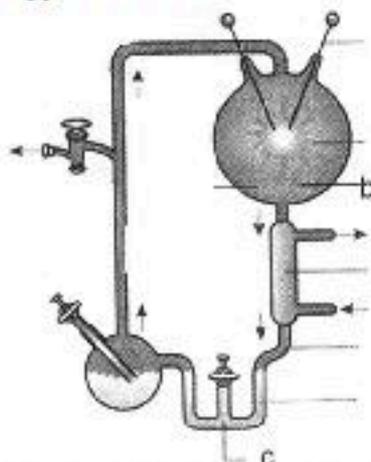


- Give the genotype of the following.
    - Parents
    - The individual 'X' in second generation.
  - State the possible blood groups of the individual 'Y' in third generation.
  - How does the inheritance of this blood group explain codominance?
24. (a) Name and explain by giving reasons the type of immunity provided to the new born by colostrum and vaccination.  
 (b) Name the type of antibody:
  - present in colostrum
  - produce in response to allergens in human body.
25. Read the following article regarding "Gene therapy" and answer the following questions.  
 "The ultimate goal of gene therapy is the gene replacement therapy. Gene replacement therapy permits physiological regulation of the transgenes and elimination of the possibility of insertional activation of other cellular gene which occur at the time of random integration of the foreign gene. At present the current strategy for gene therapy largely centres around gene augmentations therapy, where the foreign gene replaces the defective or missing gene."  
 (a) Mention the cause and the body system affected by ADA deficiency in humans.  
 (b) How is gene therapy being used in treating ADA deficiency patients? Explain in steps.

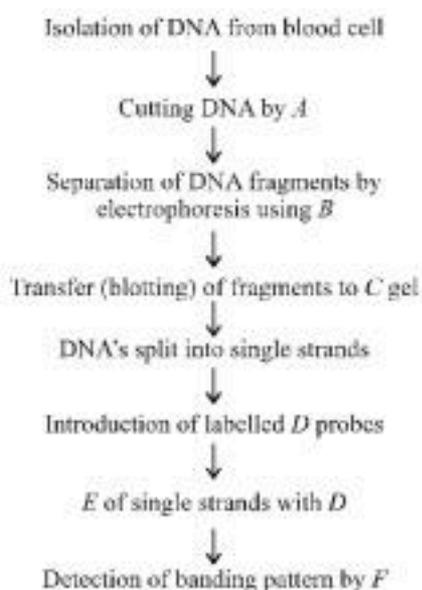
26. (a) Identify 'A' and 'B' in the figure given below representing proportionate number of major vertebrate taxa.



- (b) Name the type of biodiversity represented by the following:
- 50,000 different strains of rice in India.
  - Estuaries and alpine meadows in India.
- (c) Name two major causes of biodiversity losses in a geographical region.
27. The figure given below represents Miller's apparatus used for his experiment. Name the chemicals found in the samples drawn from 'c'. How did this experiment support evolution?



28. The following is the flow chart highlighting the steps in DNA fingerprinting technique. Identify *A*, *B*, *C*, *D*, *E* and *F*.



### SECTION-D

29. Read the following and answer any four questions from 29(i) to 29(iv) given below:

#### Acquired Immuno Deficiency Syndrome:

The word AIDS stands for Acquired Immuno Deficiency Syndrome. AIDS is caused by the Human Immuno deficiency Virus (HIV), a member of a group of viruses called retrovirus, which have an envelope enclosing the RNA genome. Transmission of HIV-infection generally occurs by (a) sexual contact with infected person, (b) by transfusion of contaminated blood and

blood products, (c) by sharing infected needles as in the case of intravenous drug abusers and (d) from infected mother to her child through placenta. So, people who are at high risk of getting this infection includes - individuals who have multiple sexual partners, drug addicts who take drugs intravenously, individuals who require repeated blood transfusions and children born to an HIV infected mother. 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 (Figure 8.6). The macrophages continue to produce virus and in this way 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 that could have been otherwise overcome such as those due to bacteria especially Mycobacterium, viruses, fungi and even parasites like Toxoplasma. The patient becomes so immuno-deficient that he/she is unable to protect himself/herself against these infections. A widely used diagnostic test for AIDS is enzyme linked immuno-sorbent assay (ELISA). Treatment of AIDS with anti-retroviral drugs is only partially effective. They can only prolong the life of the patient but cannot prevent death, which is inevitable.

- (i) HIV selectively targeted on which cells?
- (ii) Name the test used to diagnose AIDS?
- (iii) "Opportunistic infection are more frequent and more severe in people with HIV." Statement is true or false?
- (iv) Which is not considered a common method of transmission for HIV?

30. Read the following and answer any four questions from 30(i) to 30(iv) given below:

**Polymerase Chain Reaction:**

PCR stands for Polymerase Chain Reaction. In this reaction, multiple copies of the gene (or DNA) of interest is synthesised in vitro using two sets of primers (small chemically synthesised oligonucleotides that are complementary to the regions of DNA) and the enzyme DNA polymerase. The enzyme extends the primers using the nucleotides provided in the reaction and the genomic DNA as template. If the process of replication of DNA is repeated many times, the segment of DNA can be amplified to approximately billion times, i.e., 1 billion copies are made. Such repeated amplification is achieved by the use of a thermostable DNA polymerase (isolated from a bacterium, *Thermus aquaticus*), which remain active during the high temperature induced denaturation of double stranded DNA. The amplified fragment if desired can now be used to ligate with a vector for further cloning.

- (i) In the PCR technology the DNA segment is replicated over a billion time. Which enzyme is used in this repeated replication?
- (ii) Which source is used in Taq polymerase in PCR?
- (iii) Write the correct order of steps in polymerase chain reaction (PCR)?
- (iv) What induced denaturation of double stranded DNA?

**SECTION-E**

31. What are the reasons for the accelerated rates of species extinction, facing the world?

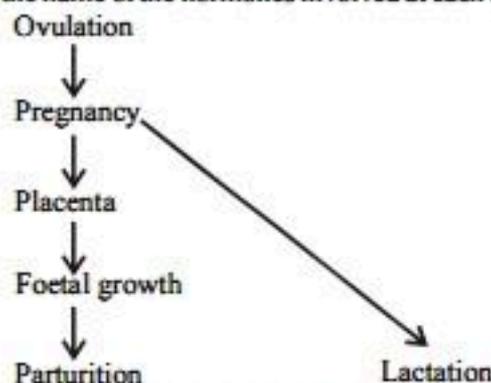
OR

What is genetic diversity? Give its significance.

32. Starting with the zygote, draw the diagrams of the different stages of embryo development in a dicot.

OR

Study the flow chart given below. Give the name of the hormones involved at each stage and explain their role.



33. Write steps of packaging of DNA helix. Give salient features of double helical structure of DNA.

OR

- (a) Explain the role of DNA dependent RNA polymerase in initiation, elongation and termination during transcription in bacterial cell.
- (b) How is transcription a more complex process in eukaryotic cells? Explain

# Solutions

## SAMPLE PAPER-7

1. (d) (1 mark)
2. (b) In diploid organisms, specialised cells called meiocytes undergo meiosis. Blue-green algae (cyanobacteria) are unicellular with haploid chromosomes, where the most common method of multiplication is binary fission. (1 mark)
3. (d) (1 mark)
4. (a) (1 mark)
5. (c) (1 mark)
6. (b) Lactational amenorrhoea is the absence of menstruation. It is the breast sucking of mother by her child for a long time which is considered to contribute a gap for pregnancy. It is based on the fact that ovulation and the menses do not occur during the period of intense lactation following parturition. (1 mark)
7. (c) PCR is a technique for enzymatically replicating DNA without using a living organism such as *E. coli* or Yeast. It is commonly used in medical and biological research labs for a variety of tasks like detection of hereditary diseases, identification of genetic fingerprints etc.  
The correct steps shown in the given figure are:  
A – Denaturation at a temperature of about 94° to 98°C. During the denaturation, the double strand melts open to single stranded DNA, and all enzymatic reactions stop.  
B – Annealing (binding of DNA primer to the separated strands occurs at 50° to 65°C, which is lower than the optimal temperature of the DNA polymerase).  
C – Extension or elongation of the strands using the DNA primer with heat-stable DNA polymerases, most frequently Taq (*Thermus aquaticus*) polymerase at 72°C. (1 mark)
8. (d) Hisardale is a new breed of sheep developed in Punjab by crossing Bikaneri ewes and Marino rams. Cross breeding is a method in which superior male of one breed is mated with superior females of another breed. It allows the desirable qualities of two different breeds to be combined. (1 mark)
9. (d) Living fossils is a living species of organism that appears to be similar to a species otherwise known only from fossils without having any close living relatives. (1 mark)
10. (d) (1 mark)
11. (d) (1 mark)
12. (d) Alleles of two genes are segregating independently. Mendel explained by crossing a pea plant with round and yellow seeds and one with wrinkled and green ones. All  $F_1$  hybrids give yellow and round seeds. Since yellow colour is dominant over the green and the round shape is dominant over the wrinkled.  
When the  $F_1$  - hybrid plants are crossed to each or allowed to self fertilise, and  $F_2$  - generation form as represented in the following figure. (1 mark)
13. (c) Ground nut and pea are non-endospermic as they do not have residual endosperm. Endosperm are filled with reserve food materials and are used for nutrition of developing embryo. Endosperm may either be completely

consumed by developing embryo (e.g., pea, groundnut, beans) before seed maturation or it may persist in mature seed (e.g., castor and coconut) and used up during seed germination. (1 mark)

14. (c) Head of a sperm has acrosome but the spiral row of mitochondria are present in the mid (connecting) piece of the sperm. (1 mark)
15. (a) A genotype describes the actual set (complement) of genes carried by an organism. Genotype of the organism includes all dominant and recessive characters. (1 mark)
16. (b) Diarrhoeal disease include frequent and excessive discharge of watery material from the bowel. Such diseases mostly result from ingestion of harmful germs with food and water. *E. coli*, *Shigella* sp. and *Salmonella* sp. causes diarrhoea. Diarrhoea caused by virus, bacteria or parasites possesses two characteristics- firstly, the offending organisms colonise the intestine and as a consequence cause inflammation of the intestine or enteritis; and secondly, they upset the balance of intestinal fluid absorption and secretion mechanism, often enhancing the latter very considerably, which is then manifested as watery stool discharged frequently in large volumes. Dehydration is common to all types of diarrhoeal diseases and adequate supply of fluids and electrolytes that provides ions, should be ensured. (1 mark)
17. Age structure of different populations are :

- (a) **Expanding Population** : This type of population has more pre-reproductive and reproductive population and less post reproductive population.

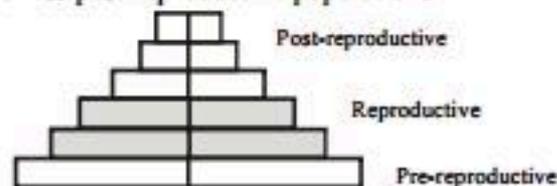


Fig - Expanding age pyramid

- (b) **Stable Population** : In this type of population, there are nearly equal number of pre-reproductive and reproductive individuals with a declining number of post reproductive individuals.

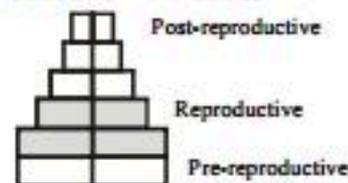


Fig - Stable age pyramid

- (c) **Declining Population** : This population has large number of post-reproductive individuals as compared to pre-reproductive and reproductive population.

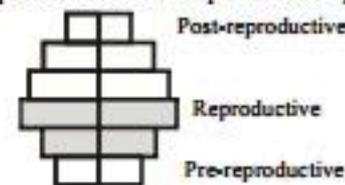


Fig - Declining age pyramid

(2 marks)



Steps followed in gene therapy are as follows:

- (i) Lymphocytes from patient's blood were grown in a culture, functional ADA and cDNA were introduced in these lymphocytes using a retroviral vector which was subsequently returned to the patient.
  - (ii) As these cells are immortal, patient requires periodic infusion of such genetically engineered lymphocytes.
  - (iii) If the gene isolated from the bone marrow cells producing ADA is introduced at early embryonic stage, it can be permanent cure. (2 marks)
26. (a) • A-Mammals  
• B-Amphibians
- (b) (i) Genetic diversity  
(ii) Ecological diversity
- (c) The two major causes of species losses in a geographical region are:
- (i) Habitat loss and fragmentation.
  - (ii) Over exploitation of natural resources.
  - (iii) Alien species invasions.
  - (iv) Co-extinction (2 × ½ + 2 × ½ + 4 × ½ marks)
27. Amino acids, (other scientist observed formation sugars, bases pigments and fats) were the chemicals found in the samples drawn from 'c'. Miller experiment supports chemical evolution *i.e.*, the formation of organic molecules from inorganic molecules. (3marks)
28. A – Restriction endonuclease  
B – Ethidium bromide  
C – Agarose  
D – VNTR  
E – A piece  
F – Autoradiography (6 × ½ = 3 marks)
29. (i) HIV enters into helper T-lymphocytes, replicates and produce progeny viruses.  
(ii) Enzyme linked immuno-sorbent assay (ELISA).  
(iii) Above statement is true. Opportunistic infections occur in people whose immune systems do not function well: these infections would often not cause problems for healthy individuals. Opportunistic infections are more common in people with HIV, but they are less common now than in the early days of the HIV epidemic due to improved treatment protocols.  
(iv) HIV is spread among humans by certain fluids, including blood, semen, breast milk, vaginal secretions, rectal fluids, and pre-seminal fluid. The infected fluid must come in contact with a skin break or mucous membrane of the healthy person in order for infection to occur. Contamination of the bloodstream (e.g. by a needle or syringe from an infected person) can also spread the virus. HIV is not spread by urine or contact with urine from an infected person. (1+1+1+1 marks)
30. (i) *Taq* polymerase.  
(ii) *Thermus aquaticus* (thermophilic bacteria).  
(iii) Denaturation, annealing, extension.  
(iv) At high temperature, double stranded DNA denatured. (1+1+1+1 marks)
31. The world is facing accelerated rate of species extinction largely due to human activities. There are four major causes called 'The evil quartet'.

- (i) **Habitat loss and fragmentation** : Urbanisation, industrialization, clearing forest for agriculture, filling wetlands, caused extinction of endemic species.
- (ii) **Over exploitation** : Causing reduction to size of its population so that it becomes vulnerable to extinction.
- (iii) **Alien species invasions** : Non-native species introduced for economic and other uses, invaded and drive away the local species. Exotic/alien species have proved harmful to both aquatic and terrestrial ecosystem.
- (iv) **Co-extinction** : Certain obligatory mutualistic relationships exist in nature. Extinction of one will automatically cause extinction of other. For example, if the host fish becomes extinct all the parasites exclusively found in it will also become extinct. (1 + 4 × 1 = 5 marks)

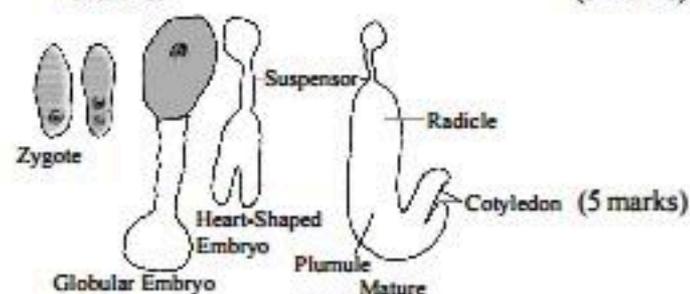
OR

Genetic diversity is the diversity of the number and types of genes as well as chromosomes present in different species and the variations in the genes and their alleles in the same species. (2 marks)

**Significance:**

- (i) It is helpful in adaptation to changes in environmental condition.
- (ii) It helps in speciation or evolution of new species.
- (iii) Lower genetic diversity within a species or variety especially of a crop plant may be useful for uniformity in yield as well as higher yield. However, there is disadvantage of its degradation and susceptibility to mass scale destruction due to fungal or insect attacks. (3 marks)

32.



OR

- (i) Rapid release of Luteinising Hormone (LH) ruptures Graafian follicle and release ovum (ovulation).
- (ii) Corpus luteum secretes large amount of progesterone hormone that is essential for the maintenance of the endometrium required for implantation of blastocyst leading to pregnancy.
- (iii) Placenta produces several hormones like human Chorionic Gonadotropin (hCG), human Placental Lactogen (hPL). Relaxin is also produced during later phase of pregnancy. Level of other hormones like oestrogen, progesterone, cortisol, prolactin and thyroxine also increase which is essential for supporting foetal growth, metabolic changes in mother and maintenance of pregnancy.
- (iv) Parturition signals originate from the fully developed foetus and the placenta that induce mild uterine contractions which triggers the release of oxytocin from pituitary. Oxytocin acts on the uterine muscle causing stronger uterine contractions.
- (v) The two primary hormones that are needed for lactation are prolactin and oxytocin. Sucking stimulates an increase in prolactin levels which is important for the initiation of milk production. (5 × 1 = 5 marks)

33. DNA has a double helical structure. In prokaryotes DNA is held with some proteins to form nucleoid. The DNA in nucleoid is organised in large loops held by proteins. In eukaryotes there are positively charged basic proteins called histones. Histones are organised to form a unit of eight molecules called histone octamer. The negatively charged DNA is wrapped around positively charged histone octamer to form nucleosome. A typical nucleosome contains 200 base pairs of DNA helix. Nucleosomes constitute the repeating unit of a structure in nucleus, called chromatin. The nucleosomes in chromatin are seen as "beads-on-string" under electron microscope. The beads-on-string structure in chromatin is packaged to form chromatin fibres that became condensed to form chromosomes.



Fig. EM picture - 'Beads-on-String'

The packaging of chromatin requires additional set of proteins collectively called Non-histone chromosomal proteins (NHC). The loosely packed regions of chromatin are called euchromatin and densely packed regions are called heterochromatin. (2½ marks)

The salient features of DNA are :

- (i) DNA is made of two polynucleotide chains.
- (ii) The two chains are antiparallel. One runs in 3' — 5' direction, other in 5' — 3' direction.
- (iii) Two bases are paired through hydrogen bonds. Adenine pairs with thymine by 2 hydrogen bonds. Guanine pairs with cytosine by 3 hydrogen bonds.
- (iv) The two chains are coiled in right handed fashion. The pitch of helix is 3.4 nm and consists of 10 bps in each turn. The distance between a bp is 0.34 nm.
- (v) The plane of one base pair stacks over the other in double helix giving stability to helical structure. (2½ marks)

OR

- (a) Role of DNA dependent RNA polymerase is given below:
  - (i) During initiation, it becomes associated transiently with initiation factor (sigma  $\sigma$ ) and binds to the promoter site on DNA and initiates transcription.
  - (ii) During elongation, RNA polymerase uses nucleoside triphosphate as substrates and polymerises them in a template-dependent fashion following the base complementary rule in the 5' → 3' direction.
  - (iii) It facilitates the opening of the DNA helix and continues the elongation process.
  - (iv) During termination, When polymerase falls off a terminator region on the DNA, the nascent RNA separates.
  - (v) Association of RNA polymerase with a termination factor is necessary for this. (2½ marks)
- (b) In eukaryotic cells transcription is a complex process because:
  - In the nucleus, three types of RNA polymerase involved which are-
    - RNA polymerase I, it transcribes rRNAs (28 S, 18 S and 5.8 S).
    - RNA polymerase II, it transcribes the precursor of mRNA called hnRNA.
    - RNA polymerase III, it transcribes tRNA, 5SrRNA and snRNAs
  - In prokaryotes, the structural gene is continuous and not differentiated into exons and introns. While in eukaryotes, hnRNA (primary transcript of mRNA) contains both coding sequences called exons and non-coding sequences called introns which undergo splicing.
  - In capping, unusual nucleotide, methylguanosine triphosphate residues are added at the end 5'-end of the hnRNA.
  - In tailing, 200-300 adenylate residues are added at the 3'-end of the hnRNA. (2½ marks)