Class-XII Session 2022-23
Subject - Biology (044)
Sample Question Paper - 17
With Solution

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Ch. No.	Title	Marks Per Unit	Section-A (1 marks)	Section-B (2 marks)	Section-C (3 marks)	Section-D (4 marks)	Section-E (5 marks)	Total Marks
			MCQ & A/R Ques. No.	VSA Ques. No.	SA Ques. No.	Case based Ques. No.	LA Ques. No.	
1	Reproduction in organisms	16	2(Q1, 16)					2
2	Sexual Reproduction in Flowering Plants		1(Q2)	1(Q20)				3
3	Human Reproduction		1(Q13)	1(Q19)	1(Q22)			6
4	Reproductive Health		1(Q12)			1(Q29)		5
5	Principles of Inheritance and Variation	20	1(Q3)	1(Q18)	1(Q23)		1(Q32)	11
6	Molecular Basis of Inheritance		1(Q14)		1(Q27)			4
7	Evolution		2(Q4, 10)		1(Q28)			5
8	Human Health and Disease	12			1(Q24)	1(Q30)		7
9	Strategies for enhancement in food production		2(Q5, 9)					2
10	Microbes in Human Welfare		1(Q8)	1(Q17)				3
11	Biotechnology-Principles and Processes	12	2(Q6, 15)				1(Q31)	7
12	Biotechnology and its Application		2(Q7, 11)		1(Q26)			5
13	Organisms and Populations	10		1(Q21)	1(Q25)			5
14	Ecosystem							0
15	Biodiversity and conservation						1(Q33)	5
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.

Time Allowed : 3 Hours **Max. Marks : 70**

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. Which is the most common method of reproduction in majority of fungi and bacteria?
(a) Binary fission (b) Multiple fission (c) Budding (d) Spore formation

2. Microsporogenesis occurs
(a) on margins of leaves. (b) inside the ovule. (c) inside the anther. (d) in essential floral organs.

3. In human beings, where genotype AABBCC represents dark skin colour, aabbcc represents light skin colour and AaBbCc represents intermediate skin colour; the pattern of genetic inheritance can be termed as:
(a) Pleiotropy and codominance
(b) Pleiotropy and incomplete dominance
(c) Polygenic and qualitative inheritance
(d) Polygenic and quantitative inheritance

4. Analogous organs are:
(a) different in origin but perform similar functions.
(b) common in origin and perform common functions.
(c) common in origin but perform different functions.
(d) different in origin and perform different functions.

5. 'Lean meat' is considered to be of high quality because it has
(a) lesser but easily digestible protein
(b) lesser lipid content
(c) more fat that makes the meat softer
(d) longer table life due to lesser chances of infection

6. Which one of the following is used as vector for cloning genes into higher organisms?
(a) Baculovirus (b) Salmonella typhimurium (c) Rhizopus nigricans (d) Retrovirus

7. The genetic defect, adenosine deaminase (ADA) deficiency may be cured permanently by
(a) administering adenosine deaminase through injection
(b) bone marrow transplantation
(c) enzyme replacement therapy
(d) introducing isolated gene from marrow cells producing ADA into the cells at early embryonic stages

8. Which one is used in production of alcohol/ethanol ?
(a) Saccharomyces cerevisiae
(b) Torulopsis utilis
(c) Clostridium botulinum
(d) Leuconostoc citrovorum

9. Plants can be disease resistant by
(a) breeding with their wild relatives.
(b) colchicine treatment.
(c) hormone treatment.
(d) heat treatment.

10. Which one of the following statements correctly describes the homologous structures?
(a) Organs that have no function now, but had an important function in ancestors.
(b) Organs appearing only in embryonic stage and disappearing later in the adult.
(c) Organs with anatomical similarities, but performing different functions.
(d) Organs with anatomical dissimilarities, but performing similar function.

11. Agro-chemical based agriculture includes
(a) Fertilisers and pesticides
(b) Genetically modified crops
(c) RNA interference
(d) All of these

12. Which of the following statement regarding natural methods of contraception is true?
(a) They increase phagocytosis of sperms.
(b) They employ barriers to prevent fertilization.
(c) They are the natural ways of avoiding chances of ovum and sperms meeting.
(d) They are surgical and terminal methods.

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:** Head of sperm consists of acrosome and mitochondria.
Reason: Middle piece contains spiral row of mitochondria.

14. **Assertion:** During DNA replication both the parental strand act as template for the synthesis of new daughter strand.
Reason: The Okazaki fragment are formed on the parent strand which runs in 5¢®3¢ direction and proves discontinuous strand synthesis.

15. **Assertion:** In gel electrophoresis, DNA fragments are separated.
Reason: DNA is negatively charged, so it moves towards anode under electric field.

16. **Assertion:** Leaves of Bryophyllum, Begonia help in vegetative multiplication.
Reason: Leaves of these plants possess adventitious buds.

SECTION-B

17. (a) Name the bacterium responsible for the large holes seen in "Swiss Cheese". What are these holes due to?
(b) Why are the fruit juices bought from market clearer as compared to those made at home ?
(c) Name the bioactive molecules produced by *Trichoderma polysporum* and *Monascus purpureus*.

18. Explain two situations, when independent assortment of genes occur, resulting in 50% recombinants?

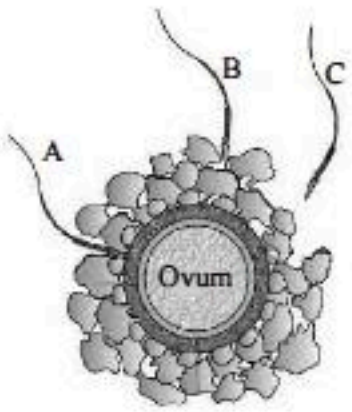
19. Give a scientific term for the following sentences.
(a) Pregnancy in which foetus is growing outside the uterus, often in fallopian tubes is known as _____.
(b) A surgical procedure performed on males in which the vas deferens are cut and tied is known as _____.
(c) A contraceptive device consisting of a small thimble-shaped cup that is placed over the uterus to prevent the entrance of spermatozoa _____.
(d) Ovum and sperms are prevented from physically meeting with the help of _____.

20. List the adaptive features of water pollinated flowers like *Vallisneria*.

21. What are the important elements which cause variations in the physical and chemical conditions of different habitats ?

SECTION-C

22. Given below is the diagram of a human ovum surrounded by a few sperms. Observe the diagram and answer the following questions.



(a) Compare the fate of sperms shown in the diagram.
(b) What is the role of zona pellucida in this process?
(c) Analyse the changes occurring in the ovum during the process.
(d) Specify the region of female reproductive system where the event represented in the diagram takes place.

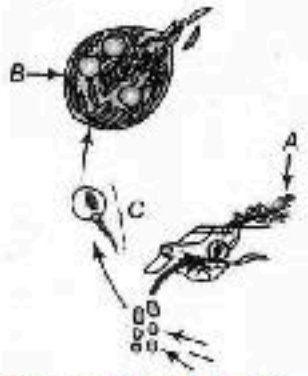
23. (a) Why are thalassemia and haemophilia categorized as Mendelian disorders ? Write the symptoms of these diseases. Explain their pattern of inheritance in humans.
(b) Write the genotypes of the normal parents producing a haemophilic son.

24. (a) All human beings have cellular oncogenes but only few suffer from cancer disease. Give reasons.

(b) How is a malignant tumor different from a benign tumor?

OR

Study a part of the life cycle of malarial parasite given below. Answer the questions that follow.

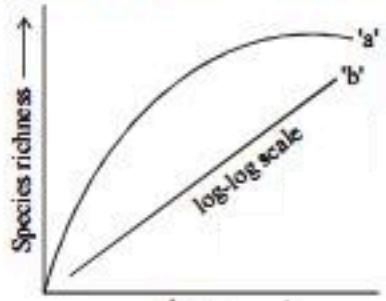


(a) Mention the roles of 'A' in the life cycle of the malarial parasite.

(b) Name the event 'C' and the organ where this event occurs.

(c) Identify the organ 'B' and name the cells being released from it.

25. The following graph shows the species-area relationship. Answer the following question as directed.



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

(b) Write the situations as discovered by the ecologists when the value of 'Z' (slope of the line) lies

(i) 0.1 and 0.2

(ii) 0.6 and 1.2

What does 'Z' stand for ?

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

OR

Since the origin of life on the earth, there were five episodes of mass extinction of species.

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

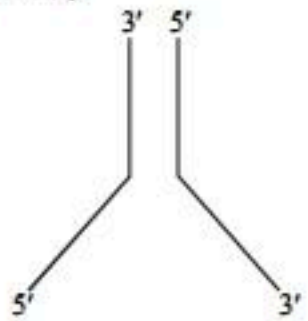
(ii) Who is mainly responsible for the 'Sixth Extinction'?

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

26. (a) Name the deficiency for which first clinical gene therapy was given.

(b) Mention the cause and one cure for this deficiency.

27.



(a) Identify the structure shown above.

(b) Redraw the structure as a replicating fork and label the parts.

(c) Write the source of energy for this replication and list the enzymes involved in this process.

(d) Mention the difference in the synthesis based on the polarity of the two template strands.

28. (a) Select the homologous structures from the combinations given below :
    (i) Forelimbs of whales and bats
    (ii) Tuber of potato and sweet potato
    (iii) Eyes of octopus and mammals
    (iv) Thorns of *Bougainvillea* and tendrils of *Cucurbita*
    (b) State the kind of evolution they represent.

SECTION-D

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

Infertility:

A large number of couples all over the world including India are infertile, i.e., they are unable to produce children inspite of unprotected sexual co-habitation. The couples could be assisted to have children through certain special techniques commonly known as Assisted reproductive technologies (ART). In vitro fertilisation (IVF-fertilisation outside the body in almost similar conditions as that in the body) followed by embryo transfer (ET) is one of such methods. In this method, popularly known as test tube baby programme, ova from the wife/donor (female) and sperms from the husband/donor (male) are collected and are induced to form zygote under simulated conditions in the laboratory. The zygote or early embryos (with upto 8 blastomeres) could then be transferred into the fallopian tube (ZIFT-zygote intra fallopian transfer) and embryos with more than 8 blastomeres, into the uterus (IUT - intra uterine transfer), to complete its further development. Embryos formed by in-vivo fertilisation (fusion of gametes within the female) also could be used for such transfer to assist those females who cannot conceive. Transfer of an ovum collected from a donor into the fallopian tube (GIFT - gamete intra fallopian transfer) of another female who cannot produce one, but can provide suitable environment for fertilisation and further development is another method attempted. Intra cytoplasmic sperm injection (ICSI) is another specialised procedure to form an embryo in the laboratory in which a sperm is directly injected into the ovum. Infertility cases either due to inability of the male partner to inseminate the female or due to very low sperm counts in the ejaculates, could be corrected by artificial insemination (AI) technique. In this technique, the semen collected either from the husband or a healthy donor is artificially introduced either into the vagina or into the uterus (IUI - intra-uterine insemination) of the female.

(i) A lady is diagnosed to have both her fallopian tubes blocked. What ART can help her to conceive a child?
(ii) What ART stands for?
(iii) What will do "test-tube baby" procedure?
(iv) Name the process in which transfer of an ovum collected from a donor into the fallopian tube of another female?

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

Drug abuse

Opioids are the drugs, which bind to specific opioid receptors present in our central nervous system and gastrointestinal tract. Heroin commonly called **smack** is chemically diacetylmorphine which is a white, odourless, bitter crystalline compound. This is obtained by acetylation of morphine which is extracted from the latex of poppy plant *Papaver somniferum*. Generally taken by snorting and injection, heroin is a depressant and slows down body functions. Cannabinoids are a group of chemicals which interact with cannabinoid receptors present principally in the brain. Natural cannabinoids are obtained from the inflorescences of the plant *Cannabis sativa*. The flower tops, leaves and the resin of cannabis plant are used in various combinations to produce marijuana, hashish, charas and ganja. Generally taken by inhalation and oral ingestion, these are known for their effects on cardiovascular system of the body.

(i) Which part of poppy plant is used to obtain the drug "smack"?
(ii) Name the source of *canabis sativa*?
(iii) Name the process from which heroin is obtained?
(iv) Name the plant from which cannabinoids were obtained?

SECTION-E

31. (a) You are provided with DNA samples which needs to be amplify for its future use. From the materials and steps given below, select those, required for *in vitro* amplification of DNA and arrange them in the order.

(i) *In vitro* synthesis of copies of DNA of interest
(ii) Chemically synthesised oligonucleotides
(iii) Enzyme DNA-polymerase
(iv) Complementary region of DNA
(v) Genomic DNA template
(vi) Nucleotides provided
(vii) Primers
(viii) Thermostable DNA-polymerase (from *Thermus aquaticus*)
(ix) Denaturation of ds-DNA

(b) Expand 'ELISA'. Why is this method preferred over conventional method of diagnosis of disease?

OR

(a) Describe the characteristics, a cloning vector must possess.

(b) Why DNA cannot pass through the cell membrane? Explain. How is a bacterial cell made competent to take up recombinant DNA from the medium?

32. Study the flow chart given below and answer the questions that follow.

(A) S-strain ⟶ into mice ⟶ mice die

(B) R-strain ⟶ into mice ⟶ mice live

(C) Heat-killed S-strain + live R-strain ⟶ into mice ⟶ A

(D) Heat-killed S-strain + DNase + live R-strain ⟶ into mice ⟶ B

(a) Give the name of the organism and differentiate between its two strains R and S.

(b) Write the result 'A' and 'B' obtained in steps 'C' and 'D' respectively.

(c) Give the name of the scientist who performed the steps A, B and C.

(d) Write the specific conclusion drawn from the step D.

OR

What is DNA finger printing ? What are the steps involved? What are their applications ?

33. Describe how habitat loss and fragmentation lead to loss of biodiversity.

OR

(a) List any three important characteristics of a population and explain.

(b) With the help of suitable diagram describe the logistic population growth curve.

Solutions

SAMPLE PAPER-9

1. **(d)** Fungi reproduce by vegetative, asexual and sexual means. About 20% fungi propagate only by asexual means. Asexual reproduction takes place during favourable conditions by the formation of a variety of conidia or spores. The spores may be unicellular (e.g., Aspergillus) or multicellular (e.g., Alternaria). Bacteria also reproduce mainly by asexual method and therefore they have a dominant haploid phase in their life-cycle. Asexual reproduction in bacteria takes place by binary fission, budding, conidia, cysts and endospores. (1 mark)

2. **(c)** Microsporogenesis is the process of formation of microspores or pollen grains, from a pollen mother cell through meiosis, Each cell of sporogenous tissue serve as microspore mother cell (MMC). These MMCs undergo meiosis and form microspore tetrad and become haploid, microspores or pollen grains. As anthers mature microspores of the tetrad separate from each other and develops into pollen grains. Each microsporangium contains numerous pollen grains which are released after dehiscence of anther wall. (1 mark)

3. **(d)** According to given question;

$Hb^A\ Hb^S \times Hb^A\ Hb^S$ (Parent)

↓

$Hb^S\ Hb^S,\ Hb^A\ Hb^A,\ Hb^S\ Hb^A,\ Hb^S\ Hb^A$

(Progenies)

Total number of affected progenies = 1

Percentage of diseased/affected progenies

$= \frac{1}{4} \times 100 = 25\%$ (1 mark)

4. **(a)** The analogous organs are different in origin or basic plan, but have similar functions or adaptations. Wings of butterfly and wings of bird and fins of fishes and flippers of whale are some of the examples of analogous organs. (1 mark)

5. **(b)** Lean meat is the kind of meat with very little fat content in it. It is also high in vitamins and minerals. (1 mark)

6. **(d)** Retrovirus has the ability to transform normal cells into cancerous cells. Hence, it can used as a vector for cloning desirable genes into animal cells. (1 mark)

7. **(d)** (1 mark)

8. **(a)** (1 mark)

9. **(a)** Plant can be made disease resistant by breeding with their wild relatives. (1 mark)

10. **(c)** Homologous organs are anatomically similar but dissimilar in shape, size and function. (1 mark)

11. **(a)** Agrochemical based agriculture is used to increase the food production. It includes use of agrochemicals such as fertilisers and pesticides. (1 mark)

12. **(c)** Natural method of contraception works on the principle of avoiding chances of ovum and sperm meeting. include periodic abstinence, coitus interrupts and lactational ammenorrhea. (1 mark)

13. **(d)** Head of a sperm has acrosome but the spiral row of mitochondria are present in the mid (connecting) piece of the sperm. (1 mark)

14. **(c)** The okazaki fragments are finally joined by the enzyme DNA ligase. (1 mark)

15. **(c)** DNA fragments can be separated with the help of gel electrophoresis, where DNA moves towards the anode (+vely charged). The DNA fragments are separated according to their size through sieving effect of agarose gel. (1 mark)

16. **(b)** (1 mark)

17. (a) *Propionibacterium sharmanii* is responsible for large holes seen in swiss cheese. The large holes in the "swiss cheese" are due to the release of CO_2 as a result of alcoholic fermentation.

(b) The fruit juices made at home are turbid due to the presence of fibres, pectins and proteins while the enzymes pectinases and proteases are used to clarify fruit juices before marketing.

(c) (i) *Trichoderma polysporum* – Cyclosporine-A

(ii) *Monascus purpureus* –Statins (½ + 1 + ½ marks)

18. The two situations are:

(i) When the genes of different traits are located on the same chromosome and must be distinctly located to enhance the recombination frequency.

(ii) When the genes of different traits may be located on different chromosomes. (1 + 1 marks)

19. (a) Ectopic pregnancy

(b) Vasectomy

(c) Cervical cap

(d) Barrier methods. (4 × ½ = 2 marks)

20. **Pollination by water** or **hydrophilly**.

The characteristics of the flowers are:

(i) Flowers are small inconspicuous

(ii) Nectar and odour absent

(iii) Pollen grains light, unwettable

(iv) Perianth and other floral parts unwettable

Female flowers reach the surface of water and male flowers are also released on to the surface of water, male flowers carried passively to the stigmas to effect pollination above water surface, e.g., *Vallisneria*. (4 × ½ marks)

21. The important elements are :

(i) **Abiotic environment :** These includes physical factors like water, air, temperature, light, rainfall and soil with its topography, inorganic and organic materials.

(ii) **Biotic environment :** These includes all the living organisms, i.e., plants and animals. (1 + 1 marks)

22. (a) 'A' is able to penetrate/ fertilise the ovum, whereas 'B' and 'C' are unable to penetrate/ fertilise. When A sperm comes in contact with the zona pellucida layer of the ovum, it induces changes in the membrane that blocks the entry of additional B and C sperms. So B and C will degenerate.

(b) Zona pellucida ensures the entry of only one sperm into the ovum.

(c) During this process, completion of meiotic division of the secondary oocyte, formation of second polar body and a haploid ovum take place.

(d) This event takes place in the ampullary-isthmic junction of the fallopian tube. (1 + ½ + 1 + ½ marks)

23. (a) Thalassaemia and haemophilia are categorised as Mendelian disorders because they occur by mutation in a single gene. Their mode of inheritance follows the principles of Mendelian genetics. Mendelian disorders can be
autosomal dominant (muscular dystrophy)
autosomal recessive (thalassaemia)
sex linked (haemophilia)

Symptoms of Thalassaemia:
Thalassaemia minor results only in mild anaemia, characterised by low haemoglobin level.
Thalassaemia major is also known as Cooley's anaemia. In this disease, affected infants are normal but as they reach 6 to 9 months of age, they develop severe anaemia, skeletal deformities, jaundice, fatigue, etc.

Symptoms of Haemophilia:
Person suffering from this disease does not develop a proper blood clotting mechanism.
A haemophilic patient suffers from non-stop bleeding even on a simple cut, which may lead to death.

Pattern of Inheritance of Thalassaemia:
Pair of alleles Hb^A and Hb^T controls the expression of this disease.
Conditions for thalassemia :
Hb^A and Hb^A : Normal
Hb^A and Hb^T : Carrier
Hb^T and Hb^T : Diseased
Let us assume that both father and mother are the carriers (Hb^A Hb^T) of beta thalassaemia.

Parents		Hb^AHb^T (Father)	×	Hb^AHb^T (Mother)
Offsprings	Hb^AHb^A Normal Child	Hb^AHb^T Carrier child with thalassaemia trait	Hb^AHb^T Carrier child with thalassaemia trait	Hb^THb^T Child with severe thalassaemia

Pattern of Inheritance of Haemophilia:
Haemophilia is an X-linked genetic disorder. Compared to females, males have higher chances of getting affected because females have 2X chromosomes while males have only X and Y chromosome. Thus, for a female to get affected by haemophilia, she has to have the mutant allele on both the X chromosomes while males can be affected if they carry it on the single X chromosome.
Conditions for haemophilia:
XY; XX: Normal
X^hY: Haemophilic
X^hX: Carrier
X^hX^h : Haemophilic
Let us assume that a carrier female (X^hX) is married to a normal male.

Parents		XY (Male)	×	X^hX (Female)
Offsprings	X^hX Carrier female	XX Normal female	X^hX Haemophilic male	XX Normal male

(b) When a normal male marries a carrier female (she is considered normal as she contains the mutant gene on one of her X chromosomes), they can produce a haemophilic son. So, the genotype of the parents would be XY and X^hX.

Parents		XY (Male)	×	X^hX (Female)
Offsprings	X^hX Carrier daughter	XX Normal daughter	X^hY Haemophilic son	XY Normal son

(2+1 marks)

24. (a) All cells have cellular oncogenes or proto-oncogene which code for certain growth factors. Under certain conditions, they get activated and lead to oncogenic transformation causing cancer. This transformation is induced by physical, chemical and biological factors called carcinogens.

(b) Differences between benign and malignant tumor are as follow

S.No.	Benign tumor	Malignant tumor
1.	It is non-cancerous tumor.	It is a cancer tumor.
2.	Benign tumor does not show metastasis and is non-invasive.	It show metastasis and thus invades other body parts.
3.	Limited adherence occurs amongst cells of benign tumor.	There is no adherence amongst cells. They tend to slippest one another.
4.	It is less fatal to the body	It is more fatal to body.

(1+2 marks)

OR

(a) A is female *Anopheles* mosquito. These mosquito act as vectors and transmit the disease from patients to healthy individuals.
(b) The event C is fertilisation. It occurs in the intestinal wall of mosquito.
(c) B is salivary glands. Sporozoites cells released from it. (1 × 3 = 3 marks)

25. (a) Alexander Von Humboldt observed that within a region species richness increased with increasing explored area, but only up to a limit. In fact, the relation between species richness and area for a wide variety of taxa turns out to be a rectangular hyperbola.

(b) (i) the slop of regression lines are similar / unaffected distribution in an area.

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

Z (slope of the line) regressio co-efficient = ½

(c) The slope of the line 'b' becomes steeper when the species richness *is more i.e.*, 0.62 – 1.2 (1 + 1 + 1 marks)

OR

(i) The difference is in the rates; the current species extinction rates are estimated to be 100-1000 times faster than in the pre-human times.

(ii) Anthropogenic or man-made activities are mainly responsible for the 'Sixth Extinction'.

Biodiversity can be conserved by protecting the whole ecosystem. There are two basic approaches for conservation of biodiversity.

(A) *In-situ* conservation (*On-site conservation*)

(a) **Biodiversity hot spots**–Regions of high levels of species richness and high degree of endemism.

(b) **Sacred grooves**–Large number of rare and threatened plant species can be found in these regions.

(B) *Ex-situ conservation* (Off-site conservation)

(a) This approach involves placing threatened animals and plants in special care units for their protection.

(b) By using cryopreservation (preservation at – 196°C) technique, sperms, eggs, animal cells, tissues and embryos can be stored for long period in gene banks, seed banks, etc. (1 + 1 + 1 marks)

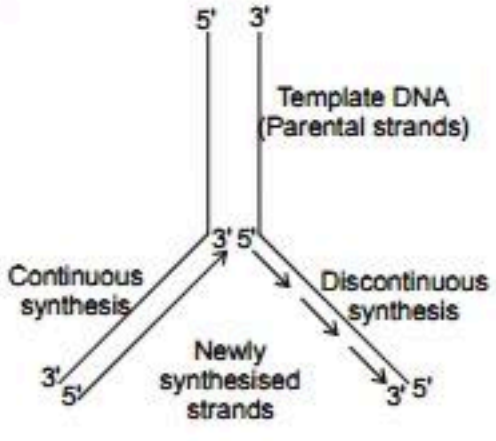
26. (a) Adenosine deaminase enzyme deficiency (ADA deficiency).

(b) The cause of this disorder is due to the deletion of a gene for the enzyme adenosine deaminase (ADA).

Cure : The disorder can be treated by enzyme replacement therapy in which functional ADA is given to the patient by injection. (1 + 2 marks)

27. (a) Replicating Fork

(b)



(c) Activiated deoxyribonucleotide triphosphate act as substrate and also provide energy for polymerisation reaction, similar to ATP.

List of enzymes

(i) Helicases : Unzips the two strands of DNA

(ii) Single stranded DNA binding proteins : Stablise single strands

(iii) Topoisomerases : Release tension in the uncoiled part by nicking resealing straightened DNA strands.

(iv) RNA polymerase Primase : for primer synthesis

(v) DNA polymerase (Prokaryotes) have three major types of DNA polymerases III, II and I)

(d) On the template strand with 3' - 5' polarity, the sythesis of new strand is continuous while in the other template strand with 5'-3' polarity the synthesis of new strand is in discontinuous fashion forming okazaki fragments. (½ + 1 + 1 + ½ marks)

28. (a) Homologous organs are the organs having similar structural plan and origin but performing different functions.

From the given options, following are homologous structures :

Forelimbs of whales and bats are similar in structure but perform different functions of swimming and flying, respectively.

Thorns of *Bougainvillea* and tendrils of *Cucurbita* are both modifications of a stem arising from axillary bud but perform different functions of protection and climbing, respectively.

(b) The evolution represented by homologous organs or structures is divergent evolution as they have common origin but have diverged (became dissimilar) with evolution due to adaptations to different needs. (2 + 1 marks)

29. (i) IVF (In vitro fertilisation).

(ii) Assisted Reproductive Technologies.

(iii) In test-tube baby fertilisation in invitro but embryo development is in-vitro.

(iv) GIFT (Gamete intra fallopian tube). (1 × 4 = 4 marks)

30. (i) Latex.

(ii) Marijuana.

(iii) Acetylation of morphine.

(iv) *Cannabis sativa* (1 × 4 = 4 marks)

31. (a) Amplification of gene of interest is done by using Polymerase Chain Reaction (PCR). For this process, different steps and materials are required which are used in the following order.

- In this process, *in vitro* synthesis of DNA copies is done. At first, denaturation of ds DNA occur. This would form genomic DNA which work as template.
- After, small chemically synthesised oligonucleotides called primers and DNA polymerase which is a thermostable (*Taq* polymerase) is used.
- Then the DNA polymerase extends the primer using then ucleotides provided in the reaction, leads to formation of complementary region of DNA.

The correct sequence is :

$$\underbrace{(i) \rightarrow (ix) \rightarrow (v)}_{-1} \rightarrow \underbrace{(ii)/(vii) \rightarrow (iii)/(viii)}_{-1} \rightarrow \underbrace{(viii)/(iii) \rightarrow (vi) \rightarrow (iv)}_{-1}$$

(b) Enzyme Linked Immunosorbent Assay.
ELISA is based on principle of antigen - antibody interaction. This method is preferred over conventional methods of diagnosis of diseases because these tests are highly sensitive, specific as compared to other methods used for detection of antigens or antibodies. (3+2 marks)

OR

(a) The following features are required to facilitate cloning into a vector:

(i) **Origin of replication (*Ori*):**
A DNA sequence that is responsible for initiating replication. Any piece of DNA when linked to this sequence can replicate within the host cells.

(ii) **Selectable Marker:**
- It helps to select the host cells which contain the vector (transformants) and eliminate the non-transformants.
- Genes encoding resistance to antibiotics like ampicillin, chloramphenicol, tetracycline, etc are useful selectable markers for *E. coli*.

(iii) **Cloning sites**
- To link the alien DNA, the vectors should have one unique recognition site for the restriction enzyme.
- Presence of a cloning/recognition site enables the particular restriction enzyme to cut the vector/ plasmid.

(iv) Small size of the vector
- The small size facilitates the introduction of the DNA into the host easily.

(b) DNA is hydrophilic and hence, cannot pass through the cell membrane. A bacterial cell must be made competent to take up this DNA.
For vector mediated gene transfer a competent host is essential. As DNA is hydrophilic molecule, it cannot pass through membrane. A specific concentration of a divalent cation such as calcium is required. It increases the efficiency with which DNA enters the cell through pores in its cell wall.
Recombinant DNA (rDNA) can then be forced into such cells by incubating the cells with recombinant DNA on ice, followed by placing them briefly at 42°C (heat shock) and then putting them back on ice. This enables the cell to take up the recombinant DNA. (3+2 marks)

32. (a)
- The organism is bacterium *Streptococcus pneumoniae* (Pneumococcus).
- S-Strain – S-strain becateria have mucous (polysaccharide) coat. Mice infected with S-strain (virulent) died from pneumonia infection.
R-Strain – These do not have mucous coat. Mice infected with R-strain (non-virulent) do not develop pneumonia infection.

(b)
- A – Mice died
- B – Mice lived

(c) Frederick Griffith performed these steps.

(d) From the step (D), it was concluded that only DNA is the transforming material, not RNA and protein. The proteases and RNase did not affect transformation, so the transforming substance was not a protein or RNA. It was DNA that acts as a hereditary material because on digesting DNA with DNase, it did inhibit transformation, suggesting that the DNA caused transformation. (½+1½+½+1+½+2 marks)

OR

DNA finger printing is a technique to identify a person on the basis of his or her DNA. Every individual has a unique DNA finger print. DNA fingerprinting involves identifying differences in some specific regions in DNA sequence called as repetitive DNA because in these sequences a small stretch of DNA is repeated many times. These repetitive DNA is separated from bulk genomic DNA during centrifugation. The bulk DNA forms a major peak and other small peaks are satellite DNA. These sequences do not code for any protein, but they form a large portion of human genome. These sequences show high degree of polymorphism and form the basis of DNA fingerprinting. DNA from every tissue of an individual show same degree of polymorphism, they become very useful in forensic tests and paternity tests.
The technique was first developed by Alec Jeffreys. He used a satellite DNA as probe that shows very high degree of polymorphism. It was called Variable Number of Tandem Repeats (VNTR).
The steps are as followed –
(i) Isolation of DNA.
(ii) Digestion of DNA by restriction endonucleases
(iii) Separation of DNA fragments by electrophoresis.
(iv) Transferring of separated DNA fragments to synthetic membranes like nitrocellulose or nylon.
(v) Hybridization using labelled VNTR probe.
(vi) Detection of hybridized DNA fragments by autoradiography.

Applications of DNA fingerprinting –
(i) In solving paternity disputes.
(ii) Can solve problems of evolution.
(iii) Useful in treatment of patients suffereing from leukaemia.
(iv) Detection of criminals in crime. Involvement of Dhanu "the human bomb" which killed late Prime Minister Rajiv Gandhi, was detected by DNA finger printing. (3+2 marks)

33. Causes for Loss of Biodiversity.
The four major causes, described as 'The Evil Quartet' are:
(i) Habitat loss and fragmentation
(ii) Over-exploitation
(iii) Invasion of Alien species
(iv) Co-extinctions

Habitat Loss and fragmentation.
- It is the most important or primary cause for extinction.
- The tropical rain forests initially covered 14% of the land surface of earth, but now they cover only 6% of the land area.

- The Amazonian forests, called as the 'Lungs of the planet', are cleared for cultivation of soyabean or conversion into grasslands for raising beef-cattle.
- Total loss of a habitat deprives many animals and plants their homes and they face extinction
- Degradation of habitats by pollution threatens the survival of many species.
- When a large habitat becomes fragmented, animals requiring large territories and those with certain migratory habits are adversely affected and their populations start decreasing. (2 + 3 marks)

OR

(a) The three important characteristics of population are as follows:
   (i) Natality is the rate of reproduction and due to it a population increases in size. New individuals are added to a population.
   (ii) Mortality is the death rate of a population which causes decrease in population size. It may be specific or crude.
   (iii) Population density of a species is the number of individuals of a species per unit area.

(b) Logistic population growth curve – When the resources become limited at certain point of time, so no population can grow exponentially. Every ecosystem or habitat has limited resources to support a particular maximum number of individuals called its carrying capacity (K). When N is plotted in relation to time t, the logistic growth shows sigmoid curve. This type of population growth is called Verhulst-Pearl Logistic Growth and it described by the following equation-

$$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$$

where, N = Population density at time t
r = Intrinsic rate of natural increase
K = Carrying capacity

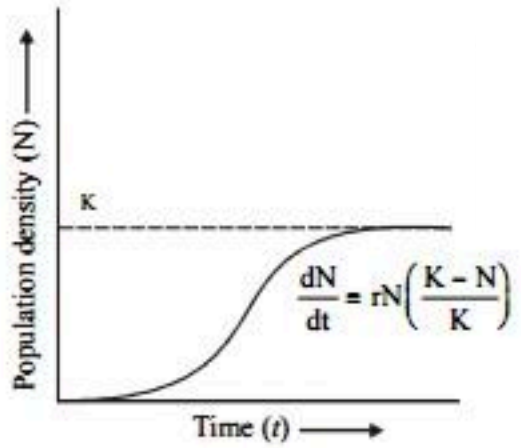


Fig.: Logistic Growth Curve

(2½ + 2½ marks)