

Class-XII Session 2022-23  
Subject - Biology (044)  
Sample Question Paper - 20  
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	
1	Reproduction in organisms	16	1(Q3)	1(Q21)				3	
2	Sexual Reproduction in Flowering Plants				1(Q23)		1(Q31)	8	
3	Human Reproduction			1(Q19)				2	
4	Reproductive Health				1(Q22)			3	
5	Principles of Inheritance and Variation	20	3(Q11, 12, 13)		1(Q27)		1(Q32)	11	
6	Molecular Basis of Inheritance		2(Q10, 14)	1(Q18)				4	
7	Evolution		2(Q1, 9)		1(Q28)			5	
8	Human Health and Disease	12	2(Q15, 16)	1(Q20)				4	
9	Strategies for enhancement in food production				1(Q26)			3	
10	Microbes in Human Welfare		1(Q2)			1(Q30)		5	
11	Biotechnology-Principles and Processes	12	2(Q5, 6)	1(Q17)	2(Q24, 25)			10	
12	Biotechnology and its Application		2(Q4, 7)					2	
13	Organisms and Populations	10	1(Q8)					1	
14	Ecosystem								
15	Biodiversity and conservation					1(Q29)	1(Q33)	9	
16	Environmental issues							0	
	Total Marks (Total Questions)		16(16)	10(5)	21(7)	8(2)	15(3)	70(33)	

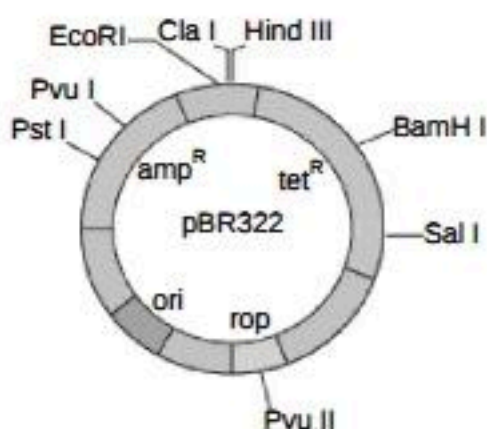
NOTE: The number given inside the bracket denotes question number, ask in the sample paper, while the number given outside the bracket are the number of questions from that particular chapter.

### General Instructions

- All questions are compulsory.
- The question paper has five sections and 33 questions. All questions are compulsory.
- 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.
- 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.
- Wherever necessary, neat and properly labeled diagrams should be drawn.

### SECTION-A

- Atmosphere of earth just before the origin of life consisted of:
  - water vapours,  $\text{CH}_4$ ,  $\text{NH}_3$  and oxygen.
  - $\text{CO}_2$ ,  $\text{NH}_3$ , and  $\text{CH}_2$
  - $\text{CH}_4$ ,  $\text{NH}_3$ ,  $\text{H}_2$  and water vapours.
  - $\text{CH}_4$ ,  $\text{O}_3$ ,  $\text{O}_2$  and water vapours.
- Methanogenic bacteria are present in
  - anaerobic sludge
  - rumen (a part of stomach) of cattle
  - both (a) and (b)
  - None of these
- Asexual reproduction is common among
  - single celled organisms only.
  - plants only.
  - animals with simple organization.
  - single celled animals, plants and animals with simple organizations.
- The trigger for activation of toxin of *Bacillus thuringiensis* is
  - acidic pH of stomach
  - high temperature
  - alkaline pH of gut
  - mechanical action in the insect gut
- The figure below is the diagrammatic representation of the E.Coli vector pBR 322. Which one of the given options correctly identifies its certain component (s)?



- $\text{ori}$  - original restriction enzyme
  - $\text{rop}$  - reduced osmotic pressure
  - Hind III, EcoRI - selectable markers
  - $\text{amp}^R$ ,  $\text{tet}^R$  - antibiotic resistance genes
- The polymerase enzyme used in PCR is
    - DNA polymerase I
    - Taq polymerase
    - reverse transcriptase
    - restriction endonuclease
  - C-peptide of human insulin is
    - a part of mature insulin molecule
    - responsible for the formation of disulphide bridges
    - removed during maturation of pro-insulin to insulin
    - responsible for its biological activity
  - The term 'precipitation' includes
    - rain
    - snow
    - Both (a) and (b)
    - None of them



9. Who proposed that the first form of life come from pre-existing non- living molecules?  
 (a) Oparin and Haldane (b) de Vries and Sturtevant  
 (c) Darwin and Lamarck (d) Louis Pasteur and Miller
10. Which one of the following pair is a purine pair?  
 (a) Uracil, Guanine (b) Cytosine, Thymine  
 (c) Adenine, Guanine (d) Adenine, Thymine
11. The law of segregation of characters postulated by Mendel can be related to  
 (a) the presence of two genes for each character in a somatic cell.  
 (b) a gamete receiving only one of the two homologous chromosomes during gamete formation.  
 (c) presence of both genes on the same chromosome.  
 (d) None of the above
12. Which of the following statement confirm the law of dominance  
 (a) 3:1 ratio in F<sub>2</sub> generation  
 (b) It is the conclusion of a dihybrid cross  
 (c) Alleles do not show any blending and both characters recovered as such in F<sub>2</sub> generation  
 (d) Alleles of a pair segregate from each other such that gamete receives only one of the two factors

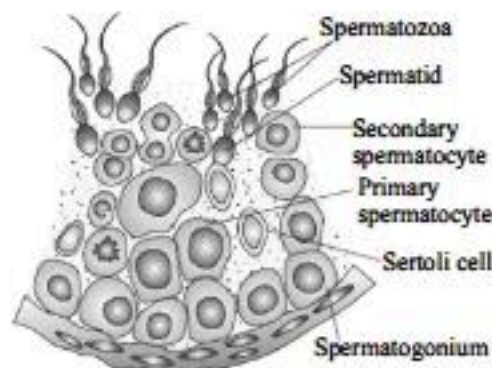
**Directions:** Q.No. 13–16: Consist of two statements–Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

- (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:** Hybrid is formed by cross between two organisms that are different in one or more traits.  
**Reason:** Mendel crossed two plants differing in one trait to obtain F<sub>1</sub> plants in monohybrid cross.
14. **Assertion:** Replication and transcription occur in the nucleus but translation takes place in the cytoplasm.  
**Reason:** mRNA is transferred from the nucleus into cytoplasm where ribosomes and amino acids are available for protein synthesis.
15. **Assertion:** An antibody is a protein molecule made by the lymphocytes.  
**Reason:** An antibody binds to a specific antigen and neutralizes its odd effects.
16. **Assertion:** Phagocyte cells digest microbes and debris  
**Reason:** Natural killer cells destroy virus-infected cells and tumor cells.

### SECTION-B

17. State the role of 'biolistic gun' in biotechnology experiments. Microparticles of which elements are used in this technique?
18. A region of a coding DNA strand has the following nucleotide sequence: -ATGC-  
 What shall be the nucleotide sequence in the following?  
 (i) Sister DNA segment it replicates.  
 (ii) m-RNA polynucleotide it transcribes.
19. Refer the figure of a part of seminiferous tubule showing different stages of sperm formation and answer the questions.



- (a) Describe the process of spermatogenesis up to the formation of spermatozoa.
- (b) Trace the path of spermatozoa from the testes up to the ejaculatory duct only.



20. Define the term 'health'. Mention any two ways of maintaining it.

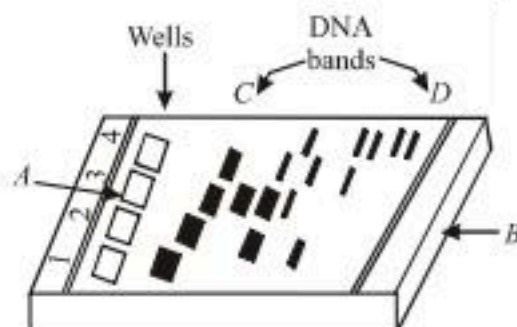
OR

Microbes play a dual role when used for sewage treatment as they not only help to retrieve usable water but also generate fuel. Write in points how this happens?

21. Cucurbits and papaya plants bear staminate and pistillate flowers. Mention the categories they are put under separately on the basis of the type of flowers they bear.

### SECTION-C

22. A large number of married couples in the world are childless. It is shocking to know that in India the female partner is often blamed for the couple being childless.
- State any two reasons responsible for the cause of infertility in case of male and female.
  - Suggest a technique that can help the couple to have a child where the problem is with male.
23. Name the organic materials exine and intine of an angiosperm pollen grains are made up of. Explain the role of exine.
24. Explain stirring type bioreactors.
25. Study the diagram given below and answer the following questions.



- Why have DNA fragments in band D moved far away in comparison to those in band C?
  - Identify the anode end in the diagram.
  - How are these DNA fragments visualised.
26. Scientists have succeeded in recovering healthy sugarcane plants from a diseased one.
- Name the part of the plant used as explant by scientists.
  - Describe the procedure the scientists followed by recover the healthy parts.
  - Name the technology used for crop improvement.
27. (a) State the cause and symptoms of Down's syndrome. Name and explain the event responsible for causing this syndrome.
- (b) Haemophilia and Thalassemia are both examples of Mendelian disorder, but show difference in their inheritance pattern. Explain how.
28. Name the ancestors of man based on the features given below:
- Human like, meat-eater with 900 cc brain, lived in Java.
  - More human with brain size 1400 cc, lived in central Asia, used hides and buried their dead.
  - Human like, vegetarian, with brain capacity between 650 cc and 800 cc.

### SECTION-D

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

#### Ex-Situ Conservation:

In this approach, threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care. Zoological parks, botanical gardens and wildlife safari parks serve this purpose. There are many animals that have become extinct in the wild but continue to be maintained in zoological parks. In recent years ex situ conservation has advanced beyond keeping threatened species in enclosures.

Now gametes of threatened species can be preserved in viable and fertile condition for long periods using cryopreservation techniques, eggs can be fertilised in vitro, and plants can be propagated using tissue culture methods. Seeds of different genetic strains of commercially important plants can be kept for long periods in seed banks.

Biodiversity knows no political boundaries and its conservation is therefore a collective responsibility of all nations. The historic Convention on Biological Diversity ('The Earth Summit') held in Rio de Janeiro in 1992, called upon all nations to take appropriate measures for conservation of biodiversity and sustainable utilisation of its benefits.



In a follow-up, the World Summit on Sustainable Development held in 2002 in Johannesburg, South Africa, 190 countries pledged their commitment to achieve by 2010, a significant reduction in the current rate of biodiversity loss at global, regional and local levels.

- (i) What was the outcome of the 1992 Earth Summit in Rio de Janeiro?
- (ii) For endangered species, *Ex-situ* conservation is a method that is?
- (iii) Which one of the following is related to ex-situ conservation of threatened animals and plants?
- (iv) World summit on sustainable development of 2002 was held in?

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

**Microbes in commercial production of Chemicals, enzymes and Bioactive molecule:**

Microbes are also used for commercial and industrial production of certain chemicals like organic acids, alcohols and enzymes. Examples of acid producers are *Aspergillus niger* (a fungus) of citric acid, *Acetobacter aceti* (a bacterium) of acetic acid; *Clostridium butylicum* (a bacterium) of butyric acid and *Lactobacillus* (a bacterium) of lactic acid. Yeast (*Saccharomyces cerevisiae*) is used for commercial production of ethanol. Microbes are also used for production of enzymes.

Lipases are used in detergent formulations and are helpful in removing oily stains from the laundry. You must have noticed that bottled fruit juices bought from the market are clearer as compared to those made at home. This is because the bottled juices are clarified by the use of pectinases and proteases.

Streptokinase produced by the bacterium *Streptococcus* and modified by genetic engineering is used as a 'clot buster' for removing clots from the blood vessels of patients who have undergone myocardial infraction leading to heart attack. Another bioactive molecule, cyclosporin A, that is used as an immunosuppressive agent in organ-transplant patients, is produced by the fungus *Trichoderma polysporum*. Statins produced by the yeast *Monascus purpureus* have been commercialised as blood-cholesterol lowering agents. It acts by competitively inhibiting the enzyme responsible for synthesis of cholesterol.

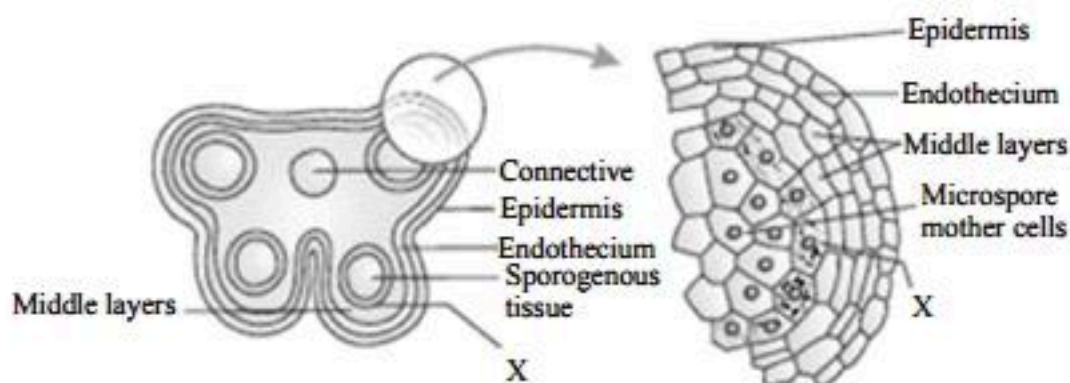
- (i) Which organisms has been Commercialised as blood cholesterol lowering agent?
- (ii) Why bottled fruit juices bought from the market are clearer as compared to those made at home?
- (iii) Identify a, b, c, d, e and f in the given table below

Organism	Bioactive Molecule	Use
1. <i>Monascus purpureus</i>	a	b
2. c	d	Antibiotic
3. e	Cyclosporin A	f

- (iv) Name the enzyme produced by the bacterium *Streptococcus*?

### SECTION-E

31. (a) "X" part in the given diagram plays an important role in the formation of pollen grain wall. Identify "X" and explain its role in the formation of pollen grain wall.



- (b) Describe the characteristics of flowers that are pollinated by wind.
- (c) Identify and explain the stage (given below) involved in post-fertilisation event of flowering plants.
  - (i) Transfer of pollen grains
  - (ii) Embryo development
  - (iii) Formation of flower
  - (iv) Formation of pollen grains

OR

- (a) Explain the menstrual phase in a human female. State the levels of ovarian and pituitary hormones during this phase.
  - (b) Why is follicular phase in the menstrual cycle also referred as proliferative phase? Explain.
  - (c) Explain the events that occur in a graafian follicle at the time of ovulation and thereafter.
32. (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.

OR

Describe the experiment that helped demonstrate the semi-conservative mode of DNA replication.

33. How is biodiversity at all levels generally conserved ?

OR

What kind of threat to biodiversity may lead to its loss ?



# SOLUTIONS

## SAMPLE PAPER-1

1. (c) The primitive atmosphere was reducing due to lack of *free molecular oxygen*. The early atmosphere contained ammonia ( $\text{NH}_3$ ), water vapour ( $\text{H}_2\text{O}$ ), hydrogen ( $\text{H}_2$ ), methane ( $\text{CH}_4$ ). (1 Mark)
2. (c) Methanobacterium, a common bacteria of methanogens, is found in the anaerobic sludge during sewage treatment and rumen of cattle (for cellulose digestion). (1 Mark)
3. (d) Asexual reproduction does not involve meiosis, ploidy reduction or fertilization, and the offspring is a clone of the parent organism because of no exchange of genetic material. Asexual reproduction is the primary form of reproduction for single-celled organisms such as the archaeobacteria, eubacteria, and protists. Many plants and fungi reproduce asexually as well. (1 Mark)
4. (c) Bt toxins are inactive protoxins but after ingested by the insect, these inactive toxin becomes active, due to the alkaline pH of the gut, that solubilise the crystals. Hence, high pH value is required to make Bt toxins active. Under high temperature and acidic pH, Bt toxins remain insoluble and inactive. (1 Mark)
5. (d) In pBR 322 ori-represents site of origin or replication rop-represents those proteins that take part in replication of plasmid. Hind III, EcoRI- Recognition sites of Restriction endonucleases amp<sup>R</sup> and tet<sup>R</sup> - They are antibiotic resistant gene part. (1 Mark)
6. (b) The enzyme used in PCR is Taq polymerase. Taq polymerase (isolated from bacterium *thermus aquaticus*) which remains active during the high temperature, usually amplifies DNA segments of upto 2 kb. (1 Mark)
7. (c) C-peptide or the connecting peptide is a short stretch of protein contains 31 amino acids. It connects the A and B chain of proinsulin molecule. After the processing of proinsulin molecule, C-peptide is removed leaving behind A and B chains which later bound together by disulphide bonds to constitute a mature insulin molecule. (1 Mark)
8. (c) Precipitation includes both rain and snow. (1 Mark)
9. (a) Oparin of Russia and Haldane of England proposed that the first form of life could have come from pre-existing non-living molecules (eg, RNA, protein etc. and that formation of life was preceded by chemical evolution i.e. formation of diverse organic molecule from inorganic molecules. (1 Mark)
10. (c) DNA (deoxyribose nucleic acid) consists of 3 different molecules-phosphate, 5-carbon deoxyribose sugar and nitrogenous base. The nitrogenous base may be a 9-membered, double purine, i.e., adenine (A) or guanine (G), or a 6-membered, single-ringed pyrimidine, i.e., thymine (T) or cytosine (C). (1 Mark)
11. (b) The law of segregation of characters postulated by Mendel can be related to a gamete receiving only one of the two homologous chromosomes during meiosis. (1 Mark)
12. (a) The law of dominance shows 1 : 3 ratio in its  $F_2$  generation. (1 mark)
13. (b) Hybrid is the offspring of two plants or animals of different species or varieties. A monohybrid cross is a mating between two organisms with different variations at one genetic chromosome of interest. One parent having two dominant alleles and the other two recessives. All the offspring have one dominant and one recessive allele for that gene.  
Hence, Mendel crossed two plants differing in one trait to obtain  $F_1$  plants which is monohybrid cross. (1 mark)
14. (a) Replication and transcription takes place in the nucleus and translation occurs in the cytoplasm. During translation, m-RNA is transferred from the nucleus into the cytoplasm where ribosomes and amino acids are available for the process of protein synthesis. (1 Mark)
15. (b) Antibodies are made by B- lymphocytes with the help of T- helper cells in response to specific antigen. Antibody neutralizes the effect of foreign antigen. So the correct option is "Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion". (1 mark)
16. (b) (1 mark)
17. • Biolistic gun (also called gene gun) is a technique of genetic engineering which is mostly used in plant biotechnology. Gene gun is commonly used to insert the genetic material into the plant cells by the particles coated into small DNA sequences.  
• High velocity microparticles of gold and tungsten are used in this technique. These are used as 'bullets' to deliver DNA into callus cells. (1 + 1 Marks)
18. (i) -TACG-  
(ii) -AUGC- (1 + 1 Marks)
19. (a) • Spermatogenesis is the sequence of events by which spermatogonia are transformed into mature sperms. This maturation process begins at puberty.  
• After several mitotic divisions, the spermatogonia grow and undergo changes. Spermatogonia are transformed into primary spermatocytes, the largest germ cells in the seminiferous tubules.  
• Each primary spermatocyte subsequently undergoes 1st meiotic division (reduction division) to form two haploid secondary spermatocytes, which are approximately half the size of primary spermatocytes. Secondary spermatocytes then undergo a second meiotic division to form four haploid spermatids.  
• These haploid spermatids are approximately half the size of secondary spermatocytes. The spermatids are gradually transformed into four mature sperm by a process known as spermiogenesis.  
(b) Seminiferous tubule → Rete testes → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct. (4 × ¼ + 1 Marks)



20. Health can be defined as a state of complete physical, mental and social well being. Good health can be achieved by taking balanced diet, maintaining personal hygiene, regular exercise/yoga, vaccination against infectious diseases, etc. (2 Marks)

OR

Before disposal, the sewage is treated in sewage treatment plants. Microbes present naturally in the sewage help in its treatment. Alongwith sewage treatment they also help to generate fuel. (any four)

- Primary treatment – Physical removal of particles leading to sludge formation.
- Secondary treatment – Carried out by microbes which reduce biochemical oxygen demand of effluent.
- Formation of activated sludge.
- In anaerobic sludge digesters other bacteria digest bacteria and fungi present in the sludge.
- Bacteria produces a mixture of gases like methane, hydrogen sulphide, carbon dioxide which form biogas.

(4 × ½ Marks)

21. *Agave* propagates vegetatively by bulbils and *Bryophyllum* do it by adventitious buds. (2 marks)

22. (a) Reasons for causing infertility:
- Male: Abnormal sperm production or function, problems with the delivery of sperm due to premature ejaculation etc.
  - Female: Ovulation disorder, uterine or cervical abnormalities, fallopian tube damage or blockage.
- (b) • Artificial Insemination (AI)
- It is a technique that can help the couple to have a child where the problem is with male partner.
  - In this technique, the semen collected either from the husband or a healthy donor is artificially introduced into the vagina or into the uterus of the female.
- ICSI (Intra cytoplasmic sperm injection)
  - It is most often used with couples who are dealing with male infertility factors like low sperm counts, poor motility or movement of the sperm, poor sperm quality, sperm that lack the ability to penetrate an egg, or azoospermia.
  - It is used to enhance the fertilisation phase of *in vitro* fertilisation (IVF) by injecting a single sperm into a mature egg. (½ + ½ + 1 + 1 Marks)

23. The similarity between geitonogamy and xenogamy is that both types of pollinations are assisted by pollinating agencies, in transferring the pollens from anther of one flower, to the receptive stigma of another flower. The difference between the two is that in geitonogamy the pollen and stigma are genetically similar because they both belong to same plant but in xenogamy they are genetically different as they belong to different plants of same species. As cleistogamous flowers show homogamy remain closed causing self-pollinations and cleistogamy occurs late in the flowering season in some plants, e.g., *Commelina*, *Oxalis*, etc. (3 marks)

24. **Stirring type** : Cylindrical/curved at base and provided with stirrer to facilitate even mixing and oxygen availability throughout bioreactor. (3 marks)

25. (i) In band D, DNA fragments are smaller than those on band C. The fragments separate according to their size through the sieving effect provided by the gel. So, the smaller fragments move farther away than the larger ones.

(ii) B is anode.

(iii) Gel containing DNA fragments is stained with ethidium bromide compound followed by exposure to UV radiation. They are visible as range of colour bands. (1 + 1 + 1 Marks)

26. (i) The apical meristem of virus infected/diseased plant remains free of virus/pathogen. The shoot apex of such plant can be cultured.

(ii) The shoot tip is grown in a test tube under sterile conditions in special nutrients media. The nutrient medium should contain sugar, inorganic salts, vitamins, amino acids and growth regulators like auxins, cytokinins, etc. The tiny plantlets are later shifted to the field for further growth.

(iii) Micropropagation is the technology used for the production of large number of individuals *in vitro* in a limited space which can be employed for agriculture, horticulture and forestry. (1 + 1 + 1 Marks)

27. (a) State the cause and symptoms of Down's syndrome. Name and explain the event responsible for causing this syndrome.

(b) Haemophilia and Thalassemia are both examples of Mendelian disorder, but show difference in their inheritance pattern. Explain how. (1½ + 1½ Marks)

28. (a) *Homo erectus*  
(b) *Homo sapiens neanderthalensis*  
(c) *Homo habilis*  
(d) *Australopithecus africanus*

29. (i) The earth summit held at Rio de Janeiro in 1992 resulted into convention on Biodiversity.

(ii) An ex situ conservation method for endangered species is cryopreservation.

(iii) Wild life safari parks is related to ex-situ conservation of threatened animals and plants.

(iv) World summit on sustainable development of 2002 was held in South Africa. (1 + 1 + 1 + 1 Marks)

30. (i) Statins Produced by the yeast *Monascus Purpureus* have been commercialised as blood-cholesterol lowering agents.

(ii) Bottled fruit juices bought from the market are clearer because they are clarified by the use of pectinases and Proteases.

- (iii) (a) Statin  
(b) Cholesterol lowering  
(c) *Penicillium notatum*  
(d) *Penicillin*  
(e) *Trichoderma polysporum*  
(f) Immunosuppressive agent

(iv) Streptokinase produced by the bacterium *Streptococcus*. (1 + 1 + 1 + 1 Marks)

31. (a) • "X" part marked in the given diagram is tapetum. Tapetum is the innermost layer of the microsporangium. It provides nourishment to the developing pollen grains, hence also known as nourishing layer.



- During microsporogenesis, the cells of tapetum produce various enzymes, hormones, amino acids, and other nutritious material which are required for the development of pollen grains.
  - It also secretes ubisch bodies (made up of sporopollenin) for exine formation (outer layer of pollen grain).
- (b) The characteristics of flowers that are pollinated by wind are as follows:
- (i) Pollen grains are light and non-sticky.
  - (ii) They have well exposed stamens.
  - (iii) They have large and feathery stigma.
  - (iv) Flowers often have a single ovule in each ovary/ inflorescence.
- (c)
- Embryo development is the stage involved in the post-fertilisation event of flowering plant. During the sexual reproduction, the events which take place after the formation of zygote are called post-fertilisation events. The process of embryo development from the zygote (called embryogenesis) takes place after the fertilisation. In all flowering plants, the zygote is formed inside the ovule. In ovule, the zygote divides several times to form an embryo. (1 + 2 + 2 Marks)

OR

- (a) Menstrual cycle is the reproductive cycle in all primates and begins at puberty (menarche). In human females, menstruation occurs once in 28 to 29 days. The cycle of events starting from one menstruation till the next one is called the menstrual cycle. These changes are brought about by ovarian and pituitary hormones. Menstrual phase refers to the beginning of menstruation wherein the endometrium along with its rich blood supply is shed (menses). During this phase, the levels of both the ovarian and the pituitary hormones are low. The level of follicle stimulating hormone (FSH) starts to increase during the later stages of this phase.
- (b) The menstrual phase is followed by the follicular phase wherein the primary follicles mature into the

Graffian follicle under the influence of FSH and LH. The developing follicles release oestrogen which causes the regeneration of the endometrium. Since, the follicles and the endometrium proliferate during the follicular phase, it is also known as proliferative phase.

- (c) At the time of ovulation, the release of gonadotropins (LH and FSH) increases. The LH and FSH are at their peak in the middle of the cycle (14th day), and cause the rupture of the Graafian follicle to release ovum (ovulation). The remains of the Graafian follicle get converted into the corpus luteum, which secretes progesterone for the maintenance of the endometrium in case of pregnancy. (2 + 1 + 2 Marks)
32. (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		$Hb^A Hb^T$ (Father)	×	$Hb^A Hb^T$ (Mother)
Offsprings	$Hb^A Hb^A$	$Hb^A Hb^T$	$Hb^A Hb^T$	$Hb^T Hb^T$
	Normal Child	Carrier child with thalassaemia trait	Carrier child with thalassaemia trait	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)
	$X^hX$ XX		$X^hX$ XX
Offsprings	Carrier female	Normal female	Haemophilic male 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)
	$X^hX$ XX		$X^hY$ XY
Offsprings	Carrier daughter	Normal daughter	Haemophilic son Normal son

(3 + 2 Marks)

OR

- Meselson and Stahl (1958) experimentally proved that the DNA replication is semi-conservative.
- The steps of the experiment are as follows:
  - They grow *E. coli* in  $^{15}\text{NH}_4\text{Cl}$  for many generations in a culture medium to get  $^{15}\text{N}$  incorporated into DNA.
  - Later on, these cells are transferred into  $^{14}\text{NH}_4\text{Cl}$  (non-radioactive isotope).
  - The extracted DNA are centrifuged in  $\text{CsCl}$  and measured to get their densities.
  - DNA extracted from the culture after one generation (20 minutes), showed intermediate hybrid density.
  - DNA extracted after two generations (40 minutes) showed light DNA and hybrid DNA.
  - Out of four DNA molecules, two are completely non-radioactive and the other two have half of molecule as nonradioactive.

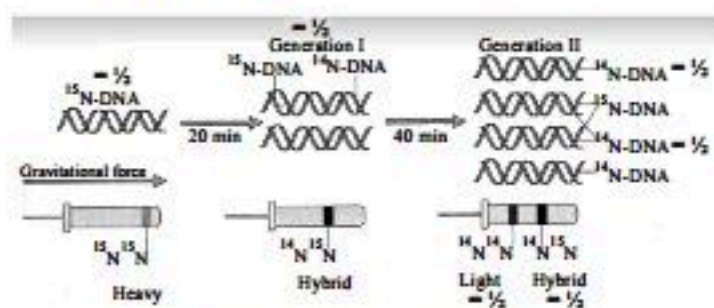


Fig.: Meselson and Stahl experiment

(5 Marks)

33. The whole ecosystem & its biodiversity can be conserved in the following strategies –

(i) **In situ strategies.**

(a) **Biosphere Reserves.**

Biosphere reserves are vital centres of biodiversity where research and monitoring activities are conducted, with the participation of local communities, to protect & preserve healthy natural systems threatened by development. There are 425 biosphere reserves in the world, of which 14 are in India. They are as follows:

(i) Nilgiri, (ii) Nanda Devi, (iii) Nokrek, (iv) Manas, (v) Sunderbans, (vi) Gulf of Mannar, (vii) Great Nicobar, (viii) Agasthyamala, (ix) Kanchenjunga, (x) Pachmarhi, (xi) Simlipal, (xii) Dehang-Debang, (xiii) Dibru Saikhowa, (xiv) Achenankmar-amarkantak. Hotspots have been identified for maximum protection to the endemic and/or endangered species. There are 34 hot spots on the global basis, of which three are in India; they are (i) Western Ghats and Sri Lanka, (ii) Indo-Burma and (iii) Himalaya.

(b) **National Parks and Wildlife Sanctuaries.** India has (according to September 2002 list) 90 National Parks and 448 wildlife sanctuaries. Jim Corbett National Park is the first to be established in India.

(c) **Sacred Forests.**

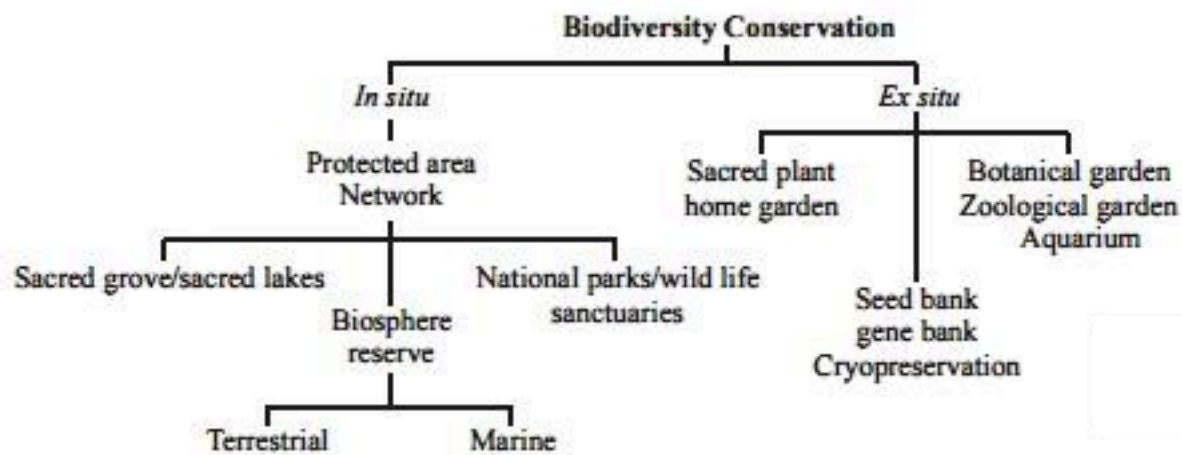
These are the undisturbed forests without any human intervention and they are surrounded by highly degraded landscapes. Such forests include a number of rare, endangered and endemic species.

Such sacred groves are found in Khasi and Jaintia hills in Meghalaya. Western Ghat regions of Karnataka and Maharashtra. Aravalli Hills of Rajasthan Sarguja, Ghanda and Bostar areas of Madhya Pradesh.

(ii) **Ex situ conservation.**

- Botanical gardens, zoological parks and arboreta are the conventional methods of *ex situ* conservation.
- India has today 35 botanical gardens and 275 zoos (zoos, deer parks, aquaria and safari parks).
- Cryopreservation is a method of conservation by storage of materials at ultra low temperatures for a very long period; gametes of threatened species can be preserved in viable and fertile condition for long periods using this technique.
- Plants are propagated using tissue culture methods (micropropagation).
- Seeds of many different genetic strains of commercially important plants are kept viable for long periods in seed banks.





(3 + 2 Marks)

**OR**

- (i) Destruction of habitat, cutting of trees, filling of wetlands.
- (ii) Pollution reduces and eliminates sensitive species.
- (iii) Eutrophication of water bodies.
- (iv) Natural disturbance like fire, defoliation by insects.
- (v) Introduction of invasive exotic species causes disappearance of native species. Organic evolution, not only creates new species, but also eliminates some old ones. This is a natural process. Dinosaurs are thought to have disappeared due to collision of a big meteorite with earth. Collision might have raised a huge dust cloud which screened sunlight, causing destruction of vegetation and fall in temperature.

(1 + 1 + 1 + 1 + 1 Marks)