Class XII Session 2024-25
Subject - Biology
Sample Question Paper - 6

Time Allowed: 3 hours **Maximum 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. The rate of storage of organic matter in producers in excess of their metabolic consumption is: **[1]**

   a) Community productivity b) Biomass

   c) Gross primary productivity d) net primary productivity

2. Female hired to develop the in-vitro fertilized egg of another female to maturity is called: **[1]**

   a) Step-mother b) Biological mother

   c) Feeding mother d) Surrogate mother

3. The Periyar sanctuary is located in: **[1]**

   a) Tamil Nadu b) Ehrenberg

   c) Karnataka d) Kerala

4. Which of the following is a STD? **[1]**

   a) Pneumonia b) Malaria

   c) Cancer d) Trichomoniasis

5. The organism used in construction of the first artificial recombinant DNA by Cohen and Boyer in 1972 was: **[1]**

   a) Bacillus thuringiensis b) E. coli

   c) Agrobacterium tumefaciens d) Salmonella typhimurium

6. Which one among the following biofertilizers does **not** fix atmospheric nitrogen? **[1]**

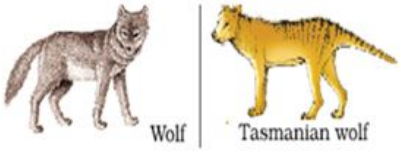
   a) Rhizobium b) Oscillatoria

   c) Azospirillum d) Glomus

7. In the pedigree analysis, the symbol shown below represent **[1]**

a) Sex unspecified
b) Affected individuals
c) Normal individuals
d) Matting between relatives

8. Picture shown below is an example of:- **[1]**

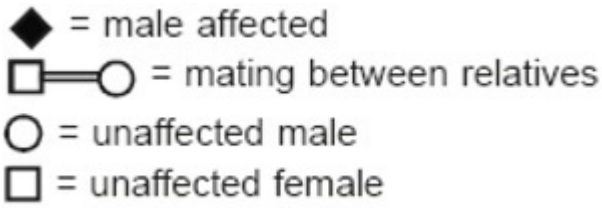


a) Convergent evolution of Australian marsupials and placental mammals
b) Divergent evolution of Australian marsupials and placental mammals
c) Homologous organs of both animals
d) Analogous organs of both animals

9. Phytoplanktons are: **[1]**

a) Saprotrophs
b) Autotrophs
c) Heterotrophs
d) All of these

10. Which one of the following symbols and its representation used in the human pedigree analysis is correct? **[1]**



a) unaffected female
b) unaffected male
c) affected male
d) Mating between relatives

11. Large-holes in **Swiss-Cheese** are due to **[1]**

a) Acetobacter aceti
b) Propionibacterium sharmanii
c) Penicillium chrysogenum
d) Saccharomyces cerevisiae

12. Thermostable DNA polymerase is isolated from bacterium: **[1]**

a) Rhizobium
b) Salmonella typhii
c) Escherichia coli
d) Thermus aquaticus

13. **Assertion (A):** Our laws permit legal adoption and it is as yet, one of the best methods for childless couples looking for parenthood. **[1]**
Reason (R): Emotional, religious and social factors are also no deterrents in the legal adoption of orphaned and destitute children in India.

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

14. **Assertion:** Statins is a blood-cholesterol lowering agents. **[1]**
Reason: It inhibiting the enzyme responsible for synthesis of cholesterol.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

15. **Assertion (A):** Primer pheromones bring about physiological changes in the receivers. **[1]**

Reason (R): Releaser pheromones cause immediate change in the receivers.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

16. **Assertion (A):** Evolution of man is the example of progressive evolution. **[1]**

Reason (R): Tapeworm is developed due to retrogressive evolution.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

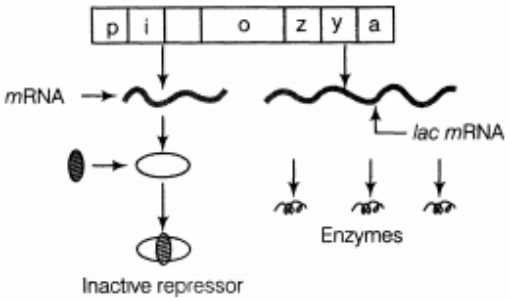
c) A is true but R is false.

d) A is false but R is true.

Section B

17. What are flocs? State their role in biological treatment of sewage. **[2]**

18. Study the figure given and answer the questions. **[2]**



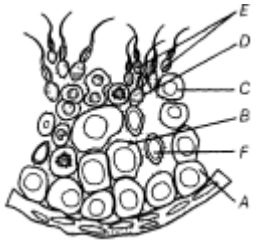
i. How does the repressor molecule get inactivated?

ii. When does the transcription of lac mRNA stop?

iii. Name the enzyme transcribed by the gene z.

19. What is the function of the two male gametes produced by each pollen grain in angiosperms? **[2]**

20. Name the labels A, B, C, D, E and F in the diagram of seminiferous tubule. **[2]**



21. a. Cattle excreta is important source for producing a domestic fuel. Name the fuel and write its main components. **[2]**

b. Write the biological process that is responsible for the production of this fuel.

OR

Mention the product and its use produced by each of the microbes listed below

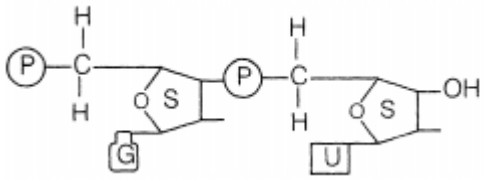
(i) Steptococcus

(ii) Lactobacillus

(iii) Saccharomyces cerevisiae

Section C

22. Answer the questions based on the dinucleotide show below. **[3]**



i. Name the type of sugar to which guanine base is attached to.

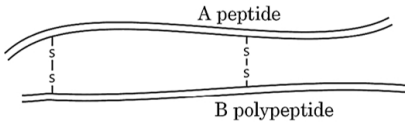
ii. Name the linkage connecting the two nucleotides.

iii. Identify the 3' end of the dinucleotide. Give a reason for your answer.

23. State Mendel's law of dominance. How did he deduce the law? Explain with the help of a suitable example. **[3]**

24. Differentiate between an **Expanding age pyramid** and a **Stable age pyramid**. Substantiate your answer with diagrams. **[3]**

25. A schematic diagram of matured human insulin is given below: **[3]**



How is the process of its formation naturally in the human body different from that of its formation by rDNA technology? Explain.

26. Which one of the two **in-situ** or **ex-situ** biodiversity conservation measures help the larger number of species to survive? Explain. **[3]**

OR

With the help of three examples, explain the **broadly utilitarian** argument for conservation of biodiversity.

27. i. Write how parasites have evolved with adaptation to co-exist with their hosts in an ecosystem. **[3]**

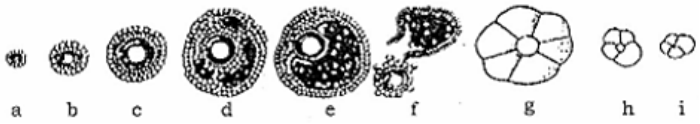
ii. Parasites are host specific and tend to co-evolve. How would the parasite respond if the host evolves a certain mechanism to resist or reject the parasite?

28. Name and explain the two types of immune responses in humans. **[3]**

Section D

29. **Read the following text carefully and answer the questions that follow:** **[4]**

The following is the illustration of the sequence of ovarian events (a-i) in a human female.



i. Identify the figure that illustrates ovulation and mentions the stage of oogenesis it represents. (1)

ii. Name the ovarian hormone and the pituitary hormone that have caused the above-mentioned event. (1)

iii. Explain changes that occur in the uterus simultaneously in anticipation. (2)

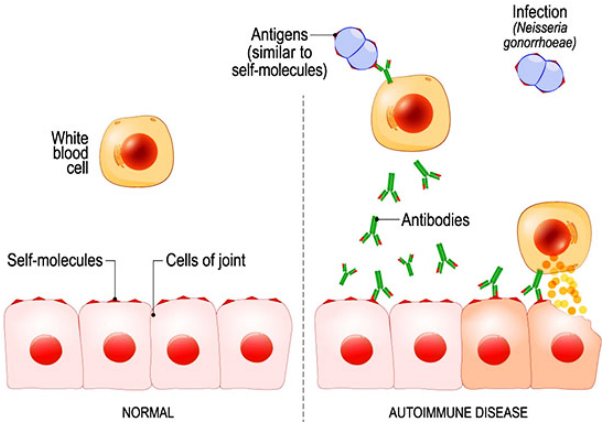
OR

Draw a labelled sketch of the structure of a human ovum prior to fertilization. (2)

30. **Read the following text carefully and answer the questions that follow:** **[4]**

A healthy immune system defends the body against disease and infection. But if the immune system malfunctions, it mistakenly attacks healthy cells, tissues, and organs. Called autoimmune disease, these attacks

can affect any part of the body, weakening bodily function and even turning life-threatening.



i. Why are autoimmune diseases called degenerative diseases? (1)

ii. Name the autoimmune disease of body muscles. (1)

iii. Which types of immunity is provided by T-lymphocytes? (2)

OR

Which immune cells form humoral immune system? (2)

Section E

31. State the similarity and differences between geitonogamy and xenogamy. Why do cleistogamous flowers assure seed sets? **[5]**

OR

a. Where is microsporangium located in an angiosperm? State the functions of tapetum and the other three layers of microsporangium.

b. Describe the structure of the male gametophyte produced as a result of microsporogenesis.

c. State the functions of each part of the male gametophyte.

32. Name and describe the steps involved in the technique widely used in forensics that serves as the basis of paternity testing in case of disputes. **[5]**

OR

Explain how does lac operon in E. coli operate

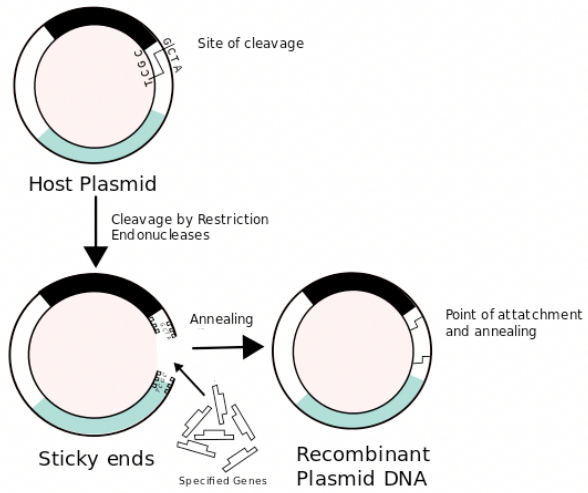
a. in the absence of an inducer.

b. in the presence of an inducer.

33. Suggest and describe a technique to obtain multiple copies of a gene of interest in vitro. **[5]**

OR

Recombinant DNA vectors are typically attenuated viruses or bacteria that are unrelated to the pathogen of interest. These vectors can penetrate human cells and often replicate within them, but do not cause disease in the host.



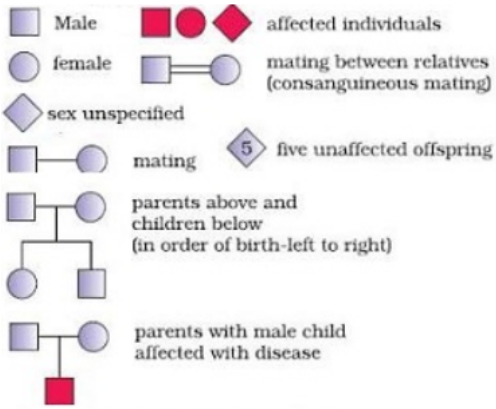
i. A recombinant vector with a gene of interest inserted within the gene of α-galactosidase enzyme, is introduced into a bacterium. Explain the method that would help in selection of recombinant colonies from non-recombinant ones.

ii. Why is this method of selection referred to as insertional inactivation?

Solution

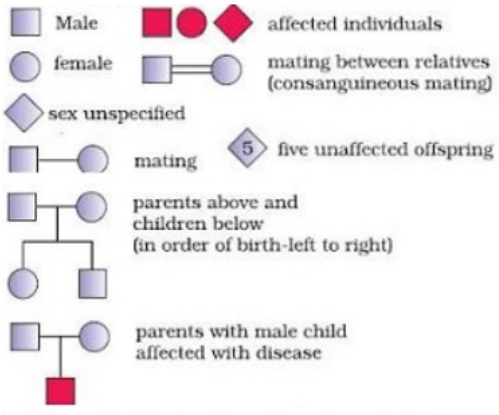
Section A

1. **(d)** net primary productivity
   Explanation: Net Primary Productivity (NPP) is the amount of carbon uptake after subtracting Plant Respiration (RES) from Gross Primary Productivity (GPP). GPP is the total rate at which the ecosystem capture and store carbon as plant biomass, for a given length of time. NPP = GPP – RES.
2. **(d)** Surrogate mother
   Explanation: Sometimes eggs of females and sperm of males are able to produce but a fallopian tube is either blocked or uterus is not capable of implantation. In this case, ovum collected from females and sperm collected from males is fertilized and transferred to another female called surrogate mother for further development.
3. **(d)** Kerala
   Explanation: Kerala
4. **(d)** Trichomoniasis
   Explanation: Trichomoniasis
5. **(d)** Salmonella typhimurium
   Explanation: Salmonella typhimurium
6. **(d)** Glomus
   Explanation: The genus Glomus exhibits symbiotic association with higher plants.
7. **(b)** Affected individuals
   Explanation: In pedigree analysis, the symbol shown above represents affected individuals.



8. **(a)** Convergent evolution of Australian marsupials and placental mammals
   Explanation: Wolf and Tasmania Wolf are examples of convergent evolution of placental mammals and Australian marsupials. They are evolved differently due to different in climatic and geographic regions.
9. **(b)** Autotrophs
   Explanation: Autotrophs
10. **(d)** Mating between relatives

Explanation: The symbols and its representation used in the human pedigree analysis is mating between relatives is correct.



11.

(b) Propionibacterium sharmanii

Explanation: Propionibacterium sharmanii

12.

(d) Thermus aquaticus

Explanation: Taq polymerase is a thermostable DNA polymerase named after the thermophilic bacterium Thermus aquaticus from which it was originally isolated by Chien et al. in 1976. Its name is often abbreviated to Taq Pol or simply Taq. It is frequently used in the polymerase chain reaction (PCR), a method for greatly amplifying the quantity of short segments of DNA. It remains active during high temperature-induced denaturation of double-stranded DNA.

13.

(c) Assertion is true but Reason is false.

Explanation: Assertion is true but Reason is false.

14. **(a)** Assertion and reason both are correct statements and reason is correct explanation for assertion.

Explanation: Assertion and reason both are correct statements and reason is correct explanation for assertion.

15.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: Depending upon the changes that pheromones bring about in the receivers, they are of three types - primer, releaser and informer. Primer pheromones bring about physiological changes in the receivers. There is no immediate structural or behavioural effect. Pheromone present in the faeces of the adult locust is locustrol. It stimulates development in nymph locust. Releaser pheromones cause immediate change in the receiver animal, e.g., alarm pheromone of harvester ant, trail making pheromone of leaf cutter ants.

16.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: Progressive evolution is the formation of more complex specialized organisms from simple and less elaborate forms. Examples: evolution of amphibians from fish like ancestors and evolution of birds and mammals from reptile-like ancestors. Retrogressive evolution is the formation of simple and less elaborate forms from more complex and specialized ones. Example: evolution of many parasitic organisms like tapeworm which does not have digestive system. It absorbs food through body surface.

Section B

17. Flocs are masses of bacteria held together by slime and fungal filaments to form mesh like structures. They are formed during the secondary treatment of sewage.
    Consume major part of organic matter in the effluent/lower BOD significantly/reduces polluting potential.
18. i. When an inducer, e.g., lactose binds to the repressor, the repressor is inactivated.
    ii. The transcription of lac mRNA stops when lactose becomes exhausted or when there is no need for energy to the cells.
    iii. β-galactosidase.
19. One of the male gametes fuses with the female gamete and forms the embryo. The embryo subsequently develops into a new plant. Another male gamete fuses with polar nuclei and eventually forms endosperm. Endosperm supplies food to the developing embryo.
20. A-Spermatogonium
    B-Primary spermatocyte

C-Secondary spermatocyte
D-Spermatid
E-Spermatozoa
F-Sertoli cell

21. a. Cattle excreta is known for producing Biogas (Gobar Gas), which has main components such as **Methane, CO_2, H_2, N_2 and O**. b.)

b. The biological process for fuel production involves microbial fermentation, where microorganisms convert organic materials like biomass or waste into biofuels like bioethanol or biodiesel.

OR

(I) Streptokinase is used to dissolve blood clots that have formed in the blood vessels. It is used immediately after symptoms of a heart attack occur to improve patient survival. This medicine may also be used to treat blood clots in the lungs (pulmonary embolism) and in the legs (deep venous thrombosis).

(ii) Lactic acid is used as a food preservative, curing agent, and flavoring agent. It is an ingredient in processed foods and is used as a decontaminant during meat processing.

(iii) Ethanol fermentation, also called alcoholic fermentation, is a biological process which converts sugars such as glucose, fructose, and sucrose into cellular energy, producing ethanol and carbon dioxide as a side-effect.

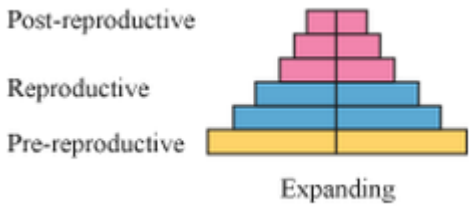
Section C

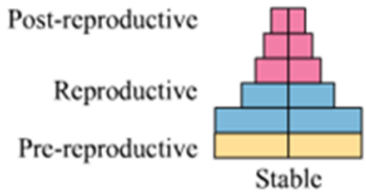
22. i. Pentose sugar or deoxyribose sugar.
ii. Two nucleotides are linked through 3'-5' phosphodiester linkage to form a dinucleotide.
iii. The ribose sugar has a free 3'-OH group which is referred to as 3' end of the polynucleotide chain.

23. Mendel's Laws of inheritance: The offspring always exhibits a dominant trait from the two alleles received from parents, the only dominant allele is expressed and other will be suppressed.
In a cross between tall (TT) plant and dwarf (tt) plant, the tall trait appears in F_1, tallness and dwarfness appear in F_2, In the ratio of 3 : 1.

24.

Expanding age pyramid	Stable age pyramid
The population of pre-reproductive age is greater than population of reproductive age	The population of pre-reproductive age equals to population of reproductive age





25. **Insulin production in human body:**

- Synthesised naturally in the form of proinsulin consisting of polypeptide chain A and polypeptide chain B, linked together by disulphide bonds and an extra stretch called C-peptide
- The C-peptide is removed during processing and proinsulin matures into functional insulin.

Insulin production by rDNA technology

- Two DNA sequences corresponding to chain A and chain B of human insulin are synthesised
- They are introduced into two different plasmids of E.coli
- Chain A and chain B are produced separately
- extracted and combined by disulphide bond to form human insulin.

26.

- In situ conservation will help the larger number of species to survive because this method involves protection and conservation of the whole ecosystem and its biodiversity. Regions with very high levels of species richness and high degree of endemism is identified and then it is marked off as a protected area. Thus in situ method helps to conserve species without disturbing their natural habitat. Hotspots, protected areas and National parks are some of the methods used in situ conservation.
- On the other hand, ex situ involves taking threatened animals and plants out from their natural habitat and placing them in special settings such as Zoological parks or botanical gardens where they can be given protection. However, this method is not ideal to conserve large variety of species.

OR

The broadly utilitarian argument described as biodiversity plays a major role in many ecosystem services that nature provides.

i. Broadly utilitarian mainly explains the broad and general use of biodiversities like **oxygen,**
ii. **pollination, and**
iii. **aesthetic value** which is not limited to particular species.

27. i. Parasites have evolved with special adaptations to co-exist with their hosts in an ecosystem in the following ways:
Loss of unnecessary sense organs
Presence of adhesive organs or suckers to cling on to the host iii. Loss of digestive system and high reproductive capacity.
ii. If the host evolves special mechanisms for rejecting or resisting the parasite, the parasite also evolves mechanisms to counteract and neutralise them, in order to be successful with the same host species. In accordance with their life styles, parasites evolve special adaptations and co-evolve with the host.

28. There are two immune response.
i. The primary immune response occurs when an antigen comes in contact with the immune system for the first time. During this time the immune system has to learn to recognize the antigen and how to make an antibody against it and eventually produce memory lymphocytes.
ii. The secondary immune response occurs when the second time (3rd, 4th, etc.) the person is exposed to the same antigen. At this point, immunological memory has been established and the immune system can start making antibodies immediately.

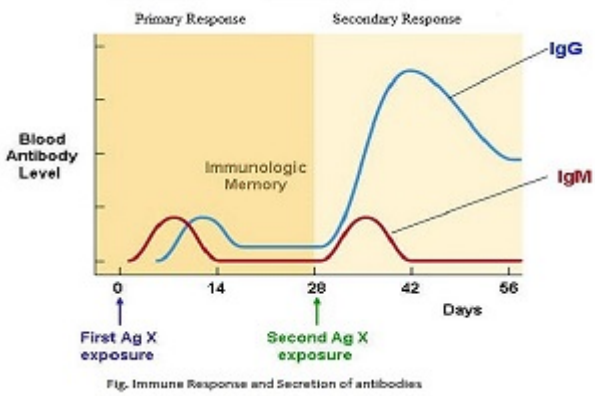
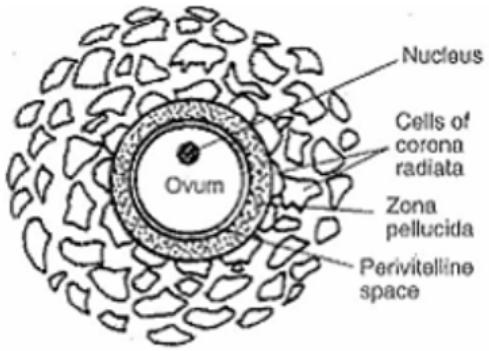


Fig. Immune Response and Secretion of antibodies

Section D

29. i. Figure f illustrates ovulation.
ii. It represents secondary oocyte stage of oogenesis.
-Pituitary hormone -LH
iii. Endometrium proliferates and becomes thicker by rapid cell multiplication development and maturation of ovum is in progress, while the figure 'h' shows that corpus luteum going towards degeneration.
OR



30. i. In autoimmune diseases, certain body cells undergo degeneration that's why these are called as degenerative diseases.
ii. Myasthemia gravis is an autoimmune disease of body muscles.
iii. Cell-mediated immunity is provided by T-lymphocytes.
OR
B-lymphocytes cells form the humoral immune system.

Section E

31. The similarity between geitonogamy and xenogamy is that both pollinations take place by pollinating agencies, pollinating agencies transfer the pollen from anther of one flower to the receptive stigma of another plant in case of xenogamy and another flower of the same plant in geitonogamy.

The difference between the two is that in geitonogamy the pollen and stigma are genetically similar because they both belong to the same plant but in xenogamy, they are genetically different as they belong to different plants of same species. Geitonogamy is functionally cross-pollination but genetically self-pollination.

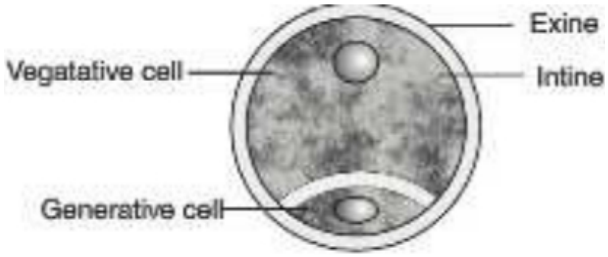
As cleistogamous flowers are the flowers which remain closed and never open, so in these flowers anther and stigma are in close association. So these flowers do not require pollinating agencies for pollination and thus produce assured seed set even in absence of pollinating agencies.

OR

a. Microsporangium located in the anther lobe in an angiosperm.
Tapetum- nourishes the developing pollen grain
Epidermis, Endothecium, middle layers- protection and dehiscence (of microsporangium)

b. Structure of Pollen grain / male gemetophyte

i. Outer wall layer - Exine
ii. Inner wall layer - Intine
iii. Vegetative cell
iv. Generative cell



c. **Function of each part of male gametophyte are**

i. Exine and Intine - Protection
ii. Vegetative cell - reserve food material / formation of pollen tube
iii. Generative cell - formation of two male gametes

32. DNA fingerprinting is used in forensic.

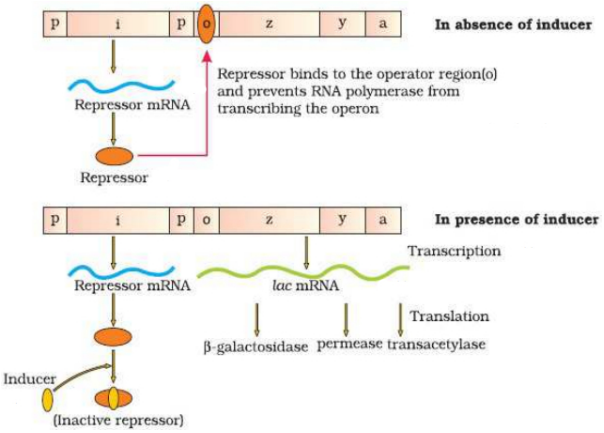
Steps which are involved in DNA fingerprinting are as follows:

i. Isolation of DNA
ii. Digestion of DNA by restriction endonuclease enzyme
iii. Separation of DNA fragments, by electrophoresis
iv. Transferring of separated DNA fragments to synthetic membrane such as nitrocellulose or nylon.
v. Hybridization, using labelled VNTR probe.
vi. Detection of hybridized DNA fragments by autoradiography

OR

a. In the absence of an inducer - The repressor of the Lac-operon is synthesised from the i gene, The repressor protein binds to the operator region of the operon in absence of the inducer, and prevents RNA polymerase from transcribing the operon.

b. In the presence of an inducer, (lactose) the repressor is inactivated by interaction with the inducer, This allows RNA polymerase access to the promoter and transcription proceeds.



33. Polymerase Chain Reaction (PCR) is a technique to obtaining multiple copies of a gene of interest in vitro. This technique amplifies DNA through a simple enzymatic reaction. This technique was developed by Kary Mullis in 1965.
The basic requirements of a PCR are the following:

i. DNA template
ii. Primers
iii. Enzyme-Taq polymerase

Amplification of recombinant DNA gene is done using Polymerase Chain Reaction (PCR). It is carried out in the following steps:

i. **Denaturation -** The double-stranded DNA is denatured by applying high temperature of 95°C for 15 seconds. Each separated strand acts as a template.
ii. **Annealing** -Two sets of primers are added, which anneal to the 3'end of each separated strand.
iii. **Extension -** DNA polymerase extends the primers by adding nucleotides complementary to the template provided in the reaction. Taq polymerase is used in the reaction, which can tolerate heat. All these steps are repeated many times to get several copies of the desired DNA.

OR

i. The insertion of recombinant DNA within the coding sequence of enzyme a-galactosidase results in the inactivation of the enzyme called insertional inactivation. The colonies do not produce a blue colour in the presence of chromogenic substrate and are identified as recombinant colonies whereas non-recombinant colonies produce blue colour from the chromogenic substrate, due to the presence of the activated enzyme.
ii. The method is referred as "insertional inactivation" because the enzyme α-galactosidase produced is inactivated due to insertion of alien DNA within the coding sequence of the enzyme, which acts as a selectable marker to differentiate recombinant colonies from non-recombinant one.