Class XII Session 2026-27
Subject - Biology
Sample Question Paper - 4

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 role of decomposers in nitrogen cycle is to: **[1]**

   a) Denitrify ammonia thus returning N_2 into the soil

   b) Fix N_2 into ammonia

   c) Release ammonia from organic compounds, thus returning it to the soil

   d) Incorporate nitrogen into amino acids and organic compounds.

2. Diaphragms are meant for: **[1]**

   a) Birth control b) Amniocentesis

   c) Reproduction d) Sterilization

3. One of endangered species of Indian medicinal plants is that of: **[1]**

   a) Nepenthes b) Ocimum

   c) Garlic d) Podophyllum

4. Cu-T prevents pregnancy by preventing: **[1]**

   a) Ovulation b) Fertilization

   c) Implantation of fertilized egg d) Non-fertilization

5. In vitro clonal propagation in plants is characterized by: **[1]**

   a) Microscopy b) Electrophoresis and HPLC

   c) PCR and RAPD d) Northern blotting

6. Which of the following sentences is incorrect about microspheres? **[1]**

a) Composed of many protein molecules
b) Have all properties of life
c) Don't have all properties of life
d) Bud to form smaller microspheres

7. Soil microorganism which converts proteins to ammonia is: **[1]**

a) Pseudomonas
b) Bacillus vulgaris
c) None of these
d) Nitrosomonas

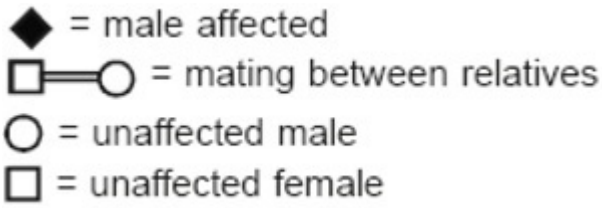
8. The minimum number of components required for an ecosystem to survive are: **[1]**

a) Primary consumers & decomposers
b) Producers & secondary consumers
c) Producers & primary consumers
d) Producers & decomposers

9. Which of the following genetic disease is autosomal recessive trait? **[1]**

a) Phenylketonuria
b) Sickle cell anemia
c) Hemophilia
d) Colour blindness

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

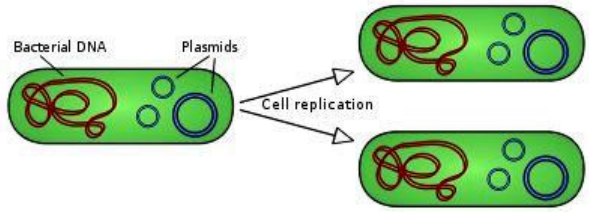


a) Mating between relatives
b) unaffected female
c) affected male
d) unaffected male

11. Which one converts nitrites to nitrates? **[1]**

a) Rhizobium
b) Nitrosomonas
c) Azotobacter
d) Nitrobacter

12. Which of the following is true for a Plasmid - **[1]**



a) It lies together with chromosomes
b) It shows independent assortment
c) It can be replicate independently
d) It cannot replicate

13. **Assertion (A):** Gamete intrafallopian transfer is actually in vivo fertilization and not in vitro fertilization. **[1]**

Reason (R): In gamete intrafallopian transfer, eggs are removed from the woman and placed in one of the fallopian tubes.

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.

14. **Assertion (A):** An organism which acts as herbicide is called bioherbicide. **[1]**
Reason (R): Phytophthora palm ivora is a mycoherbicide.

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.

15. **Assertion (A):** The detritus food chain (DFC) begins with dead organic matter. **[1]**
Reason (R): DFC consists of decomposers which are heterotrophic organisms, mainly fungi, and bacteria.

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):** Weismann discarded the **transmission of acquired characters theory** given by Lamarck. **[1]**
Reason (R): He put the theory of continuity of germplasm.

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

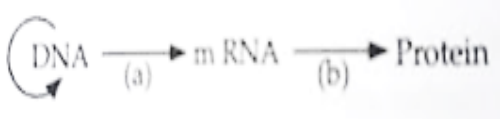
17. How have biotechnologists effectively used Agrobacterium tumefaciens in plants and retroviruses in animals? Explain. **[2]**

OR

The first clinical gene therapy was given in 1990 to a 4-year-old girl with ADA deficiency.

a. Mention the cause of this disorder.
b. List the possible treatments available for this disorder.
c. How can this disorder be cured permanently?

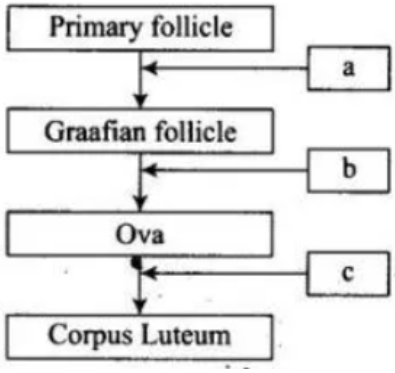
18. The flow of genetic information is shown below. Name the process of (a) and (b). **[2]**



19. In the diagram given below, show the path of a pollen tube from the pollen on the stigma into the embryo sac. Name the components of egg apparatus. **[2]**



20. Given below is a flow chart showing ovarian changes during the menstrual cycle. Fill in the spaces giving the name of the hormones responsible for the events shown. **[2]**



OR

Identify the stage of follicle where primary oocyte undergoes first meiotic division. Also mention the products of this division.

21. Draw a diagrammatic sketch of biogas plant, and label its various components given below: Gas Holder, Sludge Chamber, Digester, Dung+water chamber. **[2]**

OR

What is the key difference between primary and secondary sewage treatment?

Section C

22. i. Construct a complete transcription unit with promotor and terminator on the basis of the hypothetical template strand given below. **[3]**

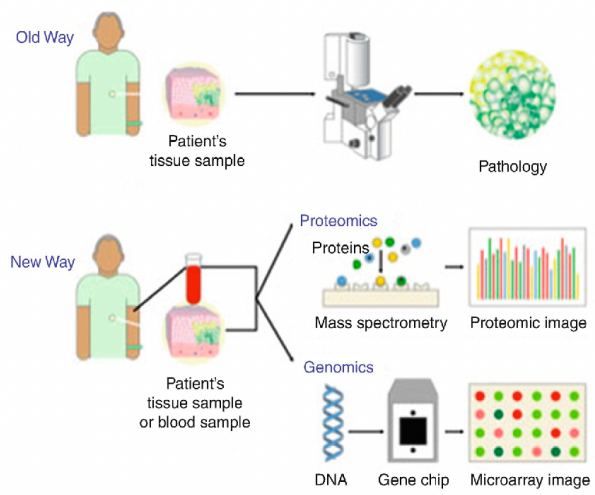


ii. Write the RNA strand transcribed from the above transcription unit along with its polarity.

23. List any four symptoms of Down's syndrome. What is the basis of this disorder? **[3]**

24. Egrets are often seen along with grazing cattle. How do you refer to this interaction? Give reason. **[3]**

25. The image below describes the molecular diagnostic procedures. **[3]**



i. Write any two biochemical/molecular diagnostic procedures for early detection of viral infection.

ii. Explain the principle of any one of them.

26. Write short notes on the following: **[3]**

i. Wildlife sanctuary

ii. Biosphere reserves

27. Find out from newspapers and popular science articles any new fossil discoveries or controversies about evolution. **[3]**

28. A group of youth were having a 'party' in an isolated area and were raided by police. Packets of 'smack' and syringes with needles were found littered around. **[3]**

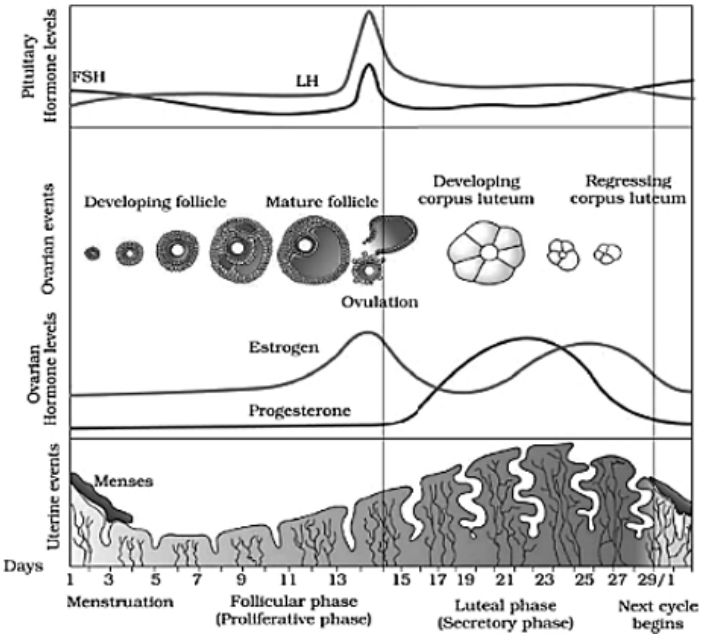
a. Why is taking 'smack' considered an abuse?

b. Write the chemical name of 'smack' and the name of its source plant.

c. Syringes and needles used by the youth for taking the drug could prove to be very fatal. Why?

Section D

29. In a human female, the reproductive phase starts on the onset of puberty and ceases around middle age of the female. Study the graph given below regarding menstrual cycle and answer the questions that follow: **[4]**



a. Name the hormones and their source organ, which are responsible for menstrual cycle at puberty. **(1)**

b. For successful pregnancy, at what phase of the menstrual cycle an early embryo (upto 3 blastomeres) should be Implanted in the Uterus (IUT) of a human female who has opted for Assisted Reproductive Technology (ART)? Support your answer with a reason. **(1)**

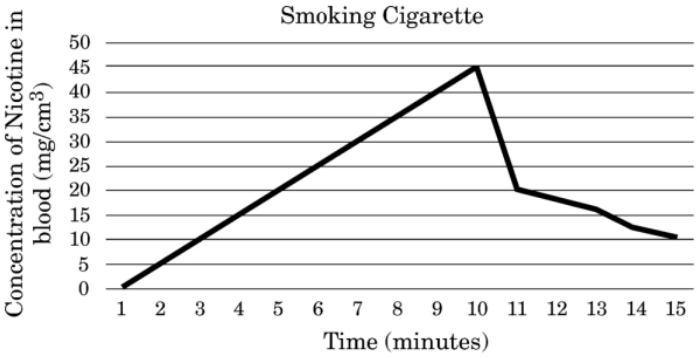
c. Name the hormone and its source organ responsible for the events occurring during proliferative phase of menstrual cycle. Explain the event. **(2)**

OR

In a normal human female, why does menstruation only occurs if the released ovum is not fertilised? Explain. **(2)**

30. **Read the following passage and answer the question that follow:** **[4]**

The data below shows the concentration of nicotine smoked by a smoker taking 10 puffs/minute.



a. i. With reference to the above graph, explain the concentration of nicotine in the blood at 10 minutes. **(1)**

OR

ii. How will this affect the concentration of carbon monoxide and haem-bound oxygen at 10 minutes? **(1)**

b. How does cigarette smoking result in high blood pressure and increase in heart rate? **(1)**

c. To which class of compounds does nicotine belong? Name one other drug from the same class. **(2)**

Section E

31. Describe the structure of mature angiospermic pollen grain. Mention one difference between the pollen of dicot and monocot. **[5]**

OR

i. State the objective of adopting artificial hybridisation programme in plants.

ii. Describe the steps followed in this technique.

32. Define an operon. Giving an example, explain an Inducible operon. **[5]**

OR

a. Describe the experiment conducted by F. Griffith in 1928 with Streptococcus pneumoniae and write the conclusions he arrived at.

b. State the contribution of Avery, MacLeod and McCarty in providing biochemical nature to the results as obtained by Griffith.

33. i. Explain how is a bacterial cell made 'competent' to take up recombinant DNA from the medium. **[5]**

ii. Explain the steps of amplification of gene of interest using PCR technique.

OR

Bioreactors are the containment vehicles of any biotechnology-based production process. For large scale production and for economic reasons the final success of biotechnological process depends on the efficiency of the bioreactor.

Answer the following questions w.r.t. the given paragraph:

i. List the operational guidelines that must be adhered to so as to achieve optimisation of the bioreactor system. Enlist any four.

ii. Mention the phase of the growth we refer to in the statement **Optimisation of growth and metabolic activity of the cells.**

iii. Is the biological product formed in the bioreactor suitable for the intended use immediate? Give reason in support of your answer.

Solution

Section A

1.

(c) Release ammonia from organic compounds, thus returning it to the soil

Explanation:

The solution is correct because decomposers, such as bacteria and fungi, break down organic matter from dead plants and animals. During this process, they convert complex organic compounds into simpler substances, including ammonia. This release of ammonia enriches the soil, making nitrogen available for plants to use. The other options describe processes that are not the primary role of decomposers in the nitrogen cycle.

2. **(a)** Birth control

Explanation:

Birth control

3.

(d) Podophyllum

Explanation:

Podophyllum

4.

(b) Fertilization

Explanation:

Fertilization

5.

(c) PCR and RAPD

Explanation:

PCR and RAPD

6.

(b) Have all properties of life

Explanation:

Microspheres are molecules developed during organic evolution. They do not have all properties of life. They are composed of protein molecules and form buds to develop smaller microspheres.

7.

(b) Bacillus vulgaris

Explanation:

Bacillus vulgaris

8.

(d) Producers & decomposers

Explanation:

Producers & decomposers

9.

(b) Sickle cell anemia

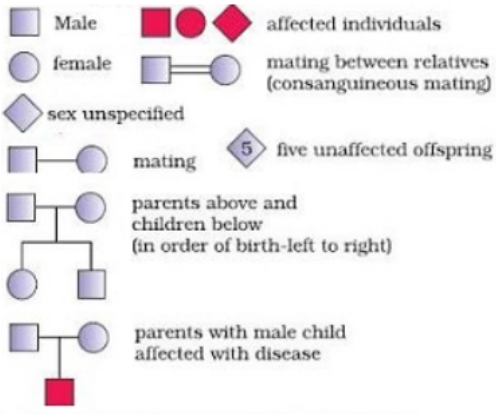
Explanation:

Sickle cell anemia is an autosomal recessive disorder that arises when both the parents are carriers of the gene.

10. **(a)** Mating between relatives

Explanation:

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



11.

(d) Nitrobacter

Explanation:

Nitrobacter

12.

(c) It can be replicate independently

Explanation:

It can be replicate independently

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

Explanation:

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

14.

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

Explanation:

An organism that controls or destroys unwanted plant growth without harming the useful plant is called bioherbicide. The first bioherbicide happened to be mycoherbicide (fungal herbicide). It was elaborated in 1981. This herbicide is Phytophthora palmivora. The fungus does not allow the Milkweed vine to grow in citrus orchards.

15.

(c) A is true but R is false.

Explanation:

A is true but R is false.

16.

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

Explanation:

Weismann was the main opponent of Lamarckian theory. He experimented on white rats cutting their tails. He obtained 901 youngs from five (22) successive generations of mutilated parents, but none of the offspring showed vestigial tail. It means that acquired character (cut tail) was not inherited. He put forward the theory of continuity of germplasm. There is a continuity of germplasm but the somatoplasm is not transmitted to the next generation hence it does not carry characters to next generation. Weismann's theory is not very satisfactory. In some cases the characters are also transmitted through somatic cells, e.g. regeneration in some animals like earthworms and vegetative propagation in plants.

Section B

17. Agrobacterium tumifaciens, a pathogen of several dicot plants is able to deliver a piece of DNA known as 't-DNA' to transform normal plant cells into a tumor and direct these tumor cells to produce the chemicals required by the pathogen.

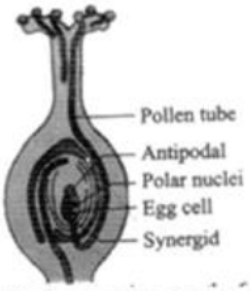
The tumor-inducing (Ti) plasmid of Agrobacterium tumifaciens has now been modified into a cloning vector which is no more pathogenic to the plants but is still able to use the mechanisms to deliver genes of our interest into a variety of plants Similarly, retroviruses in animals have the ability to transform normal cells into cancerous cells. Retroviruses have also been disarmed and are now used to deliver desirable genes into animal cells.

OR

a. Disorder is caused due to the deletion of gene coding for adenosine deaminase.
b. Bone marrow transplantation, enzyme replacement therapy, gene therapy.
c. The gene isolated from bone marrow cells producing ADA, if introduced into cells at early embryonic stage could be a permanent cure.

18. Process 'a' is Transcription and process 'b' is Translation.

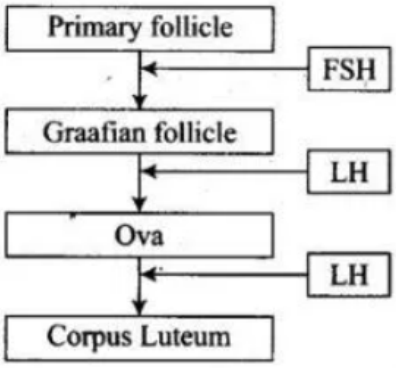
19.



Longitudinal section of a flower showing growth of pollen tube

Synergids and egg cell are the components of egg apparatus.

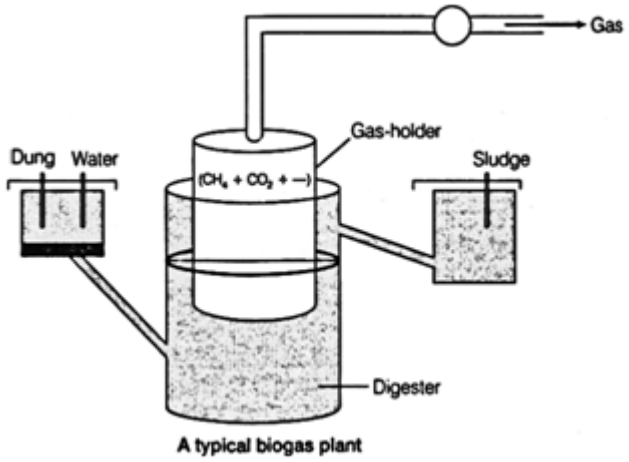
20.



OR

- Tertiary follicle in the ovary
- Secondary oocyte and 1st polar body.

21.



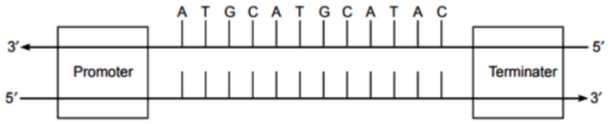
A typical biogas plant

OR

	Primary sewage treatment	Secondary sewage treatment
1.	It is a physical method of treatment	It is a biological method of treatment
2.	It involves in removal of large particles and floating materials such as leaves, papers, rags, solids such as sand, grit and oily substances	It involves the removal of fine suspended and dissolved organic matter.
3.	It makes the used of sedimentation and filtration process	It makes the use of aerobic or anaerobic biological units
4.	It is relatively simple and less time consuming process	It is relatively complex and takes a long time for its completion

Section C

22. i. Transcription unit



ii. RNA strand transcribed from the above transcriptional unit



23. Four symptoms of Down's syndrome are:
(a) feeble minded
(b) retarded growth
(c) rounded face and broad forehead
(d) permanently open mouth.
It is an autosomal aneuploidy or 21 trisomy. In this case the egg possesses 24 chromosome instead of 23 and the offspring has 47 chromosomes. (45 + XY in male, 445 + XX in female) instead of 46.

24. - Commensalism
- As egrets move, the cattle stir up and flush out from the vegetation the insects which otherwise might be difficult for the egrets to find and catch. Thus, the egrets are benefited while the cattle are neither benefited nor harmed.

25.
- **Name of biochemical/molecular diagnostic tests for viruses:**
  - **ELISA** - Enzyme-Linked Immunosorbent Assay
  - **PCR** – Polymerase Chain Reaction
- **Principle of ELISA -** It is based on antigen-antibody interaction. Infection by a pathogen can be detected by the presence of antigens or by detecting the antibodies synthesized against the pathogen.

26. i. **Wildlife sanctuary:** In a wildlife sanctuary, protection is given only to the animals and operations such as harvesting of timber, collection of minor forest products and private

ownership rights are permitted so long as they do not interfere with the well- being of animals. There are presently 368 sanctuaries in India covering over 1,07,310,13 square kilometres, amounting to 3.2 per cent of India's total geographical area.

ii. **Biosphere reserves:** Biosphere reserves are special category of protected areas of land and/or coastal environments wherein people are an integral component of the system. The concept of biosphere reserve was launched in 1975 as a part of the UNESCO's MAB (Man and Biosphere) programme. There are 14 biosphere reserves in India which are notified as National Parks. Each biosphere reserve has a core zone, buffer zone and a transition zone.

27.
- **Fossils -** These are remains of hard parts of life-forms found in rocks. Different-aged rock sediments contain fossils of different life forms who probably died during the formation of the particular sediment.
- **Few discoveries of fossils are as follows:**
  - Fossils of dinosaurs have been unearthed to reveal the evolution of reptiles in the Jurassic period and later evolution of the birds and mammals.
  - Recently, fossils of shark-toothed reptiles have been discovered from Sahara desert.
  - Archaeopteryx; a fossil sharing both reptilian and avian characters, has been discovered. It has teeth in jaws. The discovery of this fossil is strong evidence in support that birds have evolved from reptilian ancestors.

28. a. It is highly addictive drug, it is depressant/ slows down body functions

b. Diacetylmorphine, Papaver somniferum/poppy plant

c. Infections like hepatitis B or HIV can be transmitted

Section D

29. a.

Hormone name	Source Organ of the hormone
FSH	Pituitary gland
LH	Pituitary gland
Estrogen	ovary / graafian follicle
Progesterone	ovary / corpus luteum

b. Luteal phase or Secretory phase of the menstrual cycle, as endometrium is grown and suitable for implantation of an early embryo or blastocyst.

c. Estrogen, ovary/graafian (mature) follicles
Endometrium of uterus regenerates through proliferation phase of menstrual cycle.
OR
If ovum is not fertilized corpus luteum degenerates, progesterone level falls, disintegration of endometrium (and its blood vessels), leading to menstrual flow.

30. a. i. Maximum / 45mg per cm^3 at 10 minutes.
Or
ii. Concentration of Carbon monoxide increases and concentration of haem-bound oxygen decreases

b. Nicotine stimulates adrenal gland which releases adrenaline / noradrenaline in blood resulting in increase of blood pressure and heart beat.

c. Nicotine is an Alkaloid
Cocaine / coke / crack / morphine / cannabinoids.

Section E

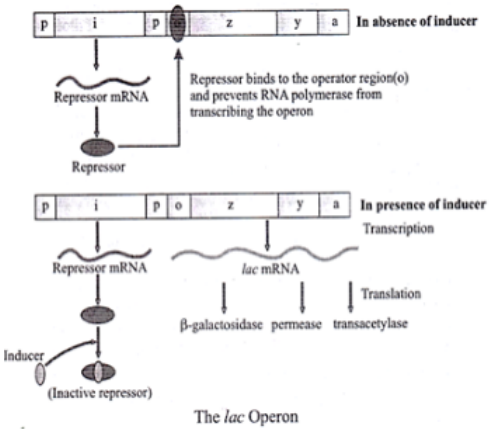
31. Pollen grains or microspores are generally spherical in outline. The wall of pollen grain is called sporoderm, which is made up of two layers - An outer thick exine and an inner thin intine. The exine is made up of sporopollenin which is biologically the most resistant substance and can withstand high temperature and strong acids and alkali. At one or more places, the exine is very thin or absent. These regions are called germ pores. Intine is continuous layer made up of cellulose and pectin. A mature pollen grain has two cells - a vegetative cell and a generative cell.

The vegetative cell is bigger and has food reserve and a large irregular nucleus. The generative cell is small, spindle shaped and floats in the cytoplasm of vegetative cell.
In dicots, pollen grains are with three germ pores, while in monocots, they are with single germinal furrow.

OR

i. To combine desirable characters from two different varieties, so as to obtain improved/superior variety.
ii. The steps of hybridization program in plants-If the female parent plant bears bisexual flowers, it is necessary to remove the anthers from the flower before its dehiscence, which is called emasculation, such flowers are then bagged, (with butter paper bags of suitable size) to prevent contamination of its stigma, which is called bagging, When the stigma of bagged flower attains receptivity, mature pollen collected from anthers of the male parent are dusted on the stigma, and flower is rebagged and fruit is allowed to develop.

32. A functioning unit of genomic DNA containing a cluster of genes under the control of a single promoter is called an operon. An operon is generally transcribed into polycistronic mRNA. A single mRNA which codes for more than one protein is called polycistronic mRNA. An operon is made up of 3 basic DNA components:
i. **Promoter:** A nucleotide sequence that enables a gene to be transcribed is called a promoter. It is recognized by RNA polymerase, which then initiates transcription.
ii. **Operator:** A segment of DNA to which a repressor binds is called the operator.
iii. **Structural genes:** The genes that are co-regulated by the operon are called structural genes.
Inducible Operon: When the operon is regulated by an inducer, it is called an inducible operon. An inducer can switch on or off the operon. Lac operon is an example of an inducible operon. Lactose is a substrate of enzyme beta-galactosidase and is the inducer of the lac operon.



The *lac* Operon

The given diagram shows the working of the lac operon. In the absence of an inducer, the repressor binds to the operator region and prevents transcription.
In the presence of an inducer, repressor becomes inactive. This allows transcription in the operator region which results in the release of mRNA. Subsequently, mRNA promotes translation and protein synthesis is accomplished.

OR

a. When Streptococcus pneumoniae (pneumococcus) bacteria are grown on a culture plate some produce smooth shiny colonies (S) while others produce rough colonies (R), mice infected with the S strain (virulent) die from pneumonia infection, but mice infected with the R strain do not develop pneumonia, Griffith was able to kill bacteria by heating them, He observed that heat-killed S strain bacteria injected into mice did not kill them, when he injected a mixture of heat-killed S and live R bacteria the mice died, he recovered living S bacteria from the dead mice.
Frederick Griffith conducted experiments with Streptococcus pneumoniae having two strains - S - virulent type (smooth shiny colonies with capsule) the other forming R-non-virulent type (rough colonies without capsule)

Live virulent S-cells + Live mice → Mice died

Non-virulent R-cells + Live mice → Mice survived

Griffith was able to kill bacteria by heating them

Heat Killes R-cells + Live mice → Mice survived

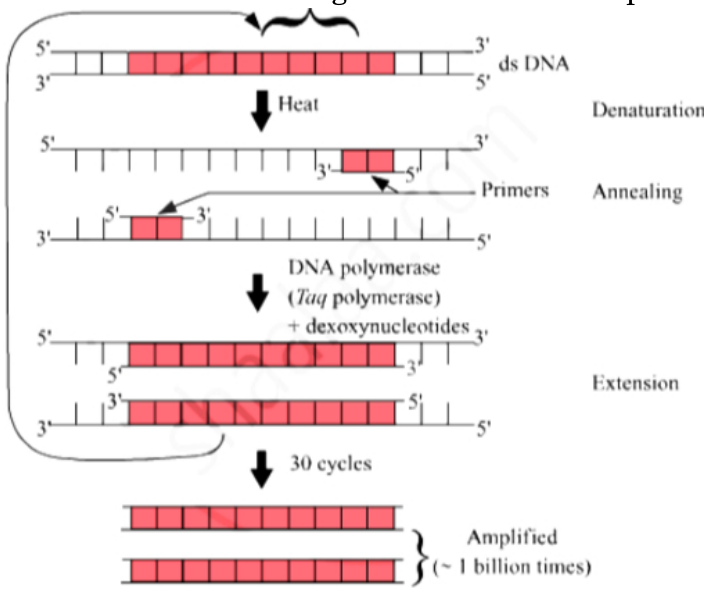
Heat killed S-cell + Live R-Cells + Live mice → Mice died

He concluded that heat killed S-type caused a transformation of the R-type bacteria into S-type bacteria / some transforming principle transferred from heat killed S-strain to R-strain to make it virulent.

b. They purified bio chemicals (proteins, DNA, RNA, etc.) from the heat-killed S cells, and discovered that DNA alone from S bacteria caused R bacteria to become transformed.

33. i. A bacterial cell is made competent by treating it with a specific concentration of a divalent cation such as calcium, which increases the efficiency with which DNA enters the cell through pores in its cell wall.

ii.
- Denaturation , DNA is heated to a high temperature resulting in the separation of two strands of DNA
- Annealing, two primers are annealed to each of the singlestranded template DNA.
- Extension , enzyme Taq polymerase extends the primers using the nucleotides provided in the reaction and the genomic DNA as template.



OR

i. Optimisation of the bioreactor system can be achieve by Temperature, pH, Substrate, Salts, Vitamins, Oxygen

ii. Log phase/Exponential phase is referred

iii. No

It needs separation and purification/down-streaming process/quality control testing/needs to be formulated with suitable preservatives/clinical trials.