# Class XII Session 2026-27
# Subject - Biology
# Sample Question Paper - 10

**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 primary productivity in an ecosystem is expressed as: **[1]**

   a) $gm^{-2}yr^{-1}$ b) $gm^{-2}yr$

   c) K cal $m^{-2}yr^{-1}$ d) K cal $m^{-2}$

2. Geometric representation of age structure is a characteristic of: **[1]**

   a) Biotic community b) Ecosystem

   c) Population d) Landscape

3. Select the group which represents only critically endangered species (as per 2008 red list). **[1]**

   a) African elephant, Red Panda, Polar Bear, and Giant panda

   b) Cross River Gorilla, Arctic fox, Mountain Gorilla and Amur leopard

   c) Giant panda, Loggerhead turtle, Snow Leopard, and Leatherback turtle

   d) Amur Leopard, Cross River gorilla, Hawksbill turtle, and Leatherback turtle

4. The specialized procedure to form an embryo in a laboratory in which a sperm is directly injected into the ovum is called: **[1]**

   a) Gamete intrafallopian transfer b) Intra- uterine insemination

   c) Intracytoplasmic sperm injection d) Zygote intra fallopian transfer

5. Which one of these is not a tool of recombinant DNA technology? **[1]**

   a) Polymerase enzyme b) Introns

c) Vector

d) Restriction enzyme

6. For a nucleic acid probe to hybridize, which of the following must be true? **[1]**

a) The sequence to which it hybridizes must be identical to that of the probe

b) Both the probe and the sequence to which it hybridizes must be RNA

c) Both the probe and the sequence to which it hybridizes must be DNA

d) The sequence to which it hybridizes must be complementary to that of the probe

7. Which of the following statements is correct? **[1]**

a) Lantana is popularly known as carrot grass.

b) African catfish is not a threat to indigenous catfishes.

c) Parthenium is an endemic species of our country.

d) Steller's sea cow is an extinct animal.

8. In a grazing food chain, carnivores may also be referred to as: **[1]**

a) Primary producers

b) Secondary consumers

c) Secondary producers

d) Primary consumers

9. In Mirabilis jalapa, the percentage of plants having pink and red flowers would be _____ when pink flower plant is test crossed. **[1]**

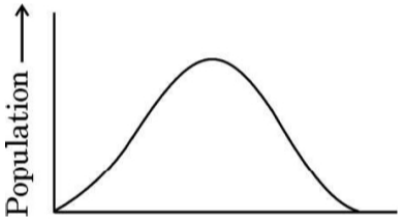
a) 25% pink & 25% red

b) 50% pink & 0% red

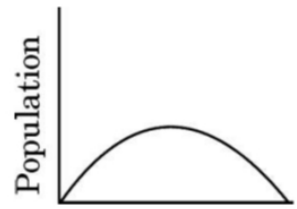
c) 0% pink & 50% red

d) 50% pink & 50% red

10. The given graph shows the range of variation among population members, for a trait determined by multiple genes. If this population is subjected to disruptive selection for several generations, which of the following distributions is most likely to result? **[1]**




a)

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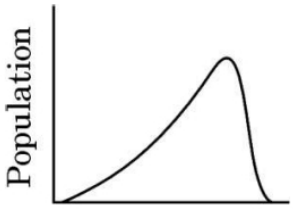
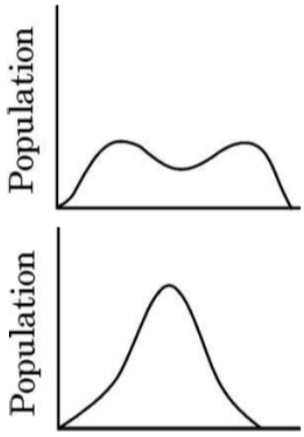



c)

d)




11. If the mean and median pertaining to a certain population are of the same value, the following is most likely to occur: **[1]**

a) A normal distribution
b) A skewed curve
c) A T-shaped curve
d) A bi-modal distribution

12. Gel electrophoresis is a technique to separate fragments of DNA from a mixture. Some of the events of electrophoresis are given below. Arrange the events in order. **[1]**



1. Cut out DNA bands
2. Expose to UV
3. Force DNA to move through gel
4. Stain DNA with ethidium bromide

a) 3 - 4 - 2 - 1
b) 4 - 3 - 2 - 1
c) 4 - 3- 1 - 2
d) 1 - 2 - 3 - 4

13. **Assertion (A):** Statutory ban on amniocentesis for sex-determination is to legally check increasing female foeticide. **[1]**
**Reason (R):** In amniocentesis, some of the amniotic fluid that has the developing foetus is taken to analyse the chromosomes in the foetal cells.

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 (A):** Nitrogen-fixing bacteria of legume nodules live in $O_2$-depleted cells. **[1]**
**Reason (R):** Leghaemoglobin completely removes $O_2$ from the nodule cells.

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 soil profiles of grassland, forest and desert biomes differ from each other. **[1]**

**Reason (R):** Soil profile develops due to weathering process, accumulation of organic matter and leaching of mineral matter.

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):** Most **evolutionary trees** place information about pattern of relationship on horizontal axis and time on vertical axis. **[1]**

**Reason (R):** An **evolutionary tree** depicts pattern of relationship among parents and offsprings.

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.

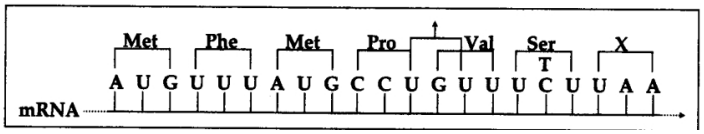
## Section B

17. Many people are apprehensive of accepting GM crops. Give three reasons so as to convince them to use these crops. **[2]**

OR

What happens when Meloidegyne incognitia consumes cells with RNAi gene?

18. Read the sequence of the nucleotides in the given segment of mRNA and the respective amino acid sequence in the polypeptide chain. **[2]**




Polypeptide: met-phe-met-proline-valine-serine

i. Provide the triplet of bases (codon) for

a. valine

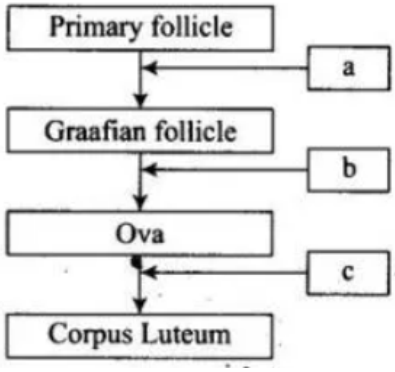
b. proline

ii. Write the nucleotide sequence of the DNA strand from which this mRNA was transcribed

iii. What does the last codon of this RNA stand for?

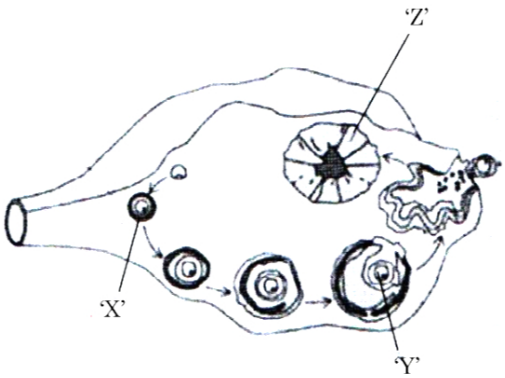
19. Explain the function of Coleorhiza. **[2]**

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

The diagram given below shows the events occurring in an ovary during Oogenesis in a human female.

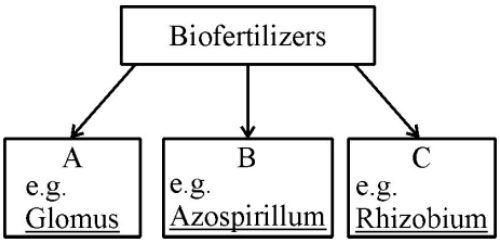



a. Identify **X**. Mention the time when the process occurs in a human female.

b. Identify **Y**. When and how is it formed?

c. Name the hormone produced by **Z**.

21. Study the flow chart and answer the following questions: **[2]**



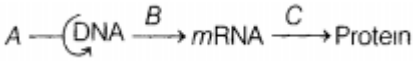

a. Identify A, B and C in the flow chart.

b. Give one another example of bio-fertilizer B.

OR

What is LAB? What is its role in human stomach?

## Section C

22.  **[3]**


i. Look at the above sequence and mention the event A, B and C.

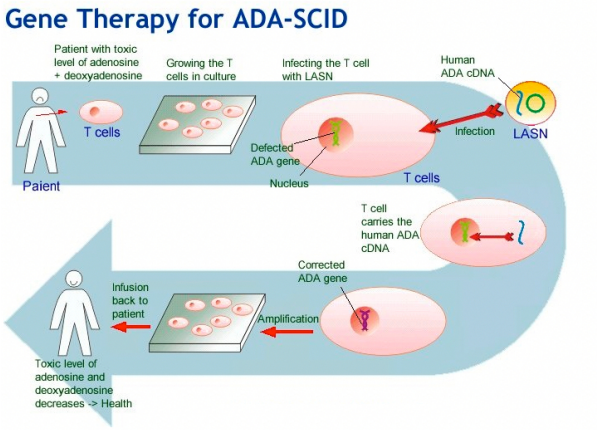
ii. What does central dogma state in molecular biology? How does it differ in some viruses?

23. $F_1$ progeny of pea plant bearing violet flowers and snapdragon plant bearing red flowers were selfed to produce their respective $F_2$ progeny. Compare the phenotypes, the genotypes and the pattern of inheritance of their respective $F_2$ progeny. **[3]**

24. Name the type of curve that characterizes most populations growing in favourable **[3]**

environment. Define carrying capacity.

25. This image highlights the process of Gene Therapy of ADA-SCID. **[3]**




i. Mention the cause of ADA deficiency in humans.

ii. How has genetic engineering helped patients suffering from it?

26. Biodiversity must be conserved as it plays an important role in many ecosystem services that nature provides. Explain any two services of the ecosystem. **[3]**

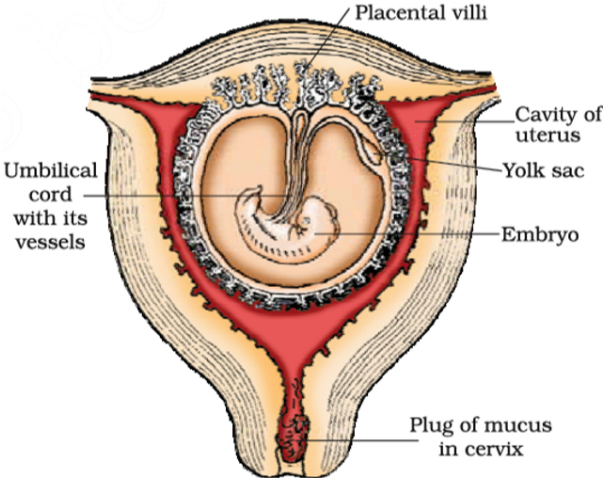
27. What is the study of fossils called? Mention any three points how the fossils throw light on the past. **[3]**

28. For an organ transplant, it is an advantage to have an identical twin. Why? **[3]**

## Section D

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

After implantation, finger-like projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood. The chorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between the developing embryo (foetus) and the maternal body.




i. Name the hormone crucial in parturition. Does the parturition signal originate from the mother or the fetus? (1)

ii. When and where do chorionic villi appear in humans? (1)

iii. Woman has conceived and implantation has occurred. Discuss the impact of progesterone and estrogen. (2)

**OR**

Fetal ejection reflex leads to parturition. Justify (2)

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

Reema, Jai and Ankit are suffering from autoimmune diseases of adrenal cortex, joints and thyroid gland, respectively. Their immune system failed to recognise self and non-self and started destroying their body's own proteins. They are seeking proper medical help for their conditions but their condition cannot be cured completely.

i. Identify autoimmune diseases of Reema, Jai and Ankit. (1)

ii. Write the characterised on Reema's autoimmune condition. (1)

iii. What do you think is the major cause of Jai's condition? (2)

**OR**

How do you think Ankit s condition got diagnosed? (2)

**Section E**

31. What is meant by 'right' and 'wrong' type of pollen when pollen lands on the stigma. A two-celled right type pollen has landed on the stigma. Explain the events taking place till fertilization in angiosperms. Why is pollen pistil interaction said to be dynamic? **[5]**

OR

a. Describe the process of double fertilisation in angiosperms.

b. Trace the development of polyploidal cell that is formed after double fertilisation in a non-albuminous seed and albuminous seed.

32. i. Draw a labelled diagram of a replication fork in a prokaryote indicating the process of DNA replication. **[5]**

ii. Differentiate between the two newly synthesised DNA strands within the fork.

iii. Name the enzymes involved in the process of DNA replication.

iv. Name the eukaryote where the semi-conservative mode of replication was experimentally proved.

OR

a. Describe the structure of a **transcription Unit**.

b. Explain the basis of defining the two DNA strands of a structural gene in a transcription unit.

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

OR

Explain briefly PCR.

# Solution

## Section A

1. **(a)** $gm^{-2}yr^{-1}$
   **Explanation:**
   Primary productivity expressed as $gm^{-2}yr^{-1}$

2. **(c)** Population
   **Explanation:**
   Geometric representation of age structure" refers to a graphical depiction of the distribution of different age groups within a population, which is a characteristic specific to a population, not an ecosystem, biotic community, or landscape.

3. **(d)** Amur Leopard, Cross River gorilla, Hawksbill turtle, and Leatherback turtle
   **Explanation:**
   According to the red data book 2008, Critically endangered is the highest conservation status animals. The Amur Leopard has just over 60 individuals left in its population. The Cross River Gorillas are a population between 200 and 300 individuals. Hawksbill Turtle, Leatherback Turtle have all unknown population numbers.

4. **(c)** Intracytoplasmic sperm injection
   **Explanation:**
   Intracytoplasmic sperm injection is a specialized procedure to form an embryo in a laboratory in which a sperm is directly injected into ovum for fertilization to form a zygote.

5. **(b)** Introns
   **Explanation:**
   Introns

6. **(d)** The sequence to which it hybridizes must be complementary to that of the probe
   **Explanation:**
   The solution is correct because hybridization of a nucleic acid probe occurs when the probe binds to a target sequence through base pairing. For this binding to happen effectively, the target sequence must be complementary to the probe. This means that the bases in the probe must pair with their corresponding complementary bases in the target sequence, allowing for stable hybridization.

7. **(d)** Steller's sea cow is an extinct animal.

**Explanation:**
Steller's sea cow is an example of a recently extinct animal.

8.

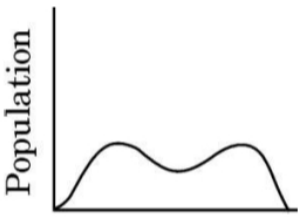
**(b)** Secondary consumers
**Explanation:**
Secondary consumers

9.

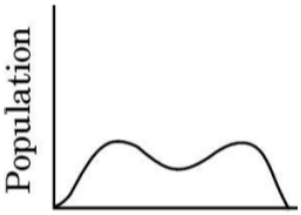
**(b)** 50% pink & 0% red
**Explanation:**
The solution is correct because in Mirabilis jalapa, flower color is determined by a simple inheritance pattern. If a plant with pink flowers (which is typically heterozygous) is test crossed with a homozygous red flower plant, the offspring will inherit one allele from each parent. Assuming pink is dominant over red, the pink flower plant can have either a homozygous (PP) or heterozygous (Pp) genotype. When test crossed with a homozygous red (pp) plant, the possible offspring from a heterozygous pink (Pp) would be 50% pink (Pp) and 50% red (pp). However, if the pink flower plant is homozygous (PP), all offspring will be pink (PP) and none will be red (pp). Since the question implies that the test cross is with a homozygous red flower plant, the only scenario that results in 50% pink and 0% red is when the pink flower plant is homozygous for pink. Thus, the correct answer is 50% pink and 0% red.

10.

**(c)**




**Explanation:**




11. **(a)** A normal distribution
**Explanation:**
A normal distribution

12. **(a)** 3 - 4 - 2 - 1
**Explanation:**
3 - 4 - 2 - 1

13. **(a)** Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.
**Explanation:**
Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

14.

**(c)** A is true but R is false.
**Explanation:**

A is true but R is false.

15.

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

**Explanation:**

The vertical layered structure of soil is called the soil profile. Soil profile develops due to weathering process, accumulation of organic matter and the leaching of mineral matter. There are four main horizons in a soil profile

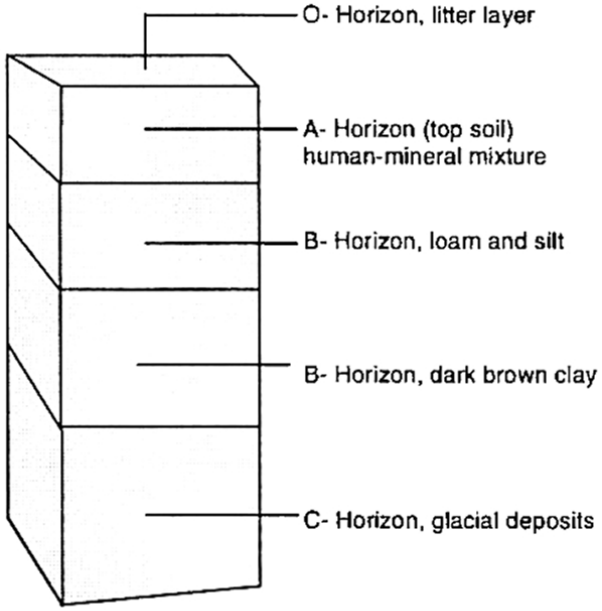



**Fig. Soil profile of temperate deciduous forests**

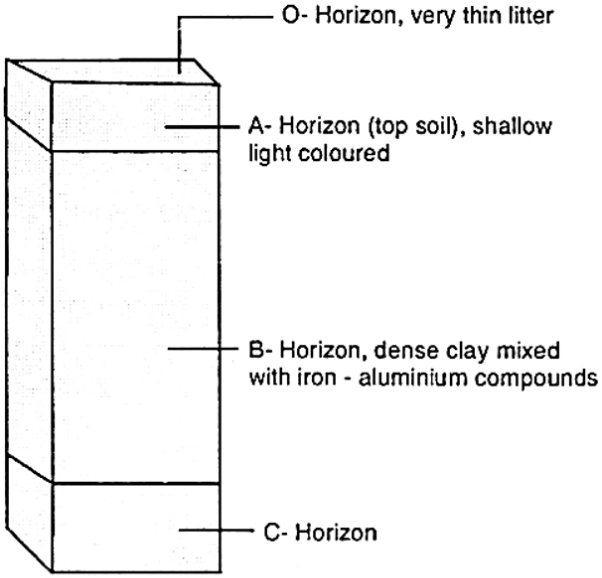



**Fig. Soil profile of tropical rain forest**

i. **O-Horizon :** It is the organic layer composed of recognisable dead organic residues.

ii. **A-Horizon :** It is also called the top soil. It is the uppermost mineral layer, which also contains roots and partially decomposed organic matter.

iii. **B-Horizon :** It is the subsoil.

iv. **C-Horizon :** It represents the less weathered parent material. Since the soil profile development is mainly governed by the climate and the kind of vegetation, therefore soils in grassland, forest and desert biomes differ markedly in colour, clay, organic matter content, and depth. In desert soils, the top soil has little or no humus. The subsoil is a mixture of sand, clay, minerals and salts. In the grassland, the roots of native plants penetrate deep in the ground, forming a dense sod that holds moisture and prevents erosion, and adds large amount of organic material to soil each year. In temperate forest

soils, the top horizon is a rich mixture of humus and inorganic soil components. In tropical rain forests, dense clay subsoil, heavy rainfall and high temperatures result in nutrient-poor and shallow soils.

16.

**(c)** A is true but R is false.

**Explanation:**

A is true but R is false.

## Section B

17. i. Crops are more tolerant to abiotic stresses (cold, drought, salt, heat).
    ii. reduced reliance on chemical pesticide (pest-resistant crops).
    iii. helped to reduce post harvest losses.
    iv. increased in efficiency of mineral usage by plants (this prevents early exhaustion of soil fertility).

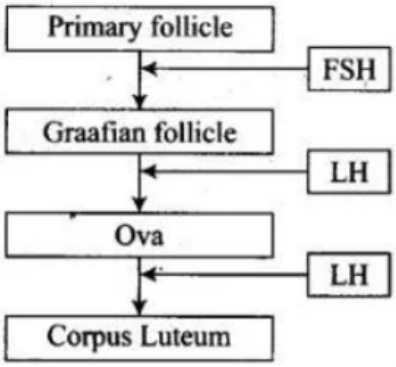
OR

When Meloidogyne incognita (parasite) consumes cells with RNAi gene, parasite cannot survive and this prevents infestation. The introduced RNAi gene DNA forms both sense and anti-sense RNA. Two strands being complementary to each other bend and form ds RNA, leading to RNAi. Thus, the mRNA of nematode is silenced and the parasite cannot survive there.

18. i. **Valine:** GUU, **Proline:** CCU
    ii. **Nucleotides of DNA strand:** TAC AAA TAC GGA CAA AGA ATT
    iii. **UAA:** Stop

19. **Coleorrhiza** is a cap-like structure present over the radicle in monocot seeds which protects the enclosed growing radicle, in early stages of root development .E.g. maize

20.




OR

a. Primary follicle
   Primary follicle develop during fetal stage.
b. Secondary Oocyte
   At follicular phase/ between 6-13 day of menstrual cycle secondary oocyte formed.
   Tertiary follicle grows in size and completes its first meiotic division and this unequal division results in a large haploid secondary Oocyte and a tiny first polar body.
c. Hormone Z is Progesterone

21. a. A- Mycorrhiza, B- Free living nitrogen fixing bacteria, C- Symbiotic nitrogen fixing bacteria.
    b. Azotobacter

OR

Lactic Acid Bacteria (LAB) or Lactics constitute a diverse group of microorganisms associated with plants, meat, and dairy. They are used in the manufacture of dairy products such as acidophilus milk, yogurt, buttermilk, and cheeses.

**Role of LAB in human stomach:**

lactic acid bacteria have a number of well-established benefits. They can improve lactose digestion, play a role in preventing and treating diarrhea and act on the immune system, helping

the body to resist and fight infection. It play a very beneficial role in checking disease-causing microbes

**Section C**

22. i. A - Replication of DNA
    B - Transcription
    C - Translation
    ii. Central dogma states that the genetic information flows from DNA to RNA and then to proteins. In some viruses the flow of information is reversed in direction, i.e. from RNA to DNA.
    It is called reverse transcription.
23. The snapdragon flower shows dominance. If a plant with red coloured flowers (RR) is crossed with a plant with white coloured flower (rr), the F1 progeny shows (Rr) the plant with pink coloured flowers.
    Hence, in the condition in which the selfing of the plant bearing red flower, they have RR genotype.

$F_1$ Red flower of snapdragon

RR X RR

Selfing

| | Ⓡ | Ⓡ |
|---|---|---|
| Ⓡ | RR | RR |
| Ⓡ | RR | RR |

Phenotype: All plants are bearing red coloured flowers.
Phenotypic ratio: 100%
Genotype: RR
Genotypic ratio: RR (100%)

24. - Sigmoid curve
    - In nature a given habitat has enough resources to support a maximum possible number of population, beyond which no further growth of the population is possible. This limit is called as natures carrying capacity (K) for that species in that habitat.
25. i. Deletion of the gene for ADA in an individual leads to ADA deficiency disorder Adenosine Deaminase (ADA) enzyme is crucial for immune system to function.
    ii. Gene therapy is helpful in the treatment of ADA deficiency.
    The treatment involves the following steps:
    a. Lymphocytes from the blood of patient are grown on a culture outside the body.
    b. A functional ADA, cDNA (using a retroviral vector) is then introduced into these lymphocytes.
    c. Such genetically engineered lymphocytes are returned to the blood of patient.
    d. Periodic infusion of such genetically engineered lymphocytes is required by the patient.
26. (1) Ecosystem provides direct economic benefits to humans in the form of food like cereals, pulses, nuts and fruits. We also get many other products of commercial importance such as timber, fibres, firewood, construction material, industrial products like tannins, lubricants, dyes, resins, perfumes and products of medicinal importance.
    (2) Forests act as 'carbon sink' and producers of huge amount of oxygen. The fast dwindling Amazon forest is producing 20 percent of the total oxygen, without which we cannot live for a moment. Thus forest ecosystem plays a crucial role in maintaining carbon-oxygen balance in nature. This keeps check on pollution and global warming.
27. Study of fossils is called Paleontology.
    (i) The rocks of early era contain less number of fossils than the rocks of later era and fossils of only simple marine invertebrates are in these rocks, which indicate that life originated in sea as

simple form.

(ii) The distribution of fossils indicates that fossils became more and more complex as we proceeded from earliest to recent rocks.

iii) On the basis of fossil study, it has been shown that the early organisms were very different from their modern forms.

28. Organ transplant involves a critical issue of tissue rejection. This happens because the immune system always tries to reject any foreign substance. In case of identical twins; most of the tissues would identical in both the individuals. Hence, chances of tissue rejection would be minimal if donor-acceptor pair is from identical twins. Hence, an identical twin is considered to be an advantage for an organ transplant.

**Section D**

29. i. The hormone is Oxytocin. The signal originates from the placenta and fully developed fetus which initiate the foetal ejection reflex triggering the release of the hormone, oxytocin.

ii. After implantation, finger-like projections appear on the trophoblast called chorionic villi. They are surrounded by uterine tissue and maternal blood.

iii. Under the impact of progesterone and estrogen the size of the uterus and birth canal increases. Relaxation of pelvic ligament takes place. The placenta is developed between chorionic and uterine tissues.

**OR**

Fully developed foetus pushes down the birth canal, causing stretching of the cervix. This generates nerve impulse which stimulates the hypothalamus. It in turn causes the posterior pituitary to release oxytocin (birth hormone). Oxytocin causes the uterine muscles to contract more vigorously which leads to parturition.

30. i. **Reema** - Addisons disease, **Jai** - Rheumatoid arthritis, **Ankit** - Hashismoto's thyroiditis

Addisons disease is an autoimmune disorder affecting the adrenal cortex. Rheumatoid arthritis is autoimmune disorder of joints and Hashimoto's thyroiditis is autoimmune disorder affecting thyroid gland.

ii. Addisons disease is characterised by under secretion of adrenal cortex hormone, weakness, nausea, weight loss, low blood sodium, low blood volume and pressure, darkened skin pigmentation, etc.

iii. Deposition of immune complexes of IgM, IgG and complement in joints thereby inflaming joints, destroying articular cartilage and fusing bones.

In rheumatoid arthritis, the cells of immune system mistakenly send antibodies to the lining of joints where they attack the tissue surrounding joints. This causes thin layers of cells (synovium) covering joints to become sore and inflamed, releasing chemicals that damage nearby bones, cartilage, tendons, ligaments. These chemical gradually cause the joints to lose shape and alignment consequently fusing the bones.

**OR**

Both Low level of thyroid hormone and elevated levels of TSH in Ankit's blood and presence of antibodies against thyroid pen oxidase (TPO antibodies) in Ankit's blood.

**Section E**

31.

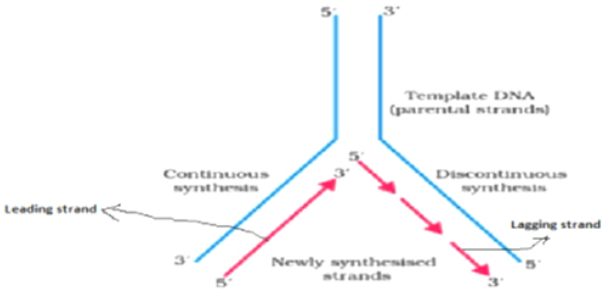
- Right- Compatible
  Wrong- Incompatible
- Two-celled pollen grain on the stigma germinates to form pollen tube through germ pore, generative cell divides and forms the two male gametes during the growth of pollen tube in the stigma, pollen tube enters ovule through micropyle then enters one of the synergids through the filiform apparatus, pollen tube releases two male gametes, one male gamete(n) fuses with egg cell (n) to form zygote (2n) thus completing syngamy, other male gamete fuses with polar nuclei in central cell to form primary endosperm nucleus ($3n$) termed triple fusion.
- Involves pollen recognition, Promotion or inhibition of (formation of pollen tube) the pollen.

OR

a. Double fertilization in angiosperms involves the fusion of two sperm cells with two distinct female gametes:
One of the male gametes, fuses with the nucleus of the egg cell, to form a diploid zygote (syngamy)
Second male gamete, fuses with two polar nuclei, to form (triploid) primary endosperm nucleus (triple fusion)

b. The primary endosperm nucleus undergoes successive nuclear divisions, to give rise to free nuclei / free nuclear endosperm, subsequent cell wall fomation results in cellular endosperm.

32. i.




Template strand (Parental strand), Continuous synthesis,Leading strand, discontinuous synthesis,Lagging strand/Okazaki fragments ,Newly synthesized strands, arrow showing the direction of replication(Polarity)

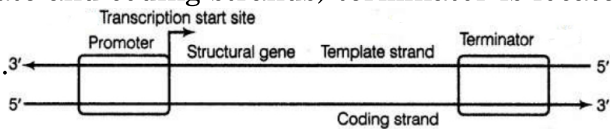
ii. Two newly synthesis DNA strand within the fork are - Parental strand with polarity 5'-3' shows discontinuous synthesis while Parental strand with polarity 3'-5' shows continuous synthesis

iii. DNA dependent DNA polymerase, ligase, Helicase, Topoisomerase, Primase

iv. Vicia faba/Faba bean

OR

a. Structure of transcription unit is - The promoter , and terminator flank/present on either side of structural gene, promoter located towards 5'end / upstream, (it is the presence of a promoter that defines the template and coding strands) terminator is located towards 3'end / downstream of the coding strand.




b. Since two DNA strands have opposite polarity, and DNA dependent RNA-polymerease catalyses the polymerisation, in only one direction 5'→3', the strand with polarity 3'→5' act as a template strand, the other strand with polarity 5'→3' is (does not code for anything) during transcription, and is referred to as coding strand.

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.

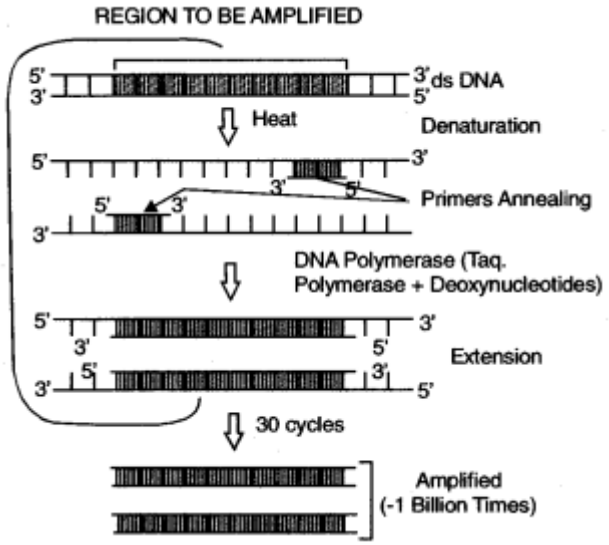
ii. **Annealing** -Two sets of primers are added, which anneal to the 3'end of each separated strand.

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

PCR (Polymerase Chain Reaction): In this reaction, multiple copies of the desired gene (DNA) is synthesised in vitro using two sets of primers (small artificially synthesised oligonucleotides that are complementary to the region of DNA) and the enzyme DNA polymerase. The enzyme extends the primers using the nucleotides provided in the reaction and genomic DNA as a template.




A schematic representation of the three steps performed during PCR. Note that the two primers used are complementary to the 3' end sequences of DNA segment t0 be amplified.

The process of DNA replication can be repeated many times and the segment of DNA can be amplified to approximately billion times, It is achieved by the use of thermostable DNA polymerase isolated from bacterium *Thermus aquaticus*.

The amplified segment can also be used to ligate with a vector for further cloning.