# Sample Paper 7

## Biology (044)

## Class XII Session 2022-23

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

**General Instructions:**

1. All questions are compulsory.
2. The question paper has five sections and 33 questions. All questions are compulsory.
3. Section—A has 16 questions of 1 mark each; Section—B has 5 questions of 2 marks each; Section—C has 7 questions of 3 marks each: Section—D has 2 case-based questions of 4 marks each; and Section—E has 3 questions of 5 marks each.
4. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
5. Wherever necessary, neat and properly labeled diagrams should be drawn.

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## SECTION - A

**16 Marks**

**1.** What phenomenon do the flowers shown in the figure exhibit?

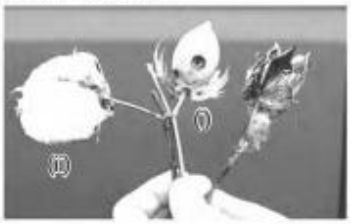
(a) Incomplete dominance
(b) Multiple allelism
(c) Co-dominance
(d) Polygenic inheritance 1

**2.** Which of the following statement(s) is/are correct?

(I) Few oral contraceptives used are Mala D, Saheli, etc.
(II) Oral administration of small doses of either progestagens or progestagen-estrogen combinations is another contraceptive method used by males.
(III) Oral contraceptives are used in the form of tablets and hence are popularly called the 'pills'.
(IV) Pills have to be taken daily for a period of 22 days

Select the correct option:
(a) (I), (II)
(b) (I), (III)
(c) (I), (II), (III)
(d) (I), (II), (III), (IV) 1

**3.** Which of following is correct for the parts labelled as (i) and (ii)?




| | I | II |
|---|---|---|
| (a) | Cotton ball destroyed by bollworms, | A fully mature cotton ball |
| (b) | A fully mature cotton ball | Cotton ball destroyed by bollworms |
| (c) | Cotton ball destroyed by bollworms | A fully immature cotton ball |
| (d) | A fully immature cotton ball | Cotton ball destroyed by bollworms |

1

4. Rakesh is a farmer. He is suggested to use biofertilisers instead of chemicals. Why are biological fertilisers and pesticides preferred over chemical ones?

(a) They are safe to use and are non-biological in origin.

(b) They do not spoil the quality of the soil and are target non-specific.

(c) They do not pollute the atmosphere and are non-poisonous.

(d) They are less expensive and are non-biodegradable. 1

5. Which Darwin's finch eating behaviour resulted in the evolution of numerous other varieties?

(a) Fruit eater (b) Cactus eater

(c) Insect eater (d) Seed eater 1

6. The figure given below represents a part of plant *Michelia*.


What part is it?

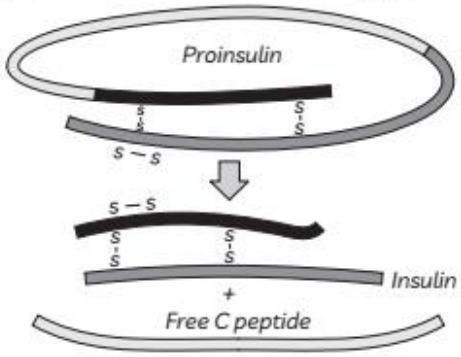
(a) A dissected flower showing pistil

(b) A multicarpellary, syncarpous pistil

(c) A multicarpellary, apocarpous gynoecium

(d) A typical anatropous ovule 1

7. Which statement is true regarding the process shown in the following figure?




(a) Two short polypeptide chains, chain A and chain C, make up insulin.

(b) Conversion of pro-insulin after removal of C-peptide is shown in the figure.

(c) Insulin is synthesized as active hormone

(d) C-peptide is usually removed much before the maturation of insulin 1

8. A complaint was filed against the offspring being exchanged at the hospital. To solve the case, the doctors used blood types. The parents' genotypes for the blood groups $I^Ai$ and $I^AI^B$. What was the blood type of the child who was mistakenly identified as their child?

(a) A (b) B

(c) AB (d) O 1

9. What is the missing level of the organization?

Tertiary consumer → Secondary consumer → ?
Primary producer

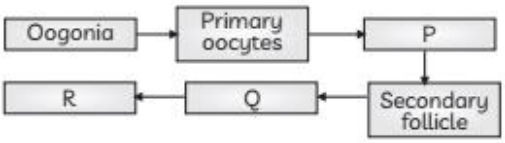
(a) Carnivore

(b) Primary consumer

(c) Decomposer

(d) Secondary producer 1

10. Match the columns that fills the missing boxes for the levels in the transformation of mother germ cells into a mature follicle in the given flowchart.




| Column (I) | | Column (II) | |
|---|---|---|---|
| (A) | P | (i) | Graffian follicle |
| (B) | Q | (ii) | Primary follicle |
| (C) | R | (iii) | Antrum |

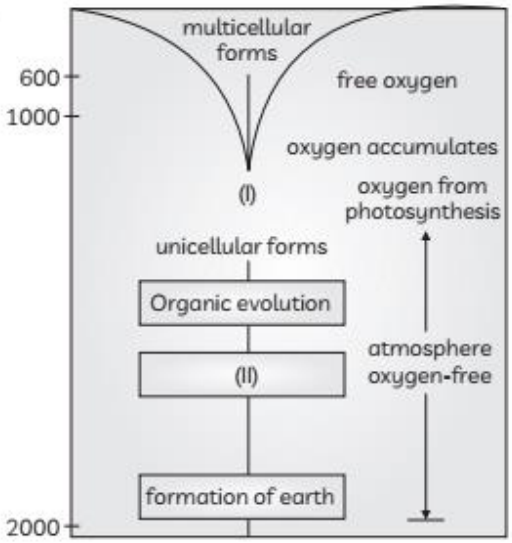
(a) (A)-(i), (B)-(ii), (C)-(iii)

(b) (A)-(ii), (B)-(i), (C)-(iii)

(c) (A)-(iii), (B)-(ii), (C)-(i)

(d) (A)-(ii), (B)-(iii), (C)-(i) 1

**11.**




Identify (I) and (II) in the above flow chart.

| | (I) | (II) |
|---|---|---|
| (a) | Producers | Chemical evolution |
| (b) | Chemical evolution | Producers |
| (c) | Consumers | Oxygen evolution |
| (d) | Autotrophs | Chemical evolution |

1

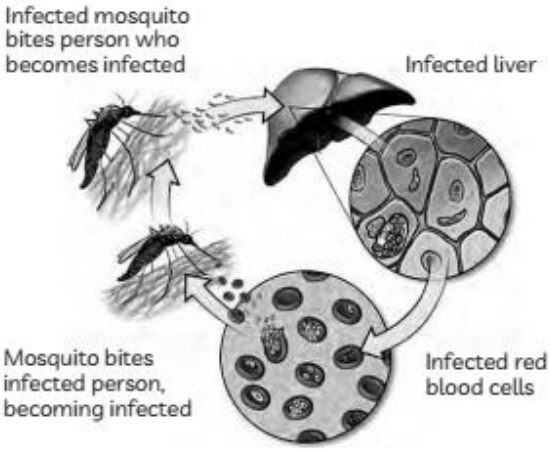
**12.** Enzyme used to digest the cell wall of bacteria is ..... .

(a) cellulose (b) lysozyme
(c) chitinase (d) zymase 1

Question No. 13 to 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.** Through the bites of female Anopheles mosquitoes carrying the parasites that cause malaria, people can contract this potentially fatal illness. It can be avoided and treated. Nearly half of the world's population would be at risk from malaria in 2020.




Assertion (A): *Plasmodium vivax* has two hosts – female anopheles while the secondary host is man.

Reason (B): Primary host is where the parasite maintains an amoeboid stage in RBCs. 1

**14.** Assertion (A): Many varieties were available with observable alternative forms for a trait or a characteristic.

Reason (B): Peas normally cross-pollinate; as their corolla does not completely encloses the reproductive organs until pollination is complete. 1

**15.** Assertion (A): The female gametophyte is formed from the contents of megaspore.

Reason (B): However it always remains embedded within the membrane of the microspore. 1

**16.** Assertion (A): The bacterial cells must be made competent to take up DNA.

Reason (B): This is done by treating them with a specific concentration of magnesium. 1

## SECTION - B

**10 Marks**

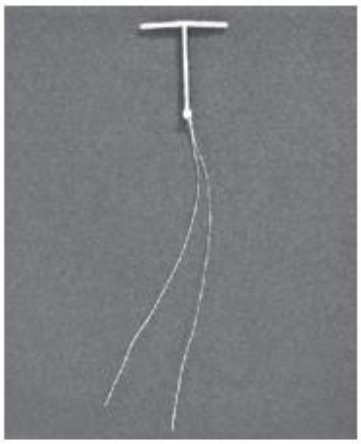
**17.** From the following table, identify the empty spaces marked (A), (B), (C), and (D):

| Type of microbe | Scientific name | Product | Medical application |
|---|---|---|---|
| Fungus | (A) | Cyclosporin | (B) |
| (C) | *Monascus Purpureus* | Statin | (D) |

2

**18.** Draw simple diagrams to represent the major plant and invertebrate that make up the world's biodiversity. 2

**19.** Look at the given image. This device is implanted in the female reproductive system by doctors.



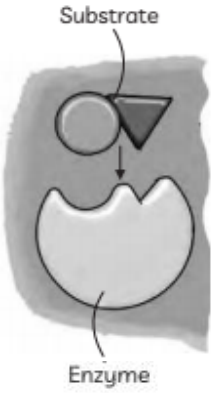
Give examples of such more devices used. Explain how this device works. 2

**20.** Rashi and her husband wanted to have a child. But their doctor told them that Rashi had a blockage in the fallopian tube. What methods of assisted reproductive techniques will help this couple to have children?

OR

"One way to achieve this goal is by offering sex education in schools." Give four reasons for why you think this statement is true. 2

**21.** (A) Can you determine whether (i) or (ii) have larger molecules based on what you have learned? How did you know ?




(i)

(ii)

(B) Give the name of the first transgenic cow created and explain how the product quality improved as a result. 2

## SECTION - C

**21 Marks**

**22.** Differentiate between the functions of flocs and anaerobic sludge digesters in the treatment of sewage. 3

**23.** (A) A farmer who lives in village Palampur is advised by his friends to use apomictic seeds. He was told that apomictic seeds are beneficial for farmers. Is that true? Explain your answer.

(B) Do you think apomixis and asexual reproduction are comparable? Give one reason to support your response.

(C) Shikha bought some oranges from market to extract juice at home. When she squeezed an orange many embryos of different shapes and sizes were seen. But normally one embryo develops in one seed. Mention how it has happened. 3

**24.** How have transgenic animals proved to be beneficial in production of biological products and chemical safety testing? 3

**25.** **(A) The principle shown below states that an individual population's allele frequency never changes. How should you interpret a population's shift in allele frequency?**

| $p^2$ : frequency of homozygous dominant genotype | 2pq: frequency of heterozygous genotype | $q^2$ : frequency of homozygous recessive genotype |
|---|---|---|

**(B) Explain how human activities affect organic evolution using appropriate examples.** 3

**26.** **(A) The biotechnologist label is allegedly shared by the wine maker and a molecular biologist who created a recombinant vaccine. Which person is right, in your opinion?**

**(B) List three important biotechnology research areas.**

**OR**

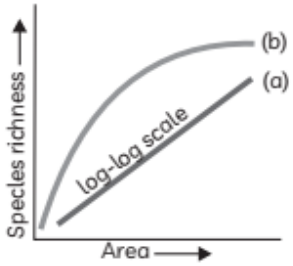
**(A) What are the two fundamental methods that made biotechnology possible?**

**(B) Name two GMO characteristics.** 3

**27.** **(A) Comment on the phrase "Migration may increase or lessen the impact of selection."**

**(B) What are the factors responsible for the evolution of synthetic theory?** 3

**28.** **The following graph shows the species–area relationship. Answer the following questions as directed.**




**(A) Name the naturalist who studied the relationship shown in the graph. What were his observations?**

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

**(i) 0.1 and 0.2**

**(ii) 0.6 and 1.2**

**What does 'Z' stand for?**

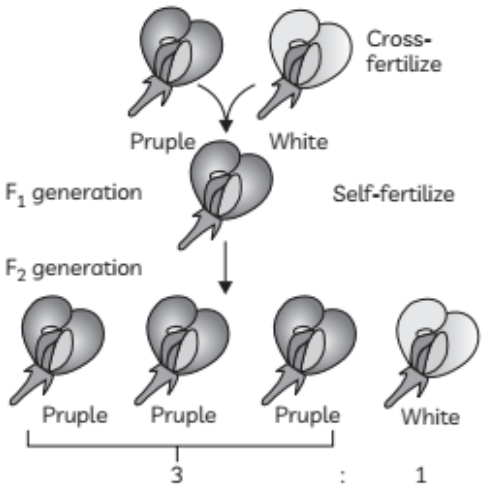
**(C) When would the slope of the line '(b)' become steeper?** 3

## SECTION - D

**8 Marks**

*(Q. No. 29 and 30 are case based questions. Each question has subparts with internal choice in one subpart.)*

**29.** *In her kitchen garden, Preksha had a pea plant with purple flowers that she was trying to identify the genotype of. She crossed a purple flowered plant with a white flowered plant to achieve this. As a result, the only flower found on every plant that was produced was purple. These plants selfed, producing 25 white flower plants and 75 purple flower plants. She can now cross a purple flowering plant with a white flowering plant to determine its genotype.*




**(A) Which law of inheritance cannot be derived from the crosses done by Preksha?** 1

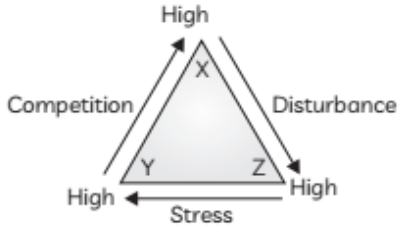
**(B) What do we call the character, i.e., purple colour of the flowers that appeared in the first filial generation?** 1

**(C) To determine the genotype of a purple flowered plant, Preksha crossed this plant with a white flowered plant. Which cross is represented by this?**

**OR**

**(C) What do we call a pair of genes that is unable to express its effect in the presence of its contrasting component in a heterozygote?** 2

**30.** *During a lesson on various environmental factors, a teacher draws a diagram that shows the historical strategies for three plant species (X, Y, and Z) along three axes: the intensity of interspecies competition, the degree of habitat disturbance, and the intensity of environmental stress. In habitats with high interspecies competition but low disturbance and stress, species X thrives. In environments with high environmental stress but low intraspecies competition, species Y thrives. In environments with little environmental stress, species Z can grow.*




(A) What are the environmental stresses that restrict production? 1

(B) Comment on the plant growth rate of different areas. 1

(C) In what kind of environment plant 'X' can be found?

OR

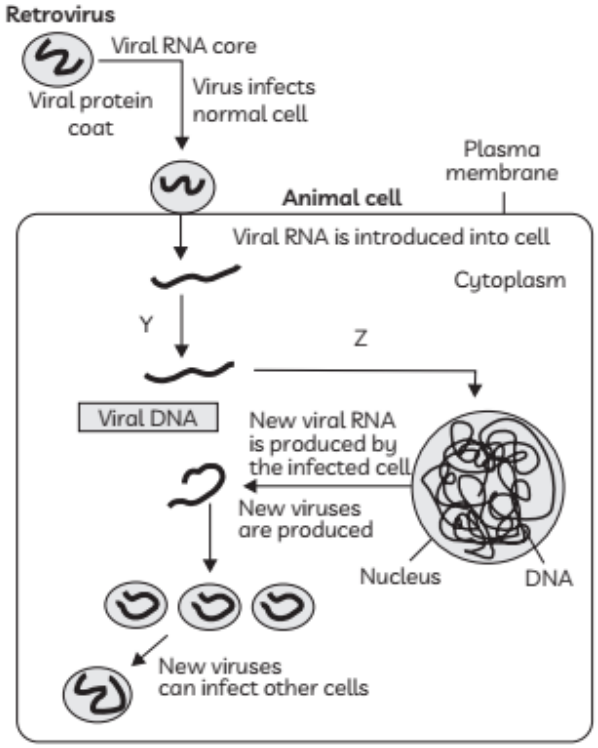
Identify what type plants are 'X', 'Y' and 'Z'. 2

## SECTION - E

**15 Marks**

**31.** A virus that uses RNA as its genomic material is referred to as a retrovirus. When a cell becomes infected with a retrovirus, the retroviral RNA is converted to retroviral DNA, which is then inserted into the DNA of the host cell. More retroviruses are then produced by the cell, infecting additional cells. Many diseases, including AIDS and some types of cancer, are linked to retroviruses.

The figure given below shows replication of retrovirus.




(A) Step 'Y' occurs in presence of which enzyme? What happens with the viral DNA formed in this step?

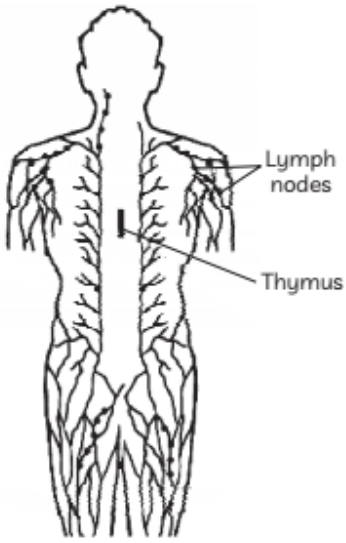
(B) What happens during the step 'Z'?

(C) What kind of infections can develop due to decrease in number of T-lymphocytes?

(D) A specialist made the diagnosis that the patient's immune system had been suppressed. Name the infection.

OR

Look at the given figure and answer the following questions:



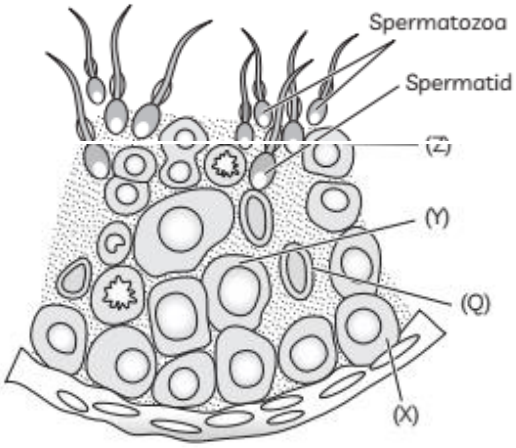

(A) What is the role of parts labelled in the following figure?

(B) What kind of lymphoid organ is thymus?

(C) What kind of lymphoid is lymph node?

(D) Name one secondary lymphoid organ which is not mentioned in the figure. State its role. 5

**32.** The following figure shows diagrammatic sectional view of a seminiferous tubule:



(A) Name and define the process by which structure 'X' produces sperms in the testis.

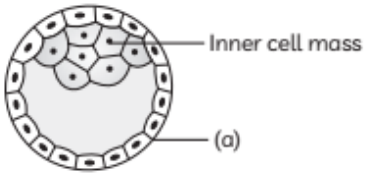
(B) How the structure 'Y' do produces the structure 'Z'?

(C) Name and define the process by which structure 'Z' develops into spermatids.

(D) Name and explain the process by which structure 'Q' is released from the seminiferous tubules.

OR

(A) Study the figure given below and answer the questions that follow:




(i) Identify the human embryonic stage that the illustration represents.

(ii) Mention the fate of the inner cell mass after implantation in the uterus,

(iii) Where are the stem cells located in this embryo?

(iv) Point out the function of 'a' in the figure and identify it.

(B) Chromosome number (2n) in the gametes is reduced to half (n) during reproduction, and it is restored to its original number (2n) in the progeny. What are the procedures that these events go through? 5

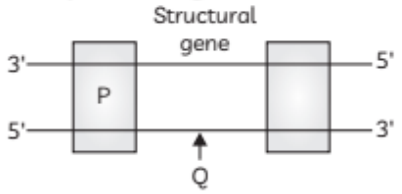
33. (A) Why does replication take place in small replication forks rather than entire lengths?

(B) Why does DNA replication in a replication fork occur both continuously and discontinuously?

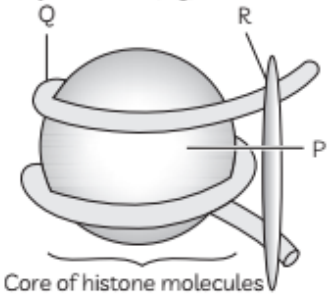
(C) What are the exceptions to the generalisation that DNA is the genetic material in all organisms? Give evidence that supports these exceptions.

OR

(A) Name the parts 'P' and 'Q' of the transcription unit given below.




(B) What does this diagram illustrate? Name the components P, Q, and R.




(C) DNA molecules are arranged in the nucleus of eukaryotes. In the absence of a nucleus, how is the DNA molecule arranged in a bacterial cell?

(D) What will happen to a eukaryotic cell if DNA replication is not followed by cell division? 5

# SOLUTION

## SECTION - A

1. *(a) Incomplete dominance*

**Explanation:** Incomplete dominance is illustrated by the inheritance of flower colour in the dog flower (snapdragon or *Antirrhinum sp.* shown in the image). It was discovered that occasionally the $F_1$ had a phenotype that was in between the two parents when experiments on peas were repeated using the flower colour trait.

**⚠ Caution**

➥ *Students should remember that incomplete dominance in Snapdragon is a result of a monohybrid cross in which one allele is only partially dominant over the other allele in the plant Snapdragon*

2. *(a) (I), (II)*

**Explanation:** New oral contraceptives in use include Mala D and Saheli. Another method of female contraception is the oral administration of small doses of progestagens

or progestagen-estrogen mixtures. They are commonly referred to as "pills" because they are used as tablets. For a total of 21 days, pills must be taken daily, ideally in the first five days of the menstrual cycle. It needs to be repeated in the same pattern every seven days (during which menstruation takes place) until the desired period of contraception.

### Related Theory

- *Oral contraceptives prevent or delay sperm entry by inhibiting ovulation and implantation as well as changing the cervical mucus' quality.*

### Caution

- *Students should know that pills are widely used by females because they are highly effective and have few side effects.*

**3.** *(a) (I): Cotton ball destroyed by bollworms; (II): A fully mature cotton ball*

**Explanation:** From *Bacillus thuringiensis*, specific Bt toxin genes were isolated and inserted into a variety of crop plants, including cotton as shown in the figure [Cotton ball: (i) destroyed by bollworms; (ii) a fully mature cotton ball].

Since the majority of Bt toxins are insect-group specific, the choice of genes depends on the crop and the targeted pest. A gene called cryIAc encodes the toxin. There are several of them; for instance, the proteins controlled by the genes cryIAc and cryIIAb and cryIAb control the corn borer.

**4.** *(c) They do not pollute the atmosphere and are non-poisonous.*

**Explanation:** Because they are safe to use and have a biological origin, biofertilizers and biopesticides are preferred over chemical fertilisers and pesticides. They are target-specific and do not degrade soil quality. They are not poisonous and do not pollute the environment. They are biodegradable and less expensive.

### Related Theory

- *In the case of secondary sewage treatment, methane, $H_2S$, and $CO_2$ are produced during the microbial digestion of organic compounds. In biogas plants, methane gas is produced from cattle dung.*

**5.** *(d) Seed eater*

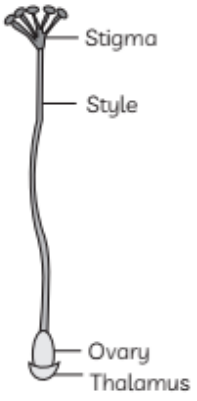
**Explanation:** Many other modified forms of beak emerged from the seed-eating finches, allowing them to eat insects, cacti, or fruit. As a result, adaptive radiation was found. One of the best illustrations of this process is found in Darwin's finches.

**6.** *(c) A multicarpellary, apocarpous gynoecium*

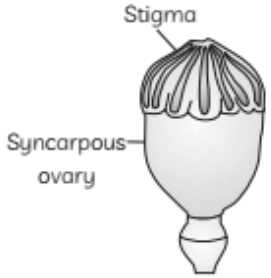
**Explanation:** The given figure represents a multicarpellary, apocarpous gynoecium of *Michelia*. The female reproductive portion of the flower is represented by the gynoecium. A single pistil (monocarpellary) or multiple pistils may be present in the gynoecium (multicarpellary). The pistils may fuse together if there are multiple (syncarpous) or may be free, (apocarpous).

### Related Theory

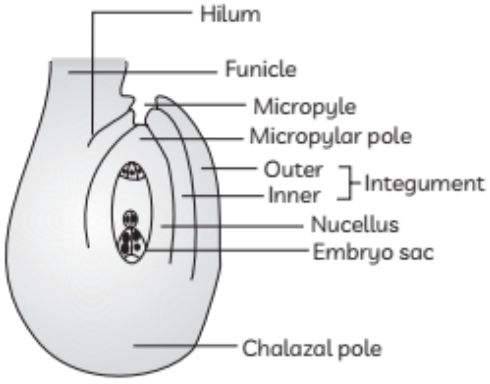
- *A dissected flower of Hibiscus showing pistil (other floral parts have been removed):*




*Multicarpellary, syncarpous pistil of Papaver:*




*A diagrammatic view of a typical anatropous ovule:*




**7.** *(b) Conversion of pro-insulin after removal of C-peptide is shown in the figure.*

**Explanation:** Chain A and Chain B, the two brief polypeptide chains that make up insulin, are connected by disulfide bridges. The extra stretch known as C-peptide that is present in pro-hormone insulin, or hormone that needs to be processed before becoming functional, is typically removed during the maturation of insulin.

**8.** *(d) O*

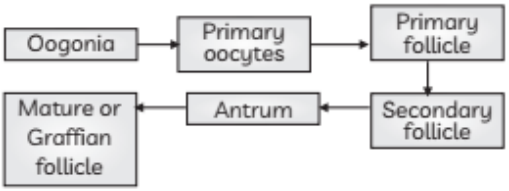
**Explanation:** The progeny of these parents can have blood group $I^AI^A$, $I^AI^B$, $I^Ai$, and $I^Bi$. The offspring can therefore have blood groups A, B, or AB. The only case that can be resolved solely on the basis of blood groups is the progeny with blood group O.

**9.** *(b) Primary consumer*

**Explanation:** The missing level of the organization is the primary consumer. These are the organisms that depend on primary producers for their energy requirements. For example cow, goat, deer, buffalo feeding on grass.

**10.** *(d) (A)-(ii), (B)-(iii), (C)-(i)*

**Explanation:** The following are the various steps that lead to the development of the mature follicle:




**11.** *(a) (I): Producers; (II): Chemical evolution*

**Explanation:** In the history of evolution on earth, chemical evolution is done after organics evolution. Evolution of primary producers in the Sea reference examines how photosynthesis evolved on Earth.

**12.** *(b) lysozyme*

**Explanation:** Lysozyme is used to digest the cell wall so that recombinant DNA can be easily pass through the bacterial cell wall.

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

**Explanation:** *Plasmodium vivax* is the cause of malaria. It has two hosts: the primary host, man, where the parasite maintains an amoeboid stage in RBCS and later produces gametophyte, and the vector of the plasmodium, female anopheles.

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

**Explanation:** Mendel selected pea plant (*Pisum sativum*) for his experiments because:

(ii) Many varieties were available with observable alternative forms for a trait or a characteristic.

(iii) Peas normally self-pollinate; as their corolla completely encloses the reproductive organs until pollination is complete.

(iv) It was easily available. It has pure lines for experimental purpose, i.e. they always breed *true*.

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

**Explanation:** From the megaspore's contents, the female gametophyte develops. But it consistently stays encased in the megaspore membrane. The mature female gametophyte is 7-celled (an egg, two synergids, three antipodals and a central cell).

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

**Explanation:** The bacterial cells must be trained to be able to absorb DNA. This is accomplished by giving them a specific calcium concentration, which improves the effciency with which DNA enters the cell through the cell wall pores. Then, by first incubating the cells with recombinant DNA on ice, followed by placing them at 42°C, and then putting them back on ice, recombinant DNA can be forced into such cells (heat shock treatment).

**Related Theory**

➥ *Recombinant DNA is directly injected into the animal cell's nucleus using micro-needles or micro-pipettes in the microinjection technique.*

*Plant cells can be bombarded with high-velocity micro-particles of gold or tungsten coated with DNA using the gene gun or biolistics technique.*

## SECTION - B

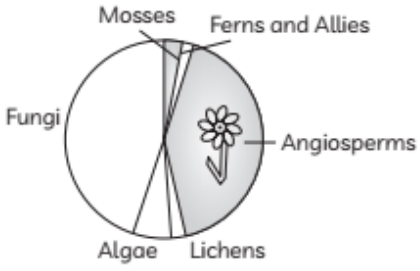
**17.** (A) *Trichoderma polysporum*

(B) Organ transplantation (Immunosuppressant)

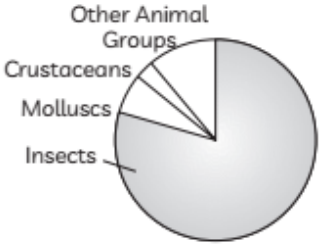
(C) Yeast

(D) Blood cholesterol-lowering agent

**18.**




**Plants**




**Invertebrates**

**19.** Given image represents copper releasing IUDs (CuT). The Intra Uterine Devices (IUDs) are currently available as hormone-releasing IUDs (Progestasert, LNG-20), copper releasing IUDs (Cu 7, Multiload 375), as well as non-medicated IUDs (such as Lippes loop). As a result of the $Cu^{2+}$ ions released and the increased phagocytosis of sperms within the uterus caused by IUDs, sperm motility and fertility are reduced.

**20.** Since the female partner's fallopian tube is blocked, in vitro fertilisation and embryo transfer (ET) will help her become pregnant. In this scenario, sperm from the male partner will be gathered and injected into the female partner's ovum to create a zygote in a lab under simulated conditions, and an embryo with more than 8 blastomeres will be transferred into the uterus (IUT - intrauterine transfer) to complete its further development.

**OR**

The importance of sex education in schools is as follows:

(1) to give the correct information regarding common myths and misconceptions.

(2) to increase public awareness of reproduction.

(3) to educate people about sexually transmitted diseases and the development of reproductive organs (STDs)

(4) educate the students on social vices like sexual assault, sex-related crimes, etc.

**21.** (A) (i) is enzymes and (ii) is DNA In comparison to enzyme molecules, the size of DNA molecules is larger. Proteins are enzymes. Genes, a small section of DNA, are used to make proteins.

(B) Human protein-enriched milk (2.4 grammes per litre) was produced by the transgenic cow Rosie.

## SECTION - C

**22.** Flocs are collections of bacteria linked to fungus filaments to create structures resembling meshes.

These microbes break down a large amount of organic matter, creating microbial biomass in the process and liberating a large amount of minerals.

In a sizable tank known as an anaerobic sludge digester, anaerobic microbes break down the sludge's aerobic and anaerobic microbes.

Methanogens are the producers of biogas. It provides energy and is flammable.

**23.** (A) It is expensive to produce hybrid seeds, but if desirable hybrids can be transformed into apomicts, there won't be any character segregation in the hybrid offspring. The farmer doesn't have to buy new seeds each year if they want to keep using hybrid seeds.

(B) Only a small percentage of flowering plants, including some Asteraceae species and grasses, have developed a unique mechanism to produce seeds without fertilisation. We refer to this as apomixis. Asexual reproduction is what apomixis is, then.

(C) Several of the nucellar cells surrounding the embryo sac in many citrus varieties begin to divide, protrude into the embryo sac, and eventually develop into embryos. Each ovule in these species houses numerous embryos. Polyembryony is the term for when a seed contains multiple embryos.

**24.** Production of biological products:

(1) Medicines required for treating human diseases are obtained by genetic engineering.

(2) $\alpha$-1-antitrypsin used to treat emphysema.

(3) Transgenic cow 'Rosie' produces human-protein enriched milk.

Chemical safety (Toxicity/safety testing): Transgenic animals are made that carry genes that make these more sensitive toxic substances than non-transgenic animals.

**25.** (A) As a result of changes in the frequency of alleles in a population brought on by disturbances in Hardy-Weinberg equilibrium or genetic equilibrium, evolution occurs.

(B) The impact of human behaviour on organic evolution are:

(1) Artificial or selective breeding programmes used to create new breeds.

(2) Rapid selection of resistant varieties has been facilitated by excessive use of pesticides, herbicides, etc. and the selection of bacteria with drug resistance.

(3) The persistence of dark-winged (melanized) moths in England after industrialization.

**26.** (A) They both qualify as biotechnologists, to be sure. A yeast strain is used in wine makers to ferment grape juice to make wine. A cloned gene is used by the molecular biologist as the antigen. Utilizing the antigen as a vaccine. Antigen can form in significant amounts thanks to this. Both use living things to produce goods and services that benefit people.

(B) (1) Supplying the best catalyst in the form of a better organism, typically a microbe or pure enzyme.

(2) Engineering the best conditions for a catalyst to function

(3) Purifying the protein or organic compound using downstream processing techniques.

**OR**

(A) The two main methods that made modern biotechnology possible are as follows:

(1) The chemistry of genetic material (DNA and RNA) can be changed using genetic engineering techniques, which can then be introduced into hosts to change the phenotype of the host organism.

(2) In chemical engineering processes, maintaining sterile (microbial contamination-free) environments allows for the large-scale growth of only the desired microbe/eukaryotic cell for the production of biotechnological products like antibiotics, vaccines, enzymes, etc.

(B) (1) They are able to produce proteins with medicinal value.

(2) They have the capacity to create enhanced, altered, or novel metabolites.

**27.** (A) Migration is the act of people moving from one location to another. Either a different group or a specific population may accept the individuals. When people transfer to another population, some alleles that provide better adaptations may be lost. Movement into a population may introduce specific alleles that distort the results of selection. Therefore, we might conclude that migration can alter the results of selection.

(B) The factors are:

(1) Changes in chromosome number and the structure.

(2) Gene mutations.

(3) Reproductive isolation

(4) Genetic recombination

(5) Natural selection

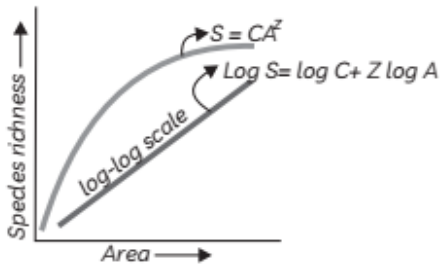
**28.** (A) German naturalist and geographer Alexander von Humboldt. He observed that within a region species richness increased with increasing explored area, but only up to a limit. In fact, the relation between species richness and area for a wide variety of taxa (angiosperm plants, birds, bats, freshwater fishes) turns out to be a rectangular hyperbola.

(B) (i) When the value of Z is between 0.1 and 0.2 the slope of regression is similar when unaffected distribution in an area is analysed.

(ii) When the value of Z is between 0.6 and 1.2 the slope of regression is steeper when we analyse the species area relationship among very large areas like entire continent. Z stands for the regression coefficient. icient.

(C) The slope will become steeper when species richness increases.

**Related Theory**




*On a logarithmic scale, the relationship is a straight line described by the equation*

$$\log S = \log C + Z \log A$$

*where*
*S = Species richness, A = Area, Z = slope of the line (regression coefficient), C = Y-intercept.*

## SECTION - D

**29.** (A) Mendel's law of independent assortment: Although Praksha has only used monohybrid cross, or one pair of traits, this law can also be derived from dihybrid crosses.

(B) **Dominant character:** The heterozygous person does not experience the effects of the other factor or allele because it is a recessive trait.

(C) Test cross: Instead of self-crossing, a test cross is made between an organism (in this case, a pea plant) exhibiting a dominant phenotype whose genotype needs to be determined and the recessive parent. It is simple to analyse the offspring of such a cross and determine the genotype of the test organism. For a monohybrid cross, the normal test cross ratio is 1, and for a dihybrid cross, it is 1:1:1:1.

**OR**

(C) Recessive factor or allele refers to the component of an allelic or allelomorphic pair that is unable to express its effect in the presence of its contrasting component in a heterozygote, such as the allele in the hybrid tall pea plant Tt. Only when a recessive factor is pure or homozygous, as in the case of the tt gene in dwarf pea plants, is its effect known.

**30.** (A) External factors that restrict production, such as shadiness, drought, nutrient scarcity, or extremely low temperatures, cause environmental stress.

(B) In areas with high stress and high disturbance, plant growth is slow. High levels of stress and disturbance cannot help plants reproduce.

(C) 'X' type of plants are competitors that thrive in low stress and low disturbance environments and have strong competitive ability at high population densities close to the carrying capacity. Such plants grow slowly and are common in non-seasonal tropical regions with little chance of drastic environmental changes.

**OR**

'X' type of plants are likely to be trees. 'Y' type of plants could be desert plants. 'Z' type of plants could be herbaceous plant.

## SECTION - E

**31.** (A) After entering the host's body, the virus enters macrophages where, with the aid of the enzyme reverse transcriptase, its RNA genome replicates to produce viral DNA. This viral DNA is incorporated into the DNA of the host cell, instructing it to produce virus particles. In this way, the macrophages function like an HIV factory as they continue to produce virus.

(B) Viral DNA incorporates in to the host genome during step Z.

(C) The person experiences episodes of fever, diarrhoea, and weight loss during this time. The person begins to develop infections that could have been treated otherwise, including those caused by viruses, fungi, bacteria, notably *Mycobacterium*, and even parasites like *Toxoplasma*, as a result of a decrease in the number of helper T lymphocytes.

(D) The patient is diagnosed with human immunodeficiency virus (HIV) if his immune system is found to be suppressed. Helper T cells allow the HIV virus to replicate and produce offspring viruses.

**OR**

(A) Lymph nodes are small, solid structures that are positioned along the lymphatic system at various locations. It serves to capture antigen that accidentally enters lymph and tissue fluid. The activation of lymphocytes is caused by antigen trapped in lymph nodes.

Thymus is situated close to the heart beneath the collar bone. It offers a micro-environment for the T-lymphocytes' growth and maturation.

(B) It is a primary lymphoid organ where immature lymphocytes differentiate into antigen-sensitive lymphocytes.

(C) It is a secondary lymphoid organ that serves as the site of lymphocyte-antigen interaction before effector cells are produced.

(D) **Spleen:** It is a large organ with a bean-like shape and primarily contains lymphocytes and phagocytes. By capturing blood-bound microorganisms, it serves as a filter for blood.

**32.** (A) Spermatogenesis, which starts at puberty, is a process by which the immature male germ cells (spermatogonia) *i.e.* structure labelled as 'X' in the testis produce sperms.

(B) Periodically, meiosis occurs in a subset of spermatogonia called primary spermatocytes. A primary spermatocyte (structure 'Y') completes the first meiotic division (reduction division), which produces secondary spermatocytes (structure 'Z'), which are two identical, haploid cells with only 23 chromosomes each.

(C) To create four identical, haploid spermatids, the secondary spermatocytes (structure 'Z') go through a second meiotic division. Spermiogenesis is the process by which the spermatids develop into spermatozoa (sperms).

(D) After spermiogenesis, sperm heads become embedded in Sertoli cells (structure 'Q') and undergo a process known as spermiation in which they are eventually freed from the seminiferous tubules.

**OR**

(A) (i) Blastocyst (Blastula).

(ii) Inner cell mass gets differentiated as embryo after implantation.

(iii) Stem cells are located in the inner cell mass.

(iv) 'a' is trophoblast: The blastocyst's trophoblast serves as its outer layer. Thus, their primary function is to nourish the growing embryo. They also aid in the implantation of the embryo.

(B) During gametogenesis, the number of chromosomes is cut in half or to (n). During fertilisation, the number of chromosomes is restored to the diploid (2n) stage.

**33.** (A) For extremely long DNA molecules, replication takes place in a small opening of a DNA helix called a replication fork. The two strands of DNA cannot be completely separated along the length of long DNA molecules because doing so would require an enormous amount of energy.

(B) DNA-dependent DNA polymerase only catalyses DNA polymerization in the 5' → 3' direction. The polarity and anti-parallel orientation of DNA strands are the opposite. Thus, DNA replication is continuous on the template strand with polarity 3' → 5' while it is discontinuous on the template strand with polarity 5' → 3'.

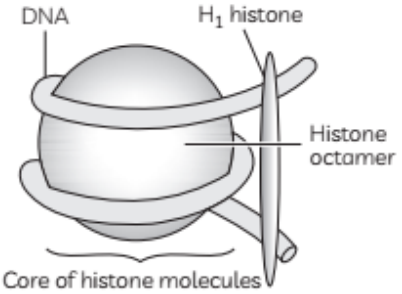
(C) All plant viruses and some animal viruses have RNA as their genetic makeup.

**OR**

(A) P-Promoter

Q-Coding strand

(B) Nucleosome




(C) DNA is not scattered in prokaryotes, such as bacteria, which lack a nucleus. In a region known as a nucleoid, negatively charged DNA binds with positively charged proteins.

(D) Chromosomes (DNA) that have undergone replication would not be distributed to daughter nuclei if cell division was not carried out afterward. The accumulation of DNA inside the cell is the result of repeated DNA replication without cell division. The cell would expand as a result of the nucleus' volume being increased. Additionally, it will cause polyploidy.