Sample Paper 8

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.

SECTION - A

16 Marks

1. ...A... enzyme is used to remove clots from the blood vessels of patients who have undergone ...B... leading to heart attack.

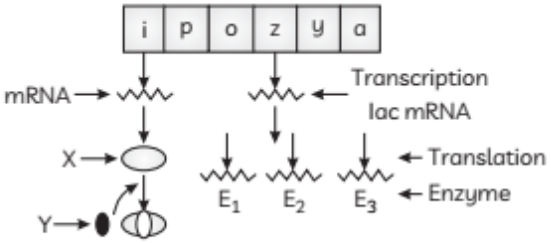
(a) A-Streptokinase; B-Myocardial infarction

(b) A-Lipases; B-Arteriosclerosis

(c) A-Proteases; B-Myocardial infarction

(d) A-Pectinases; B-Atherosclerosis 1

2. Identify components and enzymes for the given figure



(a) X- Repressor protein, Y- Inducer (lactose), E_1-Permease, E_2-Transacetylase, E_3-galactosidase.

(b) X-Repressor protein, Y-Inducer (lactose), E_1-galactosidase, E_2-Transacetylase, E_3-Permease.

(c) X- Inducer (lactose), Y- Repressor protein, E_1-galactosidase, E_2-Permease, E_3-Transacetylase.

(d) X- Repressor protein, Y- Inducer (lactose), E_1-galactosidase, E_2-Permease, E_3-Transacetylase. 1

3. Which will be able to cope with global warming?

(a) Birds (b) Mammals

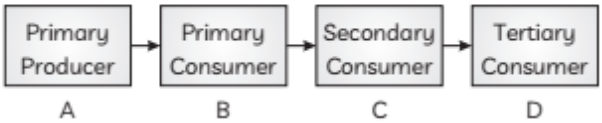
(c) Amphibians (d) Fishes 1

4. A tough tissue layer that covers the egg and prevents it from desiccation and pathogen infection. However, the same tissue also shields the egg and sperm nuclei from one another. However, sperm is known to release enzymes that break down this resilient sheet. Which sperm component is it?

(a) Acrosome (b) Tail

(c) Mitochondria (d) Sperm nuclei 1

5. The trophic level occupied by fishes, zooplankton, man and trees are respectively:



(a) B, A, D, C (b) C, D, B, A

(c) C, B, D, A (d) C, B, A, D 1

6. Rahul observed a plant in his garden. He hypothesized that the stem height exhibited incomplete dominance. To check for his, he created true-breeding lines of tall and short plants. He then crossed these and sampled 1000 progeny. Which of the following cases, matches his hypothesis?

(a) 500 tall plants, 250 intermediate plants, and 250 small plants

(b) 250 tall plants, 500 intermediate plants, and 250 small plants

(c) 250 tall plants, 250 intermediate plants, and 500 small plants

(d) 125 tall plants, 750 intermediate plants, and 125 small plants 1

7. Match the columns:

Column-I	Column-II
(A)Leaching	(i) Break down of detritus into smaller particle.
(B) Fragmentation	(ii) Precipitation of water soluble nutrients as unavailable salt Jes.
(C) Catabolism	(iii) Degradation of detritus by bacterial and fungal enzymes.

(a) (A)–(ii), (B)–(i), (C)–(iii)

(b) (A)–(ii), (B)–(iii), (C)–(i)

(c) (A)–(iii), (B)–(ii), (C)–(i)

(d) (A)–(iii), (B)–(i), (C)–(ii) 1

8. Identify the correct option:

	Conformers	Regulators
(a)	Less active	More active
(b)	Homeostatis is very little	Possess homeostatis
(c)	Can maintain their body temperature	Changes according to environment
(d)	Consume less amount of energyr	Consume more amount of energy

1

9. How is nascent oxygen toxic to aerobic living organisms?

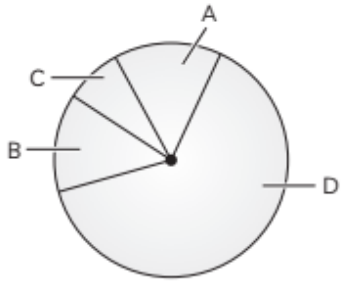
(a) Cause mutation in DNA

(b) Can degrade proteins

(c) Can degrade enzymes

(d) All of these 1

10. The pie chart shows for the number of species of major taxa of invertebrate:



Identify A, B, C and D in this figure.

(a)	(b)	(c)	(d)
A-Insects B-Crustaceans C-Molluscs D-Other animal groups	A-Other animal groups B-Molluscs C-Crustaceans D-Insects	A-Molluscs B-Insects C-Other animal groups D-Crustaceans	A-Insects B-Molluscs C-Crustaceans D-Other animal groups

1

11. Identify the mendelian disorders.

(a) Down's Syndrome

(b) Albinism

(c) Turner's Syndrome

(d) Klinefelter's Syndrome 1

12. Which of the following is not the source of variation?

(a) Recombination

(b) Genetic drift

(c) Migration

(d) Adaptations 1

Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

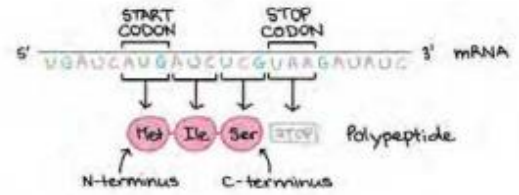
(a) Both A and R are true and R is the correct explanation of A.

(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. Depending on where the reading begins, the genetic code can be interpreted in a variety of ways. For instance, reading could begin with the letter G in the base sequence GGGAAACCC, and there would be three codons: GGG, AAA, and CCC. The string will contain the codons GGA and AAC if reading begins at G in the second position.



Assertion (A): UAA, UAG and UGA terminate protein synthesis.

Reason (R): They are not recognised by RNA. 1

14. Assertion (A): PCR, ELISA, DNA hybridisation are confirmatory tests for sexually transmitted diseases.

Reason (R): Incidence of STDs are very high in persons above the age of 30. 1

15. Assertion (A): Interferons are natural proteins produced by the cells of the immune systems of most animals in response to challenges by foreign agents.

Reason (R): Interferons stimulate inflammation at the site of injury. 1

16. Assertion (A): A woman can go to the court if a man refuses to own his child. He has blood group B and women has A, while child has O.

Reason (R): Genetically she is right, he can be father of the child. 1

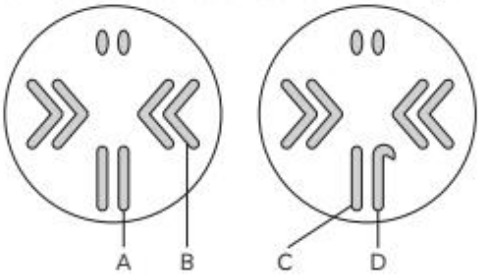
SECTION - B

10 Marks

17. Biotechnology is a field of engineering that makes use of biological systems, living organisms, or fragments thereof, to develop or produce various goods.Processes that fall under the category of biotechnology include brewing and baking bread.

List two critical research areas of biotechnology. 2

18. The diagram refers to the chromosome complement of each sex of a fruit fly.

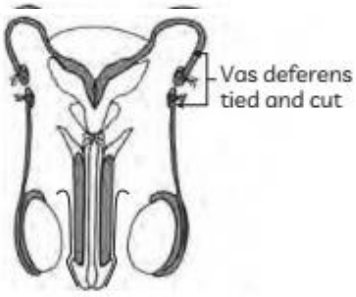


Identify the unlabelled parts. 2

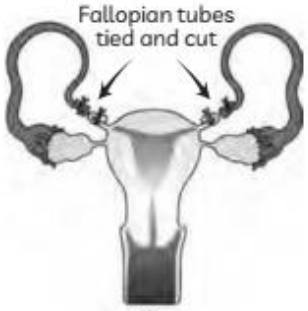
19. Give one reason why a mother's breastfeeding of her child acts as a natural form of contraception.

OR

Choose and write the appropriate device from the list below in the table:



(i)



(ii)

(iii)

(iv)

(v)

Method of Birth Control	Device
Barrier	
IUD	
Surgical technique	
Administering hormones	

2

20. Which of the two cloning vectors, bacteriophages or plasmids, will be selected by biotechnologists? Justify with reason. 2

21. What is a food chain? List the types of food chains. 2

SECTION - C

21 Marks

22. Natural selection is directional because it occurs in the context of adaptation, whereas creation and the presence of variation are directionless. Comment. 3

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

24. Describe a gene library.

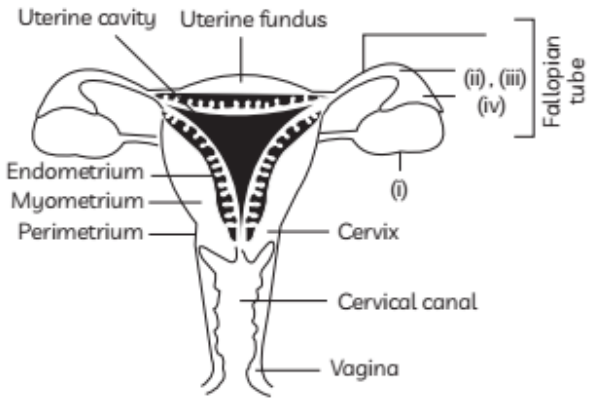
OR

Why are probes seen to be superior to other types of diagnostic equipment for diagnosing diseases? 3

25. In a Dihybrid cross 556 seeds were collected in F_2 generation. Count them shape wise and colour wise as round yellow, round green, wrinkled yellow, wrinkled green seeds separately and write their numbers. Also explain your answer. 3

26. Sometimes the presence of foreign species causes native species to become extinct. Provide any two examples that will support this claim. 3

27.



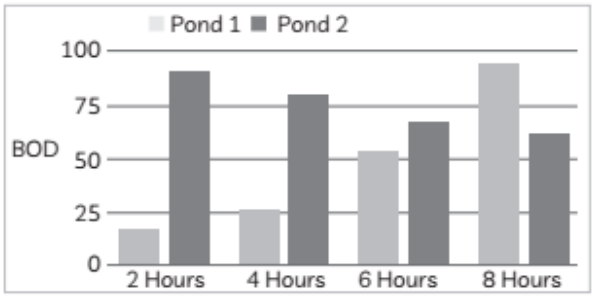
The above diagram shows a part of the human female reproductive system.

(A) Identify (i), (ii), (iii), (iv).

(B) What is the other name for the fallopian tube?

(C) Where will you find the fimbriae? What is its function? 3

28.



Answer the following:

(A) Which pond among the two mentioned in the above graph might have a greater amount of organic matter?

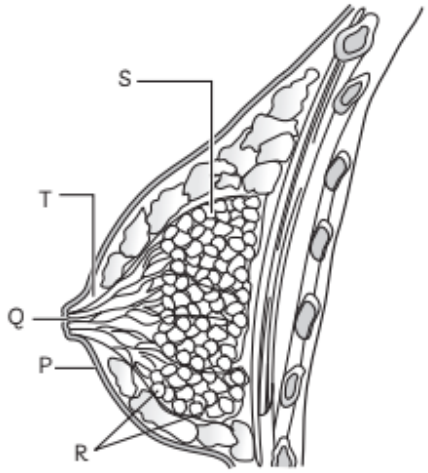
(B) Describe the process of primary and secondary treatment of sewage. 3

SECTION - D

8 Marks

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

29. *A functional mammary gland is characteristic of all female mammals. Mammary glands are paired structures that contain glandular tissue and variable amount of fat. Refer to the given figure of a mammary gland and answer the following questions.*



(A) Identify part labelled as 'T' and 'R' 1

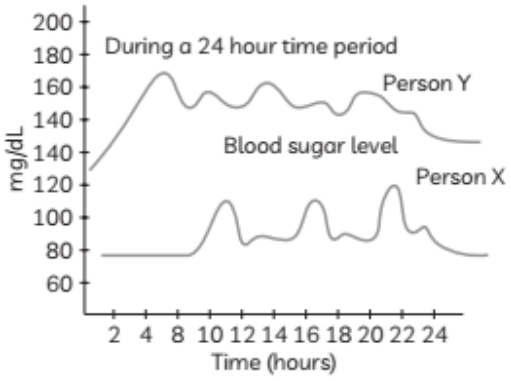
(B) Identify part labelled as 'P' and 'S' 1

(C) Why is nursing advised during the early stages of an infant's development?

OR

(C) How are mammary ampullae formed? What is areola? 2

30. *The given graphs show fluctuations in blood sugar of person X and Y during a 24 hour time period.*



Based on the above information, answer the following questions.

(A) Person Y is suffering from which disease? 1

(B) What causes weakness in person Y? 1

(C) What do you understand about person X from the above graph?

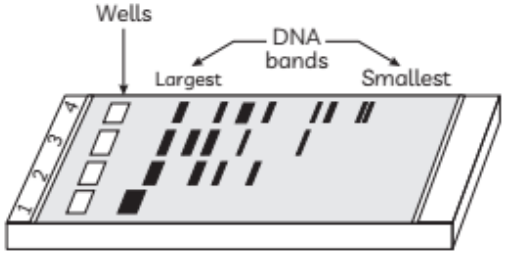
OR

What is the difference between the disease in person Y and type II diabetes? 2

SECTION - E

15 Marks

31. (A) Molecular marker genotyping with gel electrophoresis is frequently used in plant breeding and genomics, but there are many other applications as well. For instance, the polymerase chain reaction (PCR) is used to amplify specific DNA fragments that are used as markers and isolated from individual plants. The amplified DNA fragments are then loaded onto a gel. Describe the theory that underlies the separation of DNA fragments during the following process.



(B) How and why does recombinant DNA technology use the bacterium *Thermus aquaticus*? Explain.

(C) Identify the benefits of Taq polymerase and its origin.

OR

(A) Define recombinant proteins. How do bioreactors assist in their manufacture?

(B) By joining a gene to a plasmid vector, you have produced a recombinant DNA molecule. Your friend accidentally adds an exonuclease enzyme to the tube that contains the recombinant DNA. How would your experiment be impacted if you proceed with the shift right away?

(C) Why and how do bioreactors sustain a continuous culture system? 5

32. The female gametophyte's embryo sac is a structure with seven cells and eight nuclei. Justify the statement using a labelled diagram.

OR

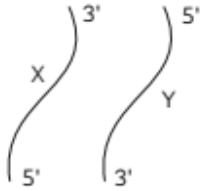
(A) Can pollen from a flowering plant in Pune pollinate a plant in Noida that is of the same species? Give details to support your response.

(B) Create a diagram of a successful pollination-affected pistil. Label the components necessary to deliver the male gametes to their final location. 5

33. (A) Why is it impossible for an alien DNA to join a chromosome anywhere along

its length and carry out regular replication?

(B) A structural gene has two DNA strands X and Y shown along side.



Identify the template strand.

(C) Describe the function of the DNA ligase enzyme in DNA replication.

(D) In a typical nucleus, some chromatin areas are stained lightly while others are stained darkly. What does it mean and why is it that way?

OR

(A) Explain where and how each of the following components fits into a transcription unit using a schematic diagram: structural gene, promoter, and terminator.

(B) How would the lac operon function if *E. coli* were to grow in a culture medium containing lactose as a source of sugar?

(C) Where and how do peptide bonds arise in a bacterial ribosome? 5

SOLUTION

SECTION - A

1. *(a) A-Streptokinase; B-Myocardial infarction*

Explanation: An enzyme and thrombolytic drug is streptokinase. In some cases of myocardial infarction (heart attack) it is used as a medicine to dissolve clots.

2. *(d) X-Repressor protein, Y-Inducer (lactose), E_1-galactosidase, E_2-Permease, E_3- Transacetylase*

Explanation: 'X' is a repressor that binds to the inducer region in the absence of lactose; in the presence of lactose(Y), the inducer protein binds to the repressor. The lactose operon gene in *E. coli* is a polycistronic gene.

Lactose is converted to glucose and galactose by the enzyme E_1, a galactosidase.

A transporter protein called E_2-permease moves lactose from the media into the cell.

E_3 is a transacetylase that converts acetyl CoA into galactosides.

3. *(a) Birds*

Explanation: Birds will be able to cope with global warming because they are homeotherms as their body temperature remains constant irrespective to change in surroundings.

4. *(a) Acrosome*

Explanation: An acrosome is a cap-like structure that can be seen on the sperm head's anterior-most end. It contains many enzymes, including hyaluronic acid, which are released when an egg comes into contact with the female oviduct. These enzymes work by breaking down the membrane, allowing the head to pass through and the subsequent release of male nuclei.

5. *(c) C, B, D, A*

Explanation: An ecosystem contains a wide range of creatures. According to the trophic levels, the creatures in the environment should be in the following order:

Fishes- C (Secondary consumer)

Zooplanktons- B (Primary consumer)

Man- D (Tertiary consumer)

Trees- A (Primary producer)

6. *(b) 250 tall plants, 500 intermediate plants, and 250 small plants*

Explanation: The phenotypic ratio of the progeny that exhibits incomplete dominance is 1:2:1. Therefore, of 1000 plants sampled from the progeny, 250 should be tall, 250 should be small, and 500 intermediate plants if incomplete dominance holds.

7. *(a) (A)–(ii), (B)–(i), (C)–(iii)*

Explanation: The process that breaks down trash into smaller particles is known as fragmentation. It is mostly caused by the behaviour of invertebrates that feed on detritus (detritivores, e.g., termites, earthworms, etc.). As it moves through an animal's digestive system, the debris is crushed. Detritus particles' surface area has significantly expanded as a result of fragmentation.

Catabolism, or the enzymatic conversion of the disintegrating debris into simpler and inorganic compounds, is carried out by the extracellular enzymes secreted by bacteria and fungi.

Leaching is the procedure by which dissolved nutrients are transferred to lower soil or groundwater layers to create inaccessible salts.

8. *(c) Conformers: Can maintain their body temperature; Regulators: Changes according to environment*

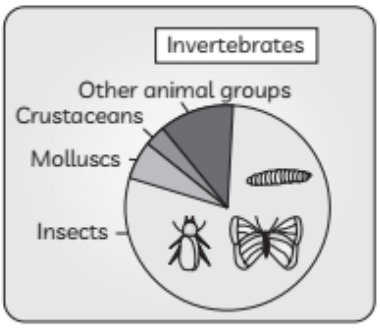
Explanation: Regulators can maintain their body temperature according to surrounding environment and conformer's changes according to environment.

9. *(d) All of these*

Explanation: All types of biomolecules, including DNA, proteins, and enzymes, that are present in living things can undergo reactions due to nascent oxygen's high reactivity. It is hazardous to aerobic life forms because it can alter DNA and breakdown proteins and enzymes through reactions.

10. *(b) A-Other animal groups, B-Molluscs, C-Crustaceans, D-Insects*

Explanation: The pie chart shows the global biodiversity of invertebrates.



From that, it is observed that A represents Other animal groups, B represents Molluscs, C represents Crustaceans, and D represents Insects.

11. *(b) Albinism*

Explanation: Albinism is the mendelian disorders while rest are chromosomal disorders.

12. *(d) Adaptations*

Explanation: There can be various sources of variations like recombination, genetic drift, gene flow etc. But adaptation is another phenomena, it is not related to variation.

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

Explanation: Synthesis of polypeptide terminates when a nonsense codon of mRNA reaches the A site. lac mRNA There are three nonsense codons UAA, UAG and UGA. These codons are not recognised by any of the the tRNAs. Therefore, no more aminoacyltRNA reaches the A-site. The P- site tRNA is hydrolysed and the completed polypeptide is released in the presence of release factor. Thus termination occurs.

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

Explanation: STDs are a major threat to healthy society. Incidence of STDs is very high in persons who are 15-24 years of age.

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

Explanation: Interferons are natural proteins produced by the cells of the immune systems of most animals in response to challenges by foreign agents such as viruses, bacteria, parasites and tumor cells. They stimulate both macrophages and NK (Natural Killer) cells. smack is more powerful analgesic than morphine. They both are also active against tumors. Interferon gamma is involved in the regulation of the immune and inflammatory response.

Related Theory

- *Interferons belong to the large class of glycoproteins known as cytokines. In human body there are three types of interferon-α, β and γ. Interferon alpha and beta are produced by many cell types, including T-cells and B-cells and are important components of the antiviral response.*

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

Explanation: The B blood type male has the genotype I^Bi.

The blood type A female carries the genotype I^Ai.

The kid has genotype ii, which causes the blood type O to induce.

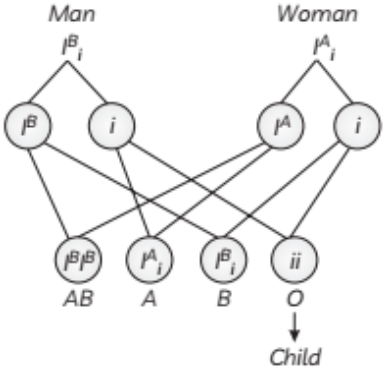
This shows that since both parents are heterozygous for their respective blood groups, the woman and the man can have a child with blood group O.

Related Theory

- *The ABO blood group in human blood involves two antigens and two antibodies which are antigen A and antigen B, antibody A and antibody B respectively. Thus we can classify human blood into 4 groups:*
  - *(1) Antigen A with antibody B*
  - *(2) Antigen B with antibody A*
  - *(3) Antigen AB with no antibodies*
  - *(4) Antigen nil with antibody A and B.*

⚠ Caution

➥ *Students usually make mistakes whiile choosing the correct option. According to the figure given below, the man might be the child's father in this situation. As a result, if he declines to take the child, the lady has the right to file a lawsuit. However, it doesn't provide conclusive evidence that he is the child's father.*



SECTION - B

17. Two critical research areas of biotechnology are:

(1) Providing the best catalyst in the form of an improved organism usually a microbe or pure enzyme.

(2) Creating optimal conditions through engineering for a catalyst to act.

18. One pair of sex chromosomes are present in *Drosophila*. In *Drosophila*, gender determination is homogametic for females and heterogametic for males, much like in humans. The female *Drosophila* is represented by the first figure, and the male *Drosophila* is represented by second figure.

X-chromosomes are indicated by 'A' in female *Drosophila*. 'B' denotes Autosome.

In male *Drosophila*, 'C' denotes X-chromosomes. 'D' denotes a male *Drosophila's* Y chromosome.

19. Lactation or by interfering with the hormone prolactin, breastfeeding the baby delays the onset or return of the menstrual cycle and the ovulation cycle. As a result, during this time—up to six months—there is no chance of conception. Therefore, breastfeeding the child may serve as a natural form of contraception for the mother (lactational amenorrhea).

OR

Method of Birth Control	Device
Barrier	(iii)
IUD	(iv)
Surgical Technique	(i), (ii)
Hormonal administrations	(v)

20. Because they have many copies of their genome within the bacterial cells, bacteriophages are preferred by biotechnologists for cloning over plasmids. Some plasmids may only have one or two copies per cell, while others may have 15–100 copies. Plasmids are less effective than phage vectors for cloning substantial DNA segments.

21. **Food Chain:** A nutritive interaction among biotic communities (organisms) involving a producer, various levels of consumers, and a decomposer forms a food chain. Each step in a food chain is called a trophic level. Kinds of the food chain. There are 3 kinds of food chains: predator, parasitic and saprophytic chains.

SECTION - C

22. Because variation occurs spontaneously and randomly, it is regarded as having no direction. It can be observed in organisms that reproduce sexually and results from gamete fusion or crossing over during meiosis. Generations after generation inherit the variations that aid humans in adjusting to their surroundings. Because it only leads down one road, i.e., selection, natural selection is directional. The survival of the fittest and the eradication of the unfit is the result of an evolutionary transformation.

23. In the process of treating sewage, flocs consume a significant portion of organic waste, turning it into microbial biomass and liberating a large amount of minerals.

While many anaerobic bacteria are present in anaerobic sludge digesters and break down the organic content, it lowers the BOD of sewage. Methane, CO_2, and other gases are created during this digestion.

24. **Gene Library:** The phrase "gene library" refers to the collection of several cell clones that reflect nearly all of an organism's genes and each contain one or a few foreign genes. Finding a clone with the desired gene can be done using that gene library.

The genome of an organism must first be divided into smaller DNA fragments containing one or a few genes. These fragments can then be cloned in a cell, resulting in a group of cells with identical foreign DNA, which are referred to as clones.

OR

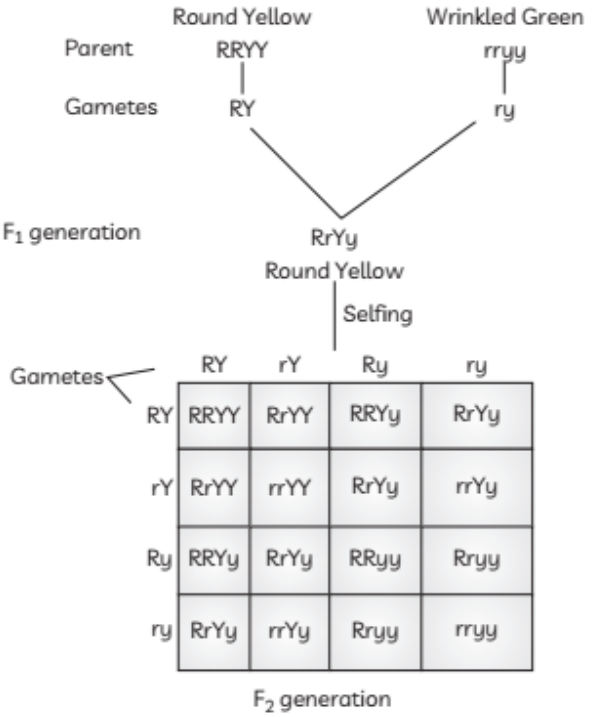
Probes superior than other types of diagnostic equipment due to the following reasons:

(1) They are a lot easier, quite focused, and relatively quick.

(2) They are incredibly effective, especially when used in conjunction with PCR; even the smallest amount of the test sample's constituent molecules can be recognised.

(3) The risk of accidental infection of laboratory staff is eliminated because the culture of microbes is not necessary.

25.



F_2 generation

In F_2 generation mendel obtained plants in the phenotypic ratio:

Round yellow	Round green	Wrinkled yellow	Wrinkled green
9/16	3/16	3/16	1/16

The number of plants with Round yellow seeds = (9/16)×556 = 312.75 or 312

The number of plants with Round green seeds = (3/16)×556 = 104.25 or 104

The number of plants with wrinkled yellow seeds = (3/16)×556 = 104.25 or 104

The number of plants with wrinkled green seeds = (1/16)×556 = 34.75 or 34

26. Indigenous species are driven to extinction as a result of invasion by alien species, which also threaten native species.

(1) More than 200 species of cichlid fish in Lake Victoria go extinct as a result of the introduction of Nile perch.

(2) Introduced plants like *Lantana* and carrot grass (*Parthenium*) have become invasive and harmed the ecology. They endanger the indigenous plant species that live in our woodlands.

27. (A) (i) Ovary, (ii) Isthmus, (iii) Ampulla, (iv) Infundibulum.

(B) Oviduct.

(C) Fimbriae are present at the edges of the Infundibulum. They help in collection of ovum after ovulation.

28. (A) Pond 1, as the biological oxygen demand is increasing with time. Greater the BOD, greater will be the amount of organic matter.

(B) **Primary treatment:** It basically involves physical removal of particles from the sewage through filtration and sedimentation. These are removed in stages; initially, floating debris is removed by sequential filtration. Then the grit are removed by sedimentation. All solids that settle form the primary sludge, and the supernatant forms the effluent.

Secondary treatment: The primary effluent is passed into large aeration tanks where it is constantly agitated and air is pumped into it allowing vigorous growth of useful aerobic microbes into flocs. Here, other kinds of anaerobic bacteria, digest the bacteria and the fungi in the sludge. The effluent from the secondary treatment plant is generally released into natural water bodies.

SECTION - D

29. (A) 'T' is mammary ampulla and 'R' is mammary alveoli.

(B) 'P' is areola and 'S' is mammary duct.

(C) Female mammary glands begin generating milk around the end of pregnancy through the lactation process, aiding the mother in feeding the baby. The milk produced in the first few days is called colostrum. Colostrum contains antibodies that are essential for helping babies establish resistance, thus doctors advise expecting parents to have a healthy baby.

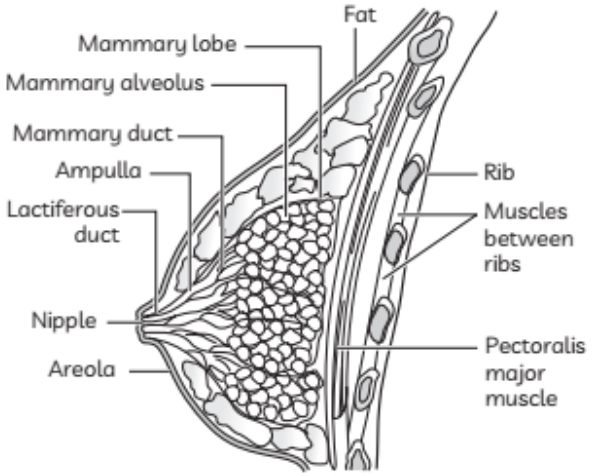
OR

Near the nipple, mammary ducts expand to form mammary ampullae where some milk may be stored before going to lactiferous ducts.

Areola is the fibrous (connective) tissue that supports the alveoli and the ducts.

⚠ Caution

➥ *Students usually get confused with the labellings and write wrong answers. The following figure shows the labelled structure of human female breast:*



30. (A) Elevated blood sugar levels in person Y indicate that he is suffering from diabetes mellitus.

(B) Excretion of glucose in urine and excessive urination caused weakness in person Y.

(C) Blood sugar level fluctuations in person X indicate that sugar level never exceeds the normal limit and suffcient s ecretion of insulin at required times removes any extra sugar from blood and converts it into glycogen for future use. This implies that person X is normal and healthy.

OR

Type I diabetes (disease in person 'y') or insulin dependent diabetes mellitus or juvenile diabetes is an autoimmune disorder caused by failure of beta cells to produce adequate amounts of insulin. Type II diabetes or non insulin dependent diabetes mellitus involves failure of insulin to facilitate the movement of glucose into body the cells.

SECTION - E

31. (A) Get electrophoresis is a method of moving molecules like DNA, RNA, and protein in the direction of an electrode with the opposite charge based on their size while being influenced by an electric field. Molecules with positive charges travel in the direction of the cathode (-ve electrode), and vice versa. These molecules can be divided based on their size and pass through a medium or matrix.

(B) *Thermus aquaticus* bacteria is used in recombinant DNA technology because it contains thermostable DNA polymerase (Taq Polymerase), which keeps working even when a PCR step is denaturized by high temperatures.

When a gene is amplified via PCR, this enzyme is used (Polymerase Chain Reaction). For additional cloning, the amplified region can be ligated to a vector.

(C) Thermostable bacteria, specifically *Thermus aquaticus*, are used to make Taq Polymerase. It is employed for DNA denaturation during PCR and stays active at higher temperatures.

OR

(A) Recombinant proteins are created whenever a gene encoding a protein is produced in a heterologous host. Large-scale recombinant protein manufacturing is facilitated by bioreactors. The ideal circumstances for producing the necessary recombinant protein via biological processes are offered by a bioreactor.

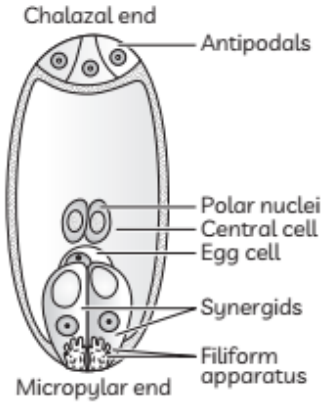
(B) Since the recombinant DNA molecule is circular and closed with no free ends, the experiment is not likely to be impacted. As a result, it won't serve as a substrate for the exonuclease enzyme, which cuts nucleotides from DNA's free ends.

(C) The used medium is drained out of one side of the bioreactor and the fresh medium is introduced from that side in order to maintain a continuous culture system. This kind of cultivating technique generates more biomass, which increases yields of the desired product.

32. The egg apparatus is made up of three cells that are typically grouped together at the micropylar end of an embryo sac. The egg apparatus itself is made up of one egg cell and two synergids.

At the chalazal end, three cells are cast as antipodals. There are two polar nuclei in the large central cell.

A typical angiosperm embryo sac has seven cells and eight nuclei when it is mature.

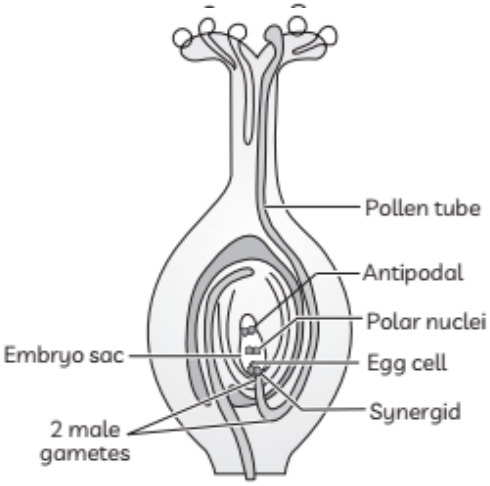


OR

(A) Yes, it is possible through artificial hybridization, which involves introducing pollen grains from one flower artificially onto the stigma of another flower. Nevertheless, self-incompatibility is not acceptable.

To protect the stigma from tampering, it's crucial to use only the desired pollen grains when pollinating (from unwanted pollen). Emasculation and bagging techniques are used to achieve this.

(B)



33. (A) Because there is no origin of replication, where the replication process is started, alien DNA cannot join a chromosome anywhere along its length and replicate correctly.

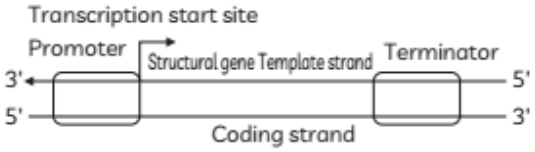
(B) 'X' is template strand. It is because the template strand has the polarity in 3' → 5' direction.

(C) By catalysing the creation of phosphodiester bonds, DNA ligase makes it easier for Okazaki fragments in lagging DNA strands to be joined together. Additionally, it aids in the restoration of duplex DNA single-strand breaks.

(D) In a normal nucleus, some chromatin regions are stained light because of loose packing, whereas other chromatin regions are stained dark because of dense packing. While heterochromatin (darkly stained) is transcriptionally inactive, euchromatin (lightly stained) is transcriptionally active chromatin.

OR

(A) Structure of a transcription unit:



The structural gene is flanked by the promoter and terminator in a transcription unit. The promoter aids in the initiation of transcription by interacting with RNA polymerase and is situated at the 5'end (upstream) of the structural gene. The terminator, which is situated near the 3'end (downstream) of the coding strand, often indicates the conclusion of the transcription process. Between the promoter and the terminator is the structural gene. For structural purposes, it codes for an enzyme or protein.

(B) In a medium containing *E. coli*, lactose acts as a substrate for the enzyme β-galactosidase, which activates the operon. As a result, it is also known as an inducer. By attaching to the repressor, it deactivates it and grants the RNA polymerase access to the promoter.

(C) The amino group ($-NH_2$) of the amino acid at the A-site and the carboxyl group (-COOH) at the P-site combine to create a peptide bond. A bacterial ribosome's peptidyltransferase enzyme creates it.