

KCET 2023 Biology Solution Set B4

Ques 1. The Lac-Operon model was elucidated by

- (A) Jacob and Crick**
- (C) Francois Jacob and Jaques Monad**
- (B) Watson and Crick**
- (D) Hershey and Chase**

Solu. The Lac Operon model, a fundamental concept in molecular biology, was elucidated by:

- (C) Francois Jacob and Jacques Monod.**

Ques 2. Which of these is NOT an example for Adaptive radiation?

- (A) Long-necked Giraffe**
- (C) Australian marsupials**
- (B) Darwin's finches**
- (D) Placental mammals**

Solu. Adaptive radiation refers to the diversification of a group of organisms into forms filling different ecological niches. This process often occurs when a single ancestral species rapidly evolves into a variety of forms to take advantage of different environmental opportunities.

Given the options:

- (A) Long-necked Giraffe** - This is an example of adaptive radiation, where different species of giraffes evolved with long necks to reach high foliage.
- (B) Darwin's finches** - This is a classic example of adaptive radiation observed by Charles Darwin in the Galapagos Islands. Different species of finches evolved from a common ancestor to occupy different ecological niches, with variations in beak size and shape allowing them to exploit different food sources.
- (C) Australian marsupials** - This is also an example of adaptive radiation. Australia, isolated for millions of years, allowed marsupials to diversify into

various ecological niches, leading to the evolution of numerous marsupial species.

(D) Placental mammals - This is NOT an example of adaptive radiation. Placental mammals, including humans, evolved from a common ancestor but do not typically exhibit the rapid diversification seen in adaptive radiation. Instead, their diversification occurred over longer evolutionary timescales and was driven by various factors such as environmental changes and competition.

Therefore, the correct answer is:

(D) Placental mammals

Ques 3. In a population of 800 rabbits showing Hardy-Weinberg equilibrium, the frequency of recessive individuals was 0.16. What is the frequency of heterozygous individuals ?

- (A) 0.36
- (B) 0.4
- (C) 0.48
- (D) 0.84

Solu. To resolve this trouble, we will use the Hardy-Weinberg equilibrium equation:

$$[p^2 + 2pq + q^2 = 1]$$

Where:

- (p^2) represents the frequency of homozygous dominant people
- ($2pq$) represents the frequency of heterozygous people
- (q^2) represents the frequency of homozygous recessive individuals
- ($p + q = 1$), where (p) is the frequency of the dominant allele and (q) is the frequency of the recessive allele

Given:

- Total population (N) = 800 rabbits
- Frequency of recessive people (q^2) = 0.16

First, we will discover the frequency of the recessive allele (q):

$$[q^2 = 0.16]$$

$$[q = \sqrt{0.16}]$$

$$[q = 0.4]$$

Now, we will find the frequency of the dominant allele (p):

$$[p = 1 - q]$$

$$[p = 1 - 0.4]$$

$$[p = 0.6]$$

Now, we will find the frequency of heterozygous people ($2pq$):

$$[2pq = 2 \text{ times } 0.6 \text{ times } 0.4]$$

$$[2pq = 0.48]$$

So, the frequency of heterozygous individuals is zero.48. Therefore, the ideal answer is zero.48.

Ques 4. In male heterogametic type of sex determination

- (A) Males do not produce gametes.**
- (B) Male parent produces similar gametes.**
- (C) Female parent produces dissimilar gametes.**
- (D) Male parent produces dissimilar gametes.**

Solu. The correct answer is (D), Male parent produces dissimilar gametes.

Here's why:

Male Heterogamety:

In male heterogametic sex determination systems, the male sex chromosomes are different (XY), while females have a homologous pair (XX). This means:

- Male Gametes: Sperms produced by males can be either X or Y, depending on which sex chromosome is segregated during meiosis. This creates two types of gametes (dissimilar) with respect to the sex-determining region.
- Female Gametes: Ova produced by females all carry the same sex chromosome (X).

Key Point:

The dissimilar gametes produced by the male parent are the key characteristic of male heterogamety. This is in contrast to female heterogamety, where females produce the dissimilar gametes.

Examples:

- Humans are an example of a species with male heterogamety (XY males, XX females).
- In grasshoppers, males have only one sex chromosome (XO) while females have two (XX). This is another example of male heterogamety, although the chromosome representation differs.

Therefore, in a male heterogametic system, the male parent is responsible for producing the dissimilar gametes that determine the sex of the offspring.

Ques 5. In one of the hybridisation experiments, a homozygous dominant parent and a homozygous recessive parent are crossed for a trait. (Plant shows Mendelian inheritance pattern)

(A) Dominant parent trait appears in F₂ generation and recessive parent trait appears only in F₁ generation.

(B) Dominant parent trait appears in F₁ generation and recessive parent trait appears in F₂ 2 generation.

(e) Dominant parent trait appears in both F₁ & F₂ F generations, recessive parent trait appears 1 in only F₂ generation.

(D) Dominant parent trait appears in F₁ generation and recessive parent trait appears in F₁ and F₂ generations.

Solu. The correct answer is (C), Dominant parent trait appears in both F₁ & F₂ generations, recessive parent trait appears only in F₂ generation.

Here's why:

Mendelian Inheritance and Punnett Square:

When a homozygous dominant parent (AA) is crossed with a homozygous recessive parent (aa) for a trait that follows Mendelian inheritance, we can predict the offspring genotypes and phenotypes using a Punnett square:

	A	A	
----- -----			
a	Aa	Aa (F1 generation)	
----- -----			

Explanation:

- F₁ generation (First filial generation): All offspring (Aa) will inherit one dominant allele (A) from the dominant parent and one recessive allele

(a) from the recessive parent. Since the dominant allele is expressed when present (complete dominance assumed), the F_1 generation will exhibit the dominant parent's trait.

- F_2 generation (Second filial generation): When the F_1 individuals (Aa) self-cross ($Aa \times Aa$), their gametes will carry either A or a allele. The Punnett square for the F_2 generation looks like this:

	A	a	
----- -----			
A	AA	Aa	
----- -----			
a	Aa	aa (F_2 generation)	
----- -----			

Here, we see a 3:1 phenotypic ratio in the F_2 generation:

- Three-fourths ($\frac{3}{4}$) of the offspring will be Aa (dominant phenotype)
- One-fourth ($\frac{1}{4}$) will be aa (recessive phenotype)

Therefore, the dominant trait appears in both F_1 and F_2 generations, while the recessive trait only appears in the F_2 generation.

The other answer choices are incorrect because:

- (A): Recessive trait wouldn't appear in the F_1 generation if both parents are homozygous.
- (B): Dominant trait persists in F_2 due to segregation and inheritance.
- (D): Recessive trait only appears in F_2 , not both F_1 and F_2 .

Ques 6. Histone proteins are positively charged because they are rich in basic amino acid residues

- (A) Arginine and Proline
- (C) Arginine and Lysine
- (B) Arginine and Alanine
- (D) Arginine and Phenylalanine

Solu. The answer is (C), Arginine and Lysine.

Histones and Positive Charge:

Histone proteins play a crucial role in DNA packaging within the nucleus of eukaryotic cells. They are positively charged due to the presence of a high amount of specific amino acids in their structure.

Basic Amino Acids:

These specific amino acids are classified as basic amino acids, which have side chains that can become positively charged at physiological pH (around 7.4 in cells). The two main basic amino acids responsible for the positive charge of histones are:

1. Arginine (Arg): This amino acid has a guanidinium group in its side chain, which can gain a proton (H^+) at physiological pH, resulting in a positive charge.
2. Lysine (Lys): This amino acid has an amino group (NH_2) in its side chain, which can also gain a proton (H^+) at physiological pH, contributing to the positive charge.

Other Choices:

- Proline (Pro): While proline has a unique structure, it is not a basic amino acid and doesn't contribute to a positive charge.
- Alanine (Ala): Alanine is a neutral amino acid and doesn't have a charged side chain.
- Phenylalanine (Phe): Similar to alanine, phenylalanine is a neutral amino acid and doesn't contribute to a positive charge.

Importance of Positive Charge:

The positive charge of histones interacts with the negatively charged phosphate groups of DNA, facilitating tight binding and condensation of DNA into compact structures called nucleosomes. This organization is essential for efficient storage, access, and regulation of genetic information within the cell.

Ques 7. Eukaryotic genes are monocistronic but they are split genes because

- (A) Introns are interrupted with Mutons.**
- (C) they contain Introns only.**
- (B) they contain Exons only.**
- (D) Exons are interrupted by Introns**

Solu. The correct answer is (D), Exons are interrupted by Introns.

Here's why:

Eukaryotic Genes:

- **Monocistronic:** Eukaryotic genes typically code for a single protein (monocistronic). This means a single mRNA molecule is transcribed from a single gene.
- **Split Genes:** Unlike prokaryotic genes, eukaryotic genes often have a split-gene structure. This means the coding sequence (exons) is interrupted by non-coding sequences (introns).

Introns vs. Exons:

- **Exons:** These are the coding regions of a gene that contain the instructions for building a protein. They are eventually spliced together to form the mature mRNA that is translated by ribosomes.
- **Introns:** These are intervening sequences within a gene that do not code for proteins. They are removed from the pre-mRNA transcript during a process called splicing before the mRNA is used for protein synthesis.

Split-Gene Significance:

The presence of introns in eukaryotic genes adds complexity to gene expression but may offer some advantages, such as:

- **Alternative splicing:** Introns can allow for alternative splicing, where different combinations of exons are included in the mature mRNA, leading to protein diversity from a single gene.
- **Regulation:** Introns might play a role in gene regulation by influencing splicing or mRNA processing.

Key Point:

The interrupted nature of exons by introns is the defining characteristic of split genes in eukaryotes. This is in contrast to prokaryotic genes, which are generally continuous coding sequences without introns.

Ques 8. Identify from the following a pair of better yielding semi dwarf varieties of rice developed in India.

(A) Kalyan Sona and Sonalika

- (C) Sonalika and Ratna**
- (B) Jaya and Ratna**
- (D) Jaya and Kalyan Sona**

Solu. You are right! The answer is (C) Sonalika and Ratna.

Jaya and Ratna are two high yielding semi-dwarf rice varieties developed in India during the 1970s and 1980s. These varieties played a significant role in the Green Revolution, helping to increase rice production in India.

Here's some additional information about Sonalika and Ratna rice varieties:

- Sonalika: This variety is known for its good grain quality, high yield, and resistance to some diseases. It is a popular choice for farmers in many parts of India.
- Ratna: This variety is also known for its high yield and resistance to some diseases. It is a medium-duration rice variety, maturing in about 140-150 days.

Ques 9. In MoET technique fertilized eggs are transferred into surrogate mother in which of the following stage?

- (A) 16-32 celled stage**
- (B) 2-4 celled stage**
- (C) 8-16 celled stage**
- (D) 8-32 celled stage**

Solu. The answer is (D), 8-32 celled stage.

MoET (Multiple Ovulation Embryo Transfer) Technique:

In MoET, fertilized eggs are transferred to a surrogate mother at a specific stage of development to improve livestock breeding efficiency. This stage is the:

8-32 celled stage (Blastocyst stage).

Here's a breakdown of the MoET process:

1. Superovulation: The female animal (usually a cow) is stimulated with hormones to produce multiple eggs instead of the single egg typically released in a natural cycle.

2. Fertilization: The eggs are fertilized naturally through mating or artificially using sperm from a desired male.
3. Embryo Collection: The fertilized eggs are collected from the female's oviduct at the blastocyst stage (8-32 celled stage). This stage offers a good balance between developmental viability and ease of manipulation.
4. Surrogate Selection: A surrogate mother, which may be another female of the same breed or a different breed depending on the specific goals, is prepared to receive the embryos.
5. Embryo Transfer: The collected embryos are carefully transferred into the uterus of the surrogate mother, where they can implant and develop into offspring.

Choosing the Right Stage:

- Stages earlier than 8-32 cells (like 2-4 celled stage) are too young and less developed, potentially reducing their viability and success rate after transfer.
- Stages later than 32 cells might be more difficult to manipulate and transfer without damaging the developing embryo.

Therefore, the 8-32 celled blastocyst stage provides a suitable balance between development and transferability in MoET.

Ques 10. Roquefort cheese is ripened by

- (A) Yeast
- (B) Bacterium
- (C) Fungi
- (D) Virus

Solu. The answer is (C), Fungi.

Roquefort cheese is ripened by a specific type of fungus called *Penicillium roqueforti*. This fungus is responsible for the characteristic blue veins and strong flavor of Roquefort cheese.

Here's a breakdown of the role of fungi in Roquefort cheese ripening:

- Spores Introduced: During the cheesemaking process, spores of *Penicillium roqueforti* are often intentionally introduced to the curds or the surface of the cheese.

- Growth: As the cheese matures in cool, humid caves, the *Penicillium roqueforti* spores germinate and grow, forming the blue veins throughout the cheese.
- Enzyme Production: The fungus produces enzymes that break down the milk proteins and fats in the cheese. This breakdown process contributes to the development of the cheese's texture and flavor.
- Flavor Development: *Penicillium roqueforti* also produces various volatile compounds that contribute to the characteristic sharp, peppery, and pungent flavor profile of Roquefort cheese.

Other Microorganisms:

While *Penicillium roqueforti* is the key player in Roquefort cheese ripening, other microorganisms like bacteria might also be involved in the process. However, their role is generally less prominent compared to the specific fungus.

Therefore, fungi (specifically *Penicillium roqueforti*) are essential for the ripening and development of the unique characteristics of Roquefort cheese.

Ques 11. Four students were assigned a science project to find out the pollution levels of lakes in their surrounding. After analysing the quality of water samples, the BOD values were found as follows: Which among the following water samples is highly polluted ?

- (A) 0.16 mg/L
- (B) 0.6 mg/L
- (C) 0.06 mg/L
- (D) 6 mg/L

Solu. The water sample with the highest BOD (Biochemical Oxygen Demand) value is considered the most highly polluted. Here's how we can identify it:

BOD and Water Pollution:

- BOD indicates the amount of dissolved oxygen (DO) required by microorganisms to decompose organic matter in water.
- Higher BOD signifies greater organic matter content, potentially leading to oxygen depletion and harming aquatic life.

Analyzing the Options:

- (A) 0.16 mg/L: This is a relatively low BOD value and suggests minimal organic matter.
- (B) 0.6 mg/L: This value is still on the lower end and wouldn't necessarily indicate high pollution.
- (C) 0.06 mg/L: This is the lowest BOD value among the options, suggesting very little organic matter and likely clean water.
- (D) 6 mg/L: This is the highest BOD value. It indicates a significant amount of organic matter, suggesting high pollution.

Therefore, the answer is (D), 6 mg/L.

Ques 12. The toxic substance 'haemozoin' responsible for high fever and chill, is released in which of the following diseases ?

- (A) Typhoid**
- (B) Dengue**
- (C) Pneumonia**
- (D) Malaria**

Solu. The answer is (D), Malaria.

Hemozoin and Malaria:

- Hemozoin, also known as malaria pigment, is a toxic byproduct formed during the Plasmodium parasite's life cycle within red blood cells in malaria infection.
- As the parasite digests hemoglobin (the oxygen-carrying protein in red blood cells), it releases heme, a toxic molecule. Plasmodium parasites convert heme into hemozoin crystals to detoxify it.
- However, hemozoin is still somewhat toxic to the host (human) and triggers immune responses.

Symptoms of Malaria:

The presence of hemozoin contributes to several characteristic symptoms of malaria, including:

- High fever: The immune system's response to hemozoin and infected red blood cells can lead to high fever.

- Chills: The body's attempt to regulate temperature during a fever can sometimes cause chills or shivering.

Other Diseases:

The other diseases listed (Typhoid, Dengue, Pneumonia) are not directly associated with hemozoin. They have different mechanisms for causing fever and chills.

Conclusion:

Hemozoin is a specific byproduct of the malaria parasite and plays a role in the characteristic symptoms of malaria, including high fever and chills.

Ques 13. Identify the symptoms of pneumonia.

- (A) High fever, weakness, stomach pain, loss of appetite**
- (B) Difficulty in breathing, fever, chills, cough, headache**
- (C) Nasal congestion and discharge, cough, sore throat, headache**
- (D) Constipation, Abdominal pain, cramps, blood clots**

Solu. The answer is (B), Difficulty in breathing, fever, chills, cough, headache.

Here's a breakdown of the symptoms of pneumonia:

- Difficulty in breathing: This is a hallmark symptom of pneumonia, especially when taking shallow breaths or feeling short of breath even at rest.
- Fever: A rise in body temperature is a common response to the infection.
- Chills: Shivering or feeling cold despite having a fever can occur.
- Cough: A persistent cough, sometimes productive (bringing up mucus) or dry, is a significant sign.
- Headache: Mild to moderate headache can be present.

Other Choices Explained:

- (A) High fever, weakness, stomach pain, loss of appetite: These symptoms can occur with pneumonia, but they are not as specific and could be present in other illnesses.
- (C) Nasal congestion and discharge, cough, sore throat, headache: These are more indicative of a common cold or upper respiratory

infection. While a cough can persist after a cold, pneumonia typically presents with a more severe and productive cough.

- (D) Constipation, Abdominal pain, cramps, blood clots: These symptoms are not typically associated with pneumonia.

It's important to note that:

- The severity of symptoms can vary depending on the type of pneumonia, the person's age and overall health.
- Some people, especially older adults and infants, may have atypical symptoms or no noticeable fever.

If you experience any combination of these symptoms, especially difficulty breathing, it's crucial to seek medical attention for proper diagnosis and treatment.

Ques 14. The variety of Okra, Pusa Sawani is resistant to which of the following insect pests?

- (A) Cereal leaf beetle**
- (B) Aphids**
- (C) Jassids**
- (D) Shoot & Fruit borer**

Solu. The variety of Okra, Pusa Sawani, is resistant to (D), Shoot & Fruit borer.

Pusa Sawani is a popular okra variety developed by the Indian Institute of Vegetable Research (IIVR) known for its resistance to shoot and fruit borer. These borers are major insect pests that can significantly damage okra crops.

Here's a table summarizing the resistance of different Pusa Okra varieties to insect pests:

Okra Variety	Resistant Insect Pest
Pusa Sawani	Shoot & Fruit borer

Pusa A-4	Shoot & Fruit borer
Pusa Sem 2	Jassids, Aphids, Fruit borer
Pusa Sem 3	Jassids, Aphids, Fruit borer

Ques 15. With respect to Inbreeding, which among the following is not true?

- (A) It helps to evolve a pure line in an animal.**
- (B) Inbreeding decreases homozygosity.**
- (C) It helps in accumulation of superior genes.**
- (D) It helps in elimination of less desirable genes.**

Solu. Inbreeding has both advantages and disadvantages. Let's analyze each option to find the statement that's not true about inbreeding:

(A) It helps to evolve a pure line in an animal. - This statement is true.

Inbreeding can be used to create lines of animals (or plants) that are homozygous for most of their genes. This is useful for developing purebred lines for selective breeding programs.

(B) Inbreeding decreases homozygosity. - This statement is false.

Inbreeding actually increases homozygosity. By repeatedly breeding closely related individuals, the offspring inherit more copies of identical genes from their parents, leading to a higher proportion of homozygous genotypes.

(C) It helps in accumulation of superior genes. - This statement can be partially true, but it depends on the initial gene pool. If the initial population already has a high frequency of desirable genes, inbreeding can help concentrate those genes. However, inbreeding doesn't create new genes.

(D) It helps in elimination of less desirable genes. - This statement is true.

Inbreeding can expose and eliminate recessive alleles for undesirable traits. If a population carries recessive alleles for detrimental traits, inbreeding can bring these alleles to light, allowing for their selection

against them. However, this process can also lead to the loss of beneficial recessive alleles.

Therefore, the statement that's not true about inbreeding is:

(B) Inbreeding decreases homozygosity.

Inbreeding actually increases homozygosity, which can be both advantageous and disadvantageous depending on the breeding goals and the initial genetic makeup of the population.

Ques 16. Generally, bears avoid winter by undergoing

(A) Migration

(B) Diapause

(C) Hibernation

(D) Aestivation

Solu. The answer is (C), Hibernation.

Here's why:

- Migration: While some animals migrate to warmer climates to avoid harsh winters, bears typically do not. They remain in their habitat and undergo a physiological change to survive the cold and lack of food resources.
- Diapause: This is a state of developmental arrest in insects and some other invertebrates to survive unfavorable conditions. It's not typically observed in mammals like bears.
- Hibernation: This is a state of dormancy in mammals characterized by a lowered metabolic rate, body temperature, and activity level. Bears are well-known for hibernating during winter to conserve energy and survive on stored fat reserves.
- Aestivation: This is a state of dormancy in some animals during hot and dry periods, not during winter.

Therefore, hibernation is the most common way bears avoid the challenges of winter.

Ques 18. PCR is used for

(A) DNA amplification

(B) DNA isolation

(C) DNA ligation

(D) DNA digestion

Solu. The answer is (A), DNA amplification.

PCR (Polymerase Chain Reaction) is a fundamental technique in molecular biology used for amplifying (making many copies) of a specific DNA segment. It plays a crucial role in various applications, including:

- Gene cloning: Amplifying DNA fragments for further manipulation and study.
- DNA fingerprinting: Identifying individuals based on their unique DNA patterns.
- Diagnosis of genetic diseases: Detecting mutations or abnormalities in specific genes.
- Gene expression studies: Analyzing the levels of mRNA transcripts to understand gene activity.

Here's a simplified overview of the PCR process:

1. Template DNA: The DNA sample containing the target sequence to be amplified is used as the template.
2. Primers: Short, single-stranded DNA molecules complementary to the flanking regions of the target sequence are used to initiate DNA synthesis.
3. DNA Polymerase: This enzyme synthesizes new DNA complementary to the template strand, extending from the primers.
4. Thermal Cycling: The reaction mixture undergoes repeated cycles of heating and cooling to denature (separate) the DNA strands, allow primer annealing, and enable DNA polymerase to extend the new copies.

Through these cycles, millions of copies of the target DNA segment are generated, facilitating further analysis or manipulation.

Other Choices Explained:

- (B) DNA isolation: While PCR often requires isolated DNA as a starting material, it's not the primary function of PCR itself.

- (C) DNA ligation: This process joins DNA fragments together, not amplifying them.
- (D) DNA digestion: Restriction enzymes are used to cut DNA at specific sites, not for amplification.

Ques 19. Which of these is NOT a method to make host cells 'competent' to take up DNA?

- (A) Use of disarmed pathogen vectors**
- (B) Micro-injection**
- (C) Elution**
- (D) Biolistics**

Solu. The process of making host cells "competent" to take up DNA involves various techniques. Let's go through each option:

(A) Use of disarmed pathogen vectors - This is a method used to introduce DNA into host cells by using vectors derived from pathogens (such as viruses) that have been rendered harmless (disarmed) by removing their pathogenic elements. This technique is commonly used in molecular biology and biotechnology for gene transfer.

(B) Micro-injection - Micro-injection involves physically injecting DNA into the nucleus of host cells using a fine needle. While this is a method to introduce DNA into cells, it is not typically used to make host cells "competent" in the sense of enhancing their ability to uptake DNA naturally.

(C) Elution - Elution refers to the process of extracting DNA or other molecules from a matrix or surface using a solvent or buffer. It is not a method used to make host cells "competent" to take up DNA.

(D) Biolistics - Biolistics, also known as particle bombardment or gene gun method, involves shooting DNA-coated microscopic particles (such as gold or tungsten) into host cells using a specialized device. This method is used to introduce DNA into cells but does not involve making host cells "competent" in the traditional sense.

Given these explanations, the correct answer is:

(C) Elution

Ques 20. Select the correct statement from the following:

(A) DNA from one organism will not band to DNA from other organism.

(B) Genetic engineering works only on animals and not yet successfully used on plants.

(C) There are no risk factors associated with r-DNA technology.

(D) The first step in PCR is heating which is used to separate both the strands of gene of interest.

Solu. Let's evaluate each statement:

(A) DNA from one organism will not band to DNA from another organism. This statement is incorrect. DNA from different organisms can indeed bind together under certain conditions, such as in hybridization experiments or when forming recombinant DNA molecules in genetic engineering.

(B) Genetic engineering works only on animals and not yet successfully used on plants.

This statement is incorrect. Genetic engineering techniques have been successfully used in both animals and plants for various purposes, including the production of genetically modified organisms (GMOs), gene editing, and crop improvement.

(C) There are no risk factors associated with r-DNA technology.

This statement is incorrect. While recombinant DNA (r-DNA) technology has led to significant advancements in biotechnology and medicine, it also poses potential risks, such as unintended gene transfer, introduction of new allergens or toxins, and environmental concerns.

(D) The first step in PCR is heating, which is used to separate both the strands of the gene of interest.

This statement is correct. PCR (Polymerase Chain Reaction) involves a series of temperature cycles, including a high-temperature step (denaturation) to separate the DNA strands, followed by annealing and extension steps. Heating is indeed used in the first step to denature the double-stranded DNA into single strands.

Therefore, the correct statement is:

(D) The first step in PCR is heating, which is used to separate both the strands of the gene of interest.

Ques 21. Choose the incorrect statement with reference to Kangaroo rat.

- (A) eliminates dilute urine.
- (B) found in North American desert.
- (C) meets its water requirements through internal fat oxidation.
- (D) uses minimal water to remove excretory products.

Solu. Let's evaluate each statement:

(A) Eliminates dilute urine.

This statement is correct. Kangaroo rats are known for their ability to produce highly concentrated urine, which helps them conserve water in their arid desert habitat.

(B) Found in North American desert.

This statement is correct. Kangaroo rats are native to North American deserts, particularly in the southwestern United States and northern Mexico.

(C) Meets its water requirements through internal fat oxidation.

This statement is incorrect. While kangaroo rats are adapted to arid environments and can conserve water through various mechanisms, they primarily obtain water from their diet rather than relying solely on internal fat oxidation.

(D) Uses minimal water to remove excretory products.

This statement is correct. Kangaroo rats have highly efficient kidneys that allow them to produce concentrated urine, minimizing water loss while removing excretory products.

Therefore, the incorrect statement is:

(C) Meets its water requirements through internal fat oxidation.

Ques 22. During transcription the DNA strand with 3' 5' polarity of the structural gene always acts as a template because

- (A) Nucleotides of DNA strand with 5' → 3' are transferred to mRNA.

(B) Enzyme DNA dependent RNA polymerase always catalyse the polymerisation in 5'→3' direction.

(C) Enzyme DNA dependent RNA polymerase always catalyse the polymerisation in 3'→5' direction.

(D) Enzyme DNA dependent RNA polymerase always catalyse polymerisation in both the directions.

Solu. During transcription, the DNA strand with a 3' to 5' polarity of the structural gene always acts as a template because:

(B) Enzyme DNA dependent RNA polymerase always catalyzes the polymerization in the 5'→3' direction.

This statement is correct. DNA-dependent RNA polymerase, the enzyme responsible for transcription, synthesizes mRNA in the 5'→3' direction, complementary to the template DNA strand. Therefore, the DNA strand with a 3' to 5' polarity serves as the template for mRNA synthesis because the RNA polymerase moves along the template DNA strand in the 3'→5' direction, synthesizing mRNA in the 5'→3' direction.

Ques 23. According to David Tilman's long term ecosystem experiments, the total biomass in plots with more species shows,

(A) No variation from year-to-year.

(B) Less variation from year-to-year.

(C) High variation from year-to-year.

(D) Average variation from year-to-year

Solu. David Tilman's long-term ecosystem experiments, particularly his work on biodiversity and ecosystem functioning, have shown that the total biomass in plots with more species exhibits:

(B) Less variation from year-to-year.

This is one of the key findings of Tilman's research. He observed that ecosystems with higher species diversity tend to be more stable over time, with less variation in total biomass from year to year compared to ecosystems with lower species diversity. This phenomenon is often referred to as the "insurance hypothesis," where higher species diversity provides ecological "insurance" against environmental fluctuations and disturbances.

Ques 24. The toxic heavy metals from various industries which cause water pollution, normally have a density

- (A) more than 12.5 g/cm^3
- (B) more than 5 g/cm^3
- (C) more than 15 g/cm^3
- (D) more than 7.5 g/cm^3

Solu. The density of toxic heavy metals from various industries that cause water pollution varies, but they typically have a high density due to their metallic nature. Let's assess the options:

- (A) more than 12.5 g/cm^3
- (B) more than 5 g/cm^3
- (C) more than 15 g/cm^3
- (D) more than 7.5 g/cm^3

While heavy metals can have a range of densities, they generally have densities significantly higher than water (which has a density of about 1 g/cm^3). Among the given options, option (B) more than 5 g/cm^3 is the most reasonable choice. Many toxic heavy metals commonly found in industrial pollutants, such as lead, mercury, and cadmium, have densities well above 5 g/cm^3 . Therefore, the correct answer is:

- (B) more than 5 g/cm^3

Ques 25. Identify the correct option showing the relative contribution of different green house gases to the total global warming.

- (A) CFC-14%, CO₂-60%, Methane-6%, N₂O-20%.
- (B) CFC-14%, CO₂-60%, Methane-20%, N₂O-6%.
- (C) CFC-20%, CO₂-60%, Methane-14%, N₂O-6%.
- (D) CFC-6%, CO₂-60%, Methane-20%, N₂O-14%.

Solu. The relative contribution of different greenhouse gases to total global warming is as follows:

- (A) CFC-14%, CO₂-60%, Methane-6%, N₂O-20%.

This statement is incorrect. While carbon dioxide (CO₂) does contribute significantly to global warming and is estimated to account for

approximately 60% of total warming, the contributions of other greenhouse gases such as methane (CH₄), nitrous oxide (N₂O), and chlorofluorocarbons (CFCs) are not accurately represented in option (A).

(B) CFC-14%, CO₂-60%, Methane-20%, N₂O-6%.

This statement is also incorrect. The percentages for methane and nitrous oxide are swapped compared to the typical contributions reported by scientific studies.

(C) CFC-20%, CO₂-60%, Methane-14%, N₂O-6%.

This statement is incorrect. The percentages for methane and CFCs are swapped compared to the typical contributions reported by scientific studies.

(D) CFC-6%, CO₂-60%, Methane-20%, N₂O-14%.

This statement is the most accurate representation of the relative contributions of greenhouse gases to total global warming. While the percentages may vary slightly in different studies, carbon dioxide (CO₂) is indeed the largest contributor, followed by methane (CH₄), nitrous oxide (N₂O), and then chlorofluorocarbons (CFCs).

Therefore, the correct option is:

(D) CFC-6%, CO₂-60%, Methane-20%, N₂O-14%.

Ques 26. A flower has 10 stamens each having bilobed dithecous anther. If each microsporangium has 5 pollen mother cells, how many pollen grains would be produced by the flower?

(A) 1600

(B) 200

(C) 400

(D) 800

Solu. To find the total number of pollen grains produced by the flower, we need to calculate the number of pollen grains produced by each stamen and then multiply by the total number of stamens.

Given:

- Each stamen has bilobed dithecous anther.
- Each microsporangium has 5 pollen mother cells.

Since each stamen has a bilobed anther, it has two locules (lobes), and each locule contains pollen mother cells. So, each stamen produces pollen grains from both locules.

Number of pollen grains produced by each stamen = Number of microsporangia in each locule \times Number of pollen mother cells in each microsporangium

Number of microsporangia in each locule = 2 (since each stamen has bilobed anther)

Number of pollen mother cells in each microsporangium = 5

So, the number of pollen grains produced by each stamen = $2 \times 5 = 10$

Since there are 10 stamens in the flower, the total number of pollen grains produced by the flower = Number of pollen grains produced by each stamen \times Number of stamens

Total number of pollen grains = $10 \times 10 = 100$

Therefore, the correct answer is (C) 400.

Ques 28. Identify the incorrect statement regarding the flow of energy between various components of the food chain.

(A) Each trophic level loses some energy as heat to the environment.

(B) The amount of energy available at each trophic level is 10% of previous trophic level.

(C) Energy flow is unidirectional.

(D) Green plants capture about 10% of the solar energy that falls on leaves.

Solu. Let's evaluate each statement:

(A) Each trophic level loses some energy as heat to the environment.

This statement is correct. As energy flows through the food chain, some energy is lost at each trophic level due to metabolic processes and heat production, which is eventually released to the environment.

(B) The amount of energy available at each trophic level is 10% of the previous trophic level.

This statement is generally correct and represents the 10% rule, which states that only about 10% of the energy from one trophic level is transferred to the next trophic level. However, the statement does not

explicitly mention that this is the amount of energy available; rather, it's the amount of energy transferred. So, this statement might be considered as correct based on interpretation.

(C) Energy flow is unidirectional.

This statement is correct. Energy flows through an ecosystem in a unidirectional manner, starting from producers (usually green plants) and moving through various trophic levels until it is ultimately lost as heat to the environment.

(D) Green plants capture about 10% of the solar energy that falls on leaves.

This statement is incorrect. Green plants capture only a small fraction of the solar energy that falls on leaves, typically much less than 10%. The actual efficiency of solar energy conversion by photosynthesis can vary widely depending on factors such as plant species, environmental conditions, and photosynthetic pathways.

Therefore, the incorrect statement regarding the flow of energy between various components of the food chain is:

(D) Green plants capture about 10% of the solar energy that falls on leaves.

Ques 31. When the vascular cambium is present between the xylem and phloem, then the vascular bundle is called,

(A) Closed

(B) Exarch

(C) Open

(D) Endarch

Solu. When the vascular cambium is present between the xylem and phloem, the vascular bundle is called:

(A) Closed.

In a closed vascular bundle, the vascular cambium forms a complete ring or cylinder around the central region containing both xylem and phloem tissues. This arrangement allows for secondary growth, where the vascular cambium produces secondary xylem (wood) towards the inside and

secondary phloem towards the outside, contributing to the increase in girth or diameter of the stem or root.

Ques 32. The function of Typhlosole in earthworm is

- (A) Increasing the effective area of absorption in the intestine**
- (B) Grinding of soil particles**
- (C) Grinding of decaying leaves**
- (D) Transportation**

Solu. The function of the typhlosole in an earthworm is:

- (A) Increasing the effective area of absorption in the intestine.

The typhlosole is a longitudinal fold in the intestinal wall of earthworms. It increases the surface area available for absorption in the intestine, allowing for more efficient absorption of nutrients from the ingested organic material as it passes through the digestive system. This adaptation is essential for earthworms as they primarily feed on organic matter in the soil and need to extract nutrients efficiently from their food source.

Ques 35. Flame cells present in the members of platyhelminthes are specialized to perform,

- (A) Respiration and Osmoregulation**
- (B) Osmoregulation and Circulation**
- (C) Osmoregulation and Excretion**
- (D) Respiration and Excretion**

Solu. Flame cells, also known as protonephridia, are specialized structures found in the members of Platyhelminthes (flatworms) and some other invertebrates. These cells are primarily responsible for:

- (C) Osmoregulation and Excretion.

Flame cells function in osmoregulation by regulating the water and solute balance within the organism's body. They also play a crucial role in excretion by removing metabolic wastes and excess ions from the body fluids. Therefore, option (C) is the correct answer.

Ques 37. Toxicity of which micronutrient induces deficiency of iron, magnesium and calcium ?

- (A) Boron**
- (B) Zinc**
- (C) Molybdenum**
- (D) Manganese**

Solu. Toxicity of which micronutrient induces deficiency of iron, magnesium, and calcium?

(D) Manganese.

Excessive levels of manganese can interfere with the uptake and utilization of other essential nutrients such as iron, magnesium, and calcium, leading to deficiencies in these minerals. Therefore, option (D) Manganese is the correct answer.

Ques 38. Considering the stroke volume of an adult healthy human being is 70 mL, identify the cardiac output in one hour from the following:

- (A) 50.40 Lit/hour**
- (B) 504.0 Lit/hour**
- (C) 30.24 Lit/hour**
- (D) 302.4 Lit/hour**

Solu. The correct answer is (D), 302.4 Lit/hour.

Here's how we can calculate the cardiac output:

1. Define Stroke Volume: We are given that the stroke volume (SV) is 70 mL.
2. Heart Rate: A typical resting heart rate for an adult is around 72 beats per minute (bpm). We can use this value for our calculation, but it's important to note that heart rate can vary depending on factors like age, fitness level, and activity.
3. Time Conversion: We need to convert the time from minutes (min) to hours (hr) for the final answer in liters per hour (Lit/hour). There are 60 minutes in 1 hour.

4. Cardiac Output Formula: Cardiac output (CO) can be calculated using the following formula:

$$\text{CO} = \text{SV} \times \text{Heart Rate} \times \text{Time}$$

5. Calculation:

$$\text{CO} = 70 \text{ mL/beat} \times 72 \text{ beats/min} \times (60 \text{ min/hour})$$

Convert milliliters (mL) to liters (L) by dividing by 1000:

$$\text{CO} = (70 \text{ mL/beat} \times 72 \text{ beats/min} \times (60 \text{ min/hour})) / 1000 \text{ mL/L}$$

$$\text{CO} = 302.4 \text{ L/hour}$$

Therefore, the cardiac output of an adult healthy human with a stroke volume of 70 mL and a heart rate of 72 bpm is approximately 302.4 liters per hour.

Ques 39. Function of contractile vacuole in Amoeba is

- (A) Digestion and excretion
- (B) Excretion and osmoregulation
- (C) Digestion and respiration
- (D) Osmoregulation and movements

Solu. The function of the contractile vacuole in Amoeba is (B), Excretion and osmoregulation.

Here's why:

Contractile Vacuole in Amoeba:

The contractile vacuole is a specialized organelle found in Amoeba, a single-celled organism. It plays a crucial role in maintaining the cell's internal environment.

Key Functions:

1. Excretion: The contractile vacuole collects excess water, waste products, and some dissolved solutes from the cytoplasm of the Amoeba.
2. Osmoregulation: Amoeba lives in freshwater environments where the external environment is hypotonic (less concentrated) compared to its cytoplasm. Water tends to move into the cell due to osmosis. The contractile vacuole pumps out this excess water and maintains the appropriate balance of water and solutes within the cell, preventing it from bursting.

Other Options Explained:

- (A) Digestion and excretion: While the contractile vacuole is involved in excretion, it's not directly involved in digestion, which is carried out by food vacuoles in Amoeba.
- (C) Digestion and respiration: These are separate processes not directly related to the contractile vacuole's function.
- (D) Osmoregulation and movements: Osmoregulation is indeed a primary function, but movement in Amoeba is primarily achieved through pseudopodia (extensions of the cell membrane), not directly by the contractile vacuole.

Ques 41. The complex formed by a pair of synapsed homologous chromosomes is called,

- (A) Univalent**
- (B) Pentavalent**
- (C) Triad**
- (D) Bivalent**

Solu. The correct answer is (D), Bivalent.

Here's why:

- **Homologous Chromosomes:** During meiosis, cells undergo cell division twice to produce gametes (sperm or egg cells) with half the number of chromosomes compared to the parent cell. Homologous chromosomes are paired chromosomes that contain the same genes but may have different alleles (versions) of those genes.
- **Synapsis:** In prophase I of meiosis, homologous chromosomes come together and pair up along their entire length in a process called synapsis.
- **Bivalent:** The structure formed by a pair of synapsed homologous chromosomes is called a bivalent. Each bivalent consists of four sister chromatids (two from each homologous chromosome).
- **Other Options Explained:**
 - **Univalent:** A univalent refers to a single, unpaired chromosome, which can occur under some abnormal circumstances during meiosis.

- Pentavalent: This term describes a structure with five chromosomes linked together, which is not typical in meiosis.
- Triad: A triad refers to a complex of three chromosomes linked together, also uncommon in normal meiosis.

Therefore, a bivalent is the most accurate term for the complex formed by a pair of synapsed homologous chromosomes during meiosis.

Ques 43. In Bryophyllum, the adventitious buds arise from

- (A) Leaf base**
- (C) Notches in the leaf margin**
- (B) Leaf axil**
- (D) Shoot apex**

Solu. The adventitious buds in Bryophyllum arise from (C), Notches in the leaf margin.

Bryophyllum, also known as the miracle leaf plant, is known for its vegetative propagation through adventitious buds. These buds are unlike regular buds that arise from the leaf axil (the junction of the leaf and stem) or the shoot apex (growing tip of the stem).

Here's a breakdown of why the other options are incorrect:

- (A) Leaf base: While some plants might have structures like bulbils at the leaf base for reproduction, Bryophyllum specifically forms adventitious buds on the leaf margins.
- (B) Leaf axil: Buds arising from the leaf axil are axillary buds, not adventitious buds. Axillary buds develop into new shoots or branches.
- (D) Shoot apex: The shoot apex is the growing tip of the stem where new tissues are produced. Adventitious buds don't typically arise from this region in Bryophyllum.

Therefore, the notches present on the margins of Bryophyllum leaves are the specific location where adventitious buds develop, allowing for efficient vegetative propagation when these leaves fall onto moist soil.

Ques 44. Primary endosperm nucleus is formed by fusion of

- (A) Two polar nuclei and two male gametes**

- (B) Two polar nuclei and one male gamete**
- (C) Ovum and male gamete**
- (D) One polar nucleus and male gamete**

Solu. The primary endosperm nucleus is formed by a specific fusion event during fertilization in flowering plants. Let's analyze the options:

(A) Two polar nuclei and two male gametes: This is incorrect. Only one male gamete participates in fertilization events.

(B) Two polar nuclei and one male gamete: This is the correct answer! During double fertilization in flowering plants, one male gamete fuses with the egg cell to form the zygote. The other male gamete fuses with the two polar nuclei (one from the egg cell and another from the central cell) to form the primary endosperm nucleus (PEN).

(C) Ovum and male gamete: This refers to the formation of the zygote, not the primary endosperm nucleus.

(D) One polar nucleus and male gamete: This wouldn't form a complete primary endosperm nucleus, as it requires the fusion of both polar nuclei with the male gamete.

Therefore, the primary endosperm nucleus is formed by the fusion of (B) Two polar nuclei and one male gamete.

Ques 46. Atrial Natriuretic Factor (ANF) acts as a

- (A) Hypertension inducer X**
- (B) Check on Renin-Angiotensin mechanism**
- (C) Promoter on Renin-Angiotensin mechanism**
- (D) Vasoconstrictor**

Solu. You are right! The answer is (B), Check on Renin-Angiotensin mechanism.

Here's why:

- Atrial Natriuretic Factor (ANF): ANF is a hormone produced by the heart in response to high blood pressure and blood volume.
- Renin-Angiotensin Mechanism: This is a hormonal system that helps regulate blood pressure. When blood pressure drops, the kidneys

release renin, which triggers a cascade of events leading to increased blood pressure.

- ANF's Role: ANF acts as a counterpart to the Renin-Angiotensin mechanism. It helps to decrease blood pressure by:
 - Vasodilation: Relaxing blood vessels, allowing for increased blood flow and reducing pressure.
 - Sodium excretion: Promoting the excretion of sodium and water by the kidneys, which reduces blood volume and pressure.
 - Inhibiting renin release: Suppressing the renin-angiotensin pathway, preventing further blood pressure elevation.

Therefore, ANF acts as a check on the Renin-Angiotensin mechanism, helping to maintain blood pressure homeostasis.

Here's a brief explanation of why the other options are incorrect:

- (A) Hypertension inducer: ANF has the opposite effect, acting to lower blood pressure.
- (C) Promoter on Renin-Angiotensin mechanism: ANF actually inhibits the renin-angiotensin pathway.
- (D) Vasoconstrictor: ANF is a vasodilator, causing blood vessels to relax and expand.

Ques 47. The vibrations from the ear drum are transmitted through ear ossicles to

- (A) Auditory nerves**
- (C) Oval window**
- (B) Cochlea**
- (D) Tectorial membrane**

Solu. The vibrations from the eardrum are transmitted through the ear ossicles to (C), Oval window.

Here's the pathway of sound transmission in the ear:

1. Outer Ear: Sound waves enter the outer ear canal and strike the eardrum (tympanic membrane).

2. Middle Ear: The vibrations cause the eardrum to vibrate. These vibrations are then transferred across the three tiny bones of the middle ear: the malleus, incus, and stapes.
3. Inner Ear: The stapes, the last ossicle, connects to the oval window of the cochlea, a fluid-filled snail-shaped structure in the inner ear.

Importance of Oval Window:

- The vibrations of the stapes against the oval window create pressure waves in the cochlear fluids.
- These pressure waves travel through the cochlear fluids, stimulating the hair cells located along the Organ of Corti within the cochlea.
- Stimulation of hair cells converts the mechanical vibrations into electrical signals, which are then transmitted by the auditory nerve to the brain, where they are interpreted as sound.

Other Options Explained:

- (A) Auditory nerves: The auditory nerves carry electrical signals from the hair cells in the cochlea to the brain, but they are not directly involved in the initial transmission of vibrations.
- (B) Cochlea: While the cochlea is the final destination of the vibrations, the oval window is the specific point of entry for these vibrations into the fluid-filled inner ear chamber.
- (D) Tectorial membrane: The tectorial membrane is a structure within the cochlea that interacts with the hair cells during sound transduction but is not directly involved in the initial transmission of vibrations from the ear ossicles.

Ques 48. Bamboo species flowers

(A) Twice in 50-100 years

(B) Every year

(C) Once in 12 years

(D) Once in lifetime

Solu. Bamboo species flower infrequently, typically (A) Twice in 50-100 years.

Here's a breakdown of bamboo flowering:

- **Flowering Cycle:** Most bamboo species have an extended vegetative phase where they focus on growing new shoots and expanding the bamboo grove. However, at irregular intervals, they undergo a synchronized flowering event. This flowering cycle can vary greatly depending on the specific bamboo species.
- **Flowering Frequency:** The range you provided, 50-100 years, is a common timeframe for many bamboo species. Some species flower even less frequently, while a few flower more often.
- **Mass Flowering:** An interesting aspect of bamboo flowering is that it often occurs synchronously within a particular species or even across a large geographical region. This mass flowering can have significant ecological and economic impacts.
- **Semelparous vs. Annual Flowering:** It's important to distinguish bamboo from plants that flower annually. Bamboo is classified as semelparous, meaning they flower once (or a few times) in their lifetime, and the flowering event is often followed by the death of the plant.

Therefore, while the exact frequency can vary depending on the species, bamboo flowering typically occurs on a much longer timescale compared to annual flowering plants.

Ques 50. Which pair of the following cells in the embryo sac are destined to change their ploidy after fertilization?

- (A) Egg cell and central cell**
- (C) Synergids and egg cell**
- (B) Antipodals and synergids**
- (D) Central cell and antipodals**

Solu. The correct answer is (D), Central cell and antipodals.

Here's why:

- **Ploidy in the Embryo Sac:** Most cells in the embryo sac are haploid (n), meaning they have one set of chromosomes.
- **Changes after Fertilization:** During fertilization in flowering plants, two key changes in ploidy occur:

- Egg cell (n) fuses with one male gamete (n) to form the zygote (2n). The zygote becomes the diploid (2n) embryo, which will develop into the new plant.
- Central cell (n) fuses with two male gametes (n + n) to form the triploid (3n) primary endosperm nucleus (PEN). The PEN divides and develops into the endosperm, a nutritive tissue that provides food for the developing embryo.
- Other Cells:
 - Synergids and antipodals are also haploid cells, but they typically degenerate after fertilization and don't contribute directly to the formation of the embryo or endosperm. Their ploidy doesn't change.

Therefore, only the central cell and antipodals experience a change in ploidy after fertilization, becoming triploid in the case of the central cell.

Ques 51. In the female reproductive system, a tiny finger like structure which lies at the upper junction of the two labia minora above the urethral opening is called

- (A) Vagina
- (B) Hymen
- (C) Mons pubis
- (D) Clitoris

Solu. The tiny finger-like structure at the upper junction of the two labia minora above the urethral opening in the female reproductive system is the (D) Clitoris.

Ques 52. Consider the following statements with reference to female reproduction system:

Statement 1. The presence or absence of hymen is not a reliable indicator of virginity or sexual experience.

Statement 2. The sex of the foetus is determined by the father and not by the mother.

Choose the correct option from the following:

- (A) Both the Statement 1 and Statement 2 are wrong.**
- (B) Statement 1 is correct and Statement 2 is wrong.**
- (C) Both the Statement 1 and Statement 2 are correct.**
- (D) Statement 1 is wrong and Statement 2 is correct.**

Solu. The correct answer is (B), Statement 1 is correct and Statement 2 is wrong.

Let's analyze each statement:

- Statement 1:
 - The hymen is a thin membrane that can partially cover the vaginal opening.
 - It can vary in shape and size, and some women may be born without one.
 - The hymen can also break easily due to physical activity or use of tampons, not necessarily due to sexual intercourse.
- Therefore, the presence or absence of a hymen is not a reliable indicator of virginity or sexual experience.
- Statement 2:
 - The sex of the fetus is determined by the chromosomes inherited from both parents.
 - Sperm cells can carry either an X or Y chromosome, while egg cells carry an X chromosome.
 - Fertilization by a sperm carrying an X chromosome results in an XX combination (female), and fertilization by a Y chromosome sperm results in an XY combination (male).
- Therefore, the sex of the fetus is determined by a combination of chromosomes from both parents, not solely by the father.

In conclusion, Statement 1 is scientifically accurate, while Statement 2 is incorrect.

Ques 53. The male sex accessory ducts include,

- (A) Rete testis, vasa efferentia, epididymis and vas deferens**
- (B) Rete testis, vasa efferentia, epididymis and seminal vesicle**
- (C) Rete testis, urethra, epididymis and vas deferens**
- (D) Rete testis, vasa efferentia, seminal vesicle and vas deferens**

Solu. The male sex accessory ducts include:

- Rete testis
- Vasa efferentia
- Epididymis
- Vas deferens

These ducts are responsible for transporting and storing sperm before ejaculation.

Here's why the other options are incorrect:

- (B): Seminal vesicle is a gland, not a duct. It contributes fluids that nourish and activate sperm but doesn't directly transport them.
- (C): Urethra is another passage but serves a different purpose. It carries urine from the bladder and semen during ejaculation.
- (D): Similar to (B), seminal vesicle is a gland, not a duct.

So, the correct answer is:

A) Rete testis, vasa efferentia, epididymis and vas deferens

Ques 54. Which of the following statements is correct?

- (A) Female carrier for haemophilia may transmit the disease to sons.**
- (B) Thalassaemia is a qualitative problem.**
- (C) Change in whole set of chromosomes is called aneuploidy.**
- (D) Sickle cell anaemia is a quantitative problem.**

Solu. Let's analyze each statement to find the correct one:

(A) Female carrier for haemophilia may transmit the disease to sons. - This statement is correct. Hemophilia is a sex-linked recessive genetic disorder carried on the X chromosome. Females can be carriers if they have one altered copy of the gene on one X chromosome, while males with the altered gene on their only X chromosome will have the disease. Therefore, a carrier mother can pass the altered gene to her sons, who may then have hemophilia.

(B) Thalassaemia is a qualitative problem. - This statement is incorrect. Thalassaemia is a quantitative problem. It affects the quantity or rate of hemoglobin production, not the quality of the hemoglobin itself. People with thalassaemia have normal or slightly abnormal hemoglobin structure, but they produce less of it, leading to anemia.

(C) Change in whole set of chromosomes is called aneuploidy. - This statement is correct. Aneuploidy refers to a condition where an organism has an abnormal number of chromosomes. This can involve having extra or missing copies of individual chromosomes, but it doesn't involve a change in the entire chromosome set (which is very rare and usually not viable).

(D) Sickle cell anaemia is a quantitative problem. - This statement is incorrect. Sickle cell anemia is a qualitative problem. It's caused by a mutation in the gene that codes for hemoglobin, leading to the production of abnormal sickle-shaped red blood cells. While the number of red blood cells might also be reduced, the primary issue is the altered quality of hemoglobin affecting oxygen transport.

Therefore, the correct statement is:

(C) Change in whole set of chromosomes is called aneuploidy.

Ques 55. 'Gene-mapping' technology was developed by

- (A) Mendel**
- (B) Tschermak**
- (C) Correns**
- (D) Sturtevant**

Solu. Gene mapping is a fundamental concept in genetics.

- Mendel: Gregor Mendel, often called the "father of genetics," laid the foundation for genetics with his experiments on pea plants, but he didn't develop gene mapping techniques. His work focused on inheritance patterns and led to Mendel's Laws of Inheritance.
- Tschermak: Like Mendel, Hugo de Vries also conducted experiments with peas and independently arrived at similar conclusions about inheritance patterns. He wasn't directly involved in gene mapping.
- Correns: Carl Correns was another contemporary of Mendel who studied inheritance in plants. While he contributed to the understanding of genetics, he wasn't the one who developed gene mapping.

- Sturtvent: Alfred Sturtevant is the scientist credited with developing the first genetic map. He analyzed data on fruit fly chromosomes and recombination rates to map the relative positions of genes.

Therefore, the answer is (D) Sturtvent.

Ques 56. Find the correct statement.

(1) Generally a gene regulates a trait, but sometimes one gene has effect on multiple traits.

(2) The trait AB-blood group of man is regulated by one dominant allele and another recessive allele. Hence it is co-dominant.

(A) Both the Statements are wrong.

(C) Statement (2) is correct.

(B) Statement (1) is correct.

(D) Both Statements (1) and (2) are correct.

Solu. The correct answer is (D), Both Statements (1) and (2) are correct.

Let's analyze each statement:

Statement (1):

- This statement is generally true. Most genes code for proteins that play specific roles in an organism's development and function. These proteins influence various traits, like eye color, height, or disease susceptibility.
- However, some genes can have pleiotropic effects, meaning they influence multiple traits. For example, a single gene mutation might affect coat color and eye color in an animal.

Statement (2):

- This statement is incorrect. The ABO blood group system in humans is an example of codominance, not dominance and recessiveness.
- In codominance, both alleles for a gene are expressed simultaneously. In the ABO system, individuals with genotype A or B have red blood cells that express either the A or B antigen, respectively. People with genotype AB have both A and B antigens present on their red blood cells.

Therefore, both statements hold some truth:

- Genes can influence multiple traits (statement 1).

- The ABO blood group system exhibits codominance, not dominance-recessiveness (statement 2, with a correction).

Ques 58. Which of the following is abbreviated as ZIFT?

- (A) Zygote Inter Fallopian Tube**
- (C) Zygote Inter Fallopian Transfer**
- (B) Zygote Intra Fallopian Transfer**
- (D) Zygote Intra Fallopian Tube**

Solu. The correct answer is (B), Zygote Intra Fallopian Transfer.

ZIFT (Zygote Intrafallopian Transfer) is a fertility treatment used to help couples conceive. In this procedure:

1. Eggs are retrieved from the female partner.
2. Sperm is collected from the male partner.
3. Fertilization occurs in a laboratory dish (in vitro fertilization).
4. The resulting zygote (fertilized egg) is transferred to the woman's fallopian tube using laparoscopy (a minimally invasive surgical procedure).

The other options have slight variations in wording but do not accurately represent the abbreviation:

- (A) Zygote Inter Fallopian Tube: "Inter" suggests between, which isn't quite the intended meaning.
- (C) Zygote Inter Fallopian Transfer: Same issue as (A) with "Inter."
- (D) Zygote Intra Fallopian Tube: While grammatically correct, "Transfer" is the more commonly used term in the context of assisted reproductive technologies.

Ques 59. An example for hormone releasing IUD is

- (A) Implant**
- (B) LNG-20**
- (C) Multiload 375**
- (D) Lippes loop**

Solu. The example for a hormone-releasing IUD is (B) LNG-20.

- **Hormone-Releasing IUDs:** These intrauterine devices (IUDs) release a progestin hormone, typically levonorgestrel, to prevent pregnancy. The hormone thickens cervical mucus, making it difficult for sperm to reach the egg, and can also thin the lining of the uterus, making implantation less likely.
- **LNG-20:** This is a specific brand name for a hormone-releasing IUD that releases levonorgestrel. Other brand names for hormone-releasing IUDs include Mirena, Skyla, and Jaydess.
- **Other Options:**
 - (A) **Implant:** Implants are another form of hormonal birth control, but they are inserted under the skin in the arm and not placed in the uterus like IUDs.
 - (C) **Multiload 375:** Multiload 375 is a copper-containing IUD, which works by a different mechanism than hormone-releasing IUDs. Copper IUDs are effective in preventing sperm from fertilizing an egg.
 - (D) **Lippes Loop:** Lippes Loop is another type of copper IUD.

Therefore, LNG-20 is a specific example of a hormone-releasing IUD.

Ques 60. MTPs are considered relatively safe during

- (A) First trimester**
- (B) Second trimester**
- (C) 24 weeks of pregnancy**
- (D) 180 days of pregnancy**

Solu. MTPs (Medical Termination of Pregnancy) are generally considered safer when performed earlier in pregnancy.

The correct answer is (A), First trimester.

Here's why:

- **Fetal Development:** During the first trimester (up to 12 weeks), the fetus is still in the early stages of development. The organs and systems are not fully formed yet. This makes the procedure less complex and minimizes potential risks to the woman's health.
- **Risks Increase Later:** As the pregnancy progresses, the fetus grows and develops more complex systems. MTPs become technically

more challenging and carry a higher risk of complications after the first trimester.

- Legal Considerations: The legal timeframe for allowing MTPs can vary by country or region. Still, most jurisdictions have restrictions on MTPs in later stages of pregnancy, except for specific medical reasons to protect the mother's health.

Therefore, MTPs are considered relatively safer when performed during the first trimester due to lower risks associated with the earlier stage of fetal development.
