CUET UG Biology Sample Paper - 9

Duration: 1 Hour **Maximum Marks: 250**

Instructions

- This paper contains a total of 50 Multiple Choice Questions.
- Each correct answer carries **+5 marks**.
- Each incorrect answer carries **-1 mark**.
- No negative marking for unattempted questions.

Q1. In a typical angiospermic embryo sac, although it is 7-celled, it is 8-nucleate. This is because:

(A) One cell contains two polar nuclei.

(B) The egg cell is binucleated.

(C) Synergids undergo endopolyploidy.

(D) Antipodals degenerate before fertilization.

Q2. If the endosperm of a gymnosperm is haploid, what would be the ploidy of the endosperm of an angiosperm if the pollen grain is from a tetraploid ($4n$) plant and the embryo sac is from a diploid ($2n$) plant?

(A) $3n$

(B) $4n$

(C) $5n$

(D) $6n$

Q3. Cleistogamous flowers are strictly autogamous because:

(A) They never open.

(B) They lack anthers.

(C) They are pollinated by bats.

(D) Stigma and anthers mature at different times.

Q4. The functional megaspore in an angiosperm develops into:

(A) Endosperm

(B) Embryo sac

(C) Ovule

(D) Pollen sac

Q5. Triple fusion involves the fusion of:

(A) Two male gametes and one egg.

(B) One male gamete and two polar nuclei.

(C) Two polar nuclei and one egg.

(D) One male gamete and one synergid.

Q6. Which of the following is the correct sequence of sperm cell formation?

(A) Spermatogonia → Spermatocyte → Spermatid → Spermatozoa

(B) Spermatid → Spermatocyte → Spermatogonia → Spermatozoa

(C) Spermatogonia → Spermatozoa → Spermatocyte → Spermatid

(D) Spermatogonia → Spermatid → Spermatocyte → Spermatozoa

Q7. In the human female, the second meiotic division in the egg is completed:

(A) Prior to ovulation.

(B) At the time of copulation.

(C) At the time of fusion of a sperm with an ovum.

(D) In the Graafian follicle.

Q8. Select the correct statement regarding the Menstrual Cycle:

(A) LH surge induces the development of the Corpus Luteum.

(B) Progesterone level is high during the Follicular phase.

(C) LH and FSH attain a peak level in the middle of the cycle (around day 14).

(D) The endometrial lining builds up during the Luteal phase due to LH.

Q9. The blastocyst stage is characterized by the presence of:

(A) Trophoblast and Inner Cell Mass.

(B) Zona Pellucida and Corona Radiata.

(C) Morula and Blastomeres.

(D) Primary and Secondary Oocytes.

Q10. Colostrum, the yellowish fluid secreted by the mother during the initial days of lactation, is essential because it contains:

(A) IgA antibodies.

(B) IgG antibodies.

(C) High levels of Progesterone.

(D) Large amounts of Glucose.

Q11. Match the Contraceptive Method with its mechanism:

Column A	List I	Column B	List II
(1)	Lippes Loop	(a)	Blocks Gamete transport
(2)	Multiload 375	(b)	Non-medicated IUD
(3)	Saheli	(c)	Copper releasing IUD
(4)	Vasectomy	(d)	Once-a-week non-steroidal pill

(A) i-b, ii-c, iii-d, iv-a

(B) i-c, ii-b, iii-d, iv-a

(C) i-b, ii-c, iii-a, iv-d

(D) i-a, ii-b, iii-c, iv-d

Q12. In which of the following ART techniques are the embryos transferred into the Fallopian tube?

(A) IUT and ZIFT

(B) ZIFT and GIFT

(C) ICSI and ZIFT

(D) GIFT and IUI

Q13. A lady is 10 weeks pregnant and wants to terminate the pregnancy legally. Which statement is true?

(A) MTP is safe only up to 8 weeks.

(B) MTP is safe and legal up to 12 weeks.

(C) MTP requires the consent of 3 doctors after 8 weeks.

(D) MTP is illegal after the first trimester.

Q14. A cross between a red-flowered plant and a white-flowered plant produces all pink-flowered offspring. If these pink flowers are self-pollinated, what is the phenotypic ratio?

(A) 3 : 1

(B) 1 : 2 : 1

(C) 9 : 3 : 3 : 1

(D) 1 : 1

Q15. A person with Klinefelter's Syndrome has the karyotype:

(A) $44 + XO$

(B) $44 + XXY$

(C) $44 + XYY$

(D) $45 + XX$

Q16. If the recombination frequency between genes A and B is 5%, B and C is 15%, and A and C is 10%, the sequence of genes on the chromosome is:

(A) A-B-C

(B) B-A-C

(C) A-C-B

(D) C-B-A

Q17. Thalassemia and Sickle Cell Anemia are caused by defects in globin chain synthesis. Select the correct statement:

(A) Both are quantitative defects.

(B) Both are qualitative defects.

(C) Thalassemia is quantitative; Sickle cell is qualitative.

(D) Thalassemia is qualitative; Sickle cell is quantitative.

Q18. Which mendelian idea is depicted by a cross in which the F_1 generation resembles both the parents?

(A) Incomplete dominance

(B) Law of dominance

(C) Co-dominance

(D) Linkage

Q19. Down's syndrome is caused by an extra copy of chromosome number 21. This is due to:

(A) Monosomy

(B) Non-disjunction during gametogenesis

(C) Polyploidy

(D) Gene mutation

Q20. The enzyme that catalyzes the synthesis of RNA primers during DNA replication is:

(A) DNA Polymerase I

(B) DNA Ligase

(C) Primase

(D) Helicase

Q21. If the sequence of the coding strand of DNA is 5′˘ATGCATGC˘3′, the sequence of mRNA will be:

(A) 5′˘UACGUACG˘3′

(B) 5′˘AUGCUAGC˘3′

(C) 5′˘AUGCAGUC˘3′

(D) 5′˘AUGCAUGC˘3′

Q22. In the Lac Operon, when lactose is present, it binds to:

(A) The Promoter to start transcription.

(B) The Structural genes to activate them.

(C) The Repressor protein, inactivating it.

(D) The Operator to block the RNA polymerase.

Q23. DNA Fingerprinting involves identifying differences in specific regions of DNA called:

(A) Coding DNA

(B) Repetitive DNA

(C) Single-copy DNA

(D) Exons

Q24. The degenerate nature of the genetic code means:

(A) One codon codes for more than one amino acid.

(B) One amino acid is coded by more than one codon.

(C) The code is read in a contiguous fashion.

(D) The same code applies to all organisms.

Q25. Spliceosomes are NOT found in the cells of:

(A) Fungi

(B) Animals

(C) Bacteria

(D) Plants

Q26. The Avery, MacLeod, and McCarty experiment proved that DNA is the transforming principle by showing that:

(A) Proteases did not affect transformation.

(B) RNases did not affect transformation.

(C) DNases inhibited transformation.

(D) All of the above.

Q27. How many nucleosomes are present in a human diploid cell (6.6×10^9 bp)?

(A) 3.3×10^7

(B) 6.6×10^7

(C) 1.1×10^7

(D) 2.2×10^7

Q28. In a population of 1000 individuals, 360 belong to genotype AA, 480 to Aa, and the remaining 160 to aa. What is the frequency of allele A?

(A) 0.4

(B) 0.5

(C) 0.6

(D) 0.7

Q29. The process by which different species in a given geographical area evolve starting from a point and radiating to other areas is called:

(A) Saltation

(B) Natural Selection

(C) Adaptive Radiation

(D) Convergent Evolution

Q30. Arrange the following hominids in the correct order of increasing brain capacity:

(A) Homo habilis → Homo erectus → Neanderthal man

(B) Homo erectus → Homo habilis → Neanderthal man

(C) Neanderthal man → Homo erectus → Homo habilis

(D) Homo habilis → Neanderthal man → Homo erectus

Q31. Stabilizing selection favors:

(A) Both extreme phenotypes.

(B) Intermediate phenotypes.

(C) One extreme phenotype.

(D) New species formation.

Q32. The infective stage of Plasmodium that enters the human body through a female Anopheles bite is:

(A) Trophozoite

(B) Sporozoite

(C) Merozoite

(D) Gametocyte

Q33. Which of the following provides "Passive Immunity"?

(A) Vaccination

(B) Natural infection with a virus

(C) Injection of Anti-tetanus serum (ATS)

(D) Exposure to allergens

Q34. Carcinogenic agents like X-rays and UV rays cause cancer by:

(A) Activating proto-oncogenes to oncogenes.

(B) Stimulating cell differentiation.

(C) Increasing contact inhibition.

(D) Decreasing the rate of mitosis.

Q35. Morphine, which is used as a sedative and painkiller, is extracted from:

(A) Leaves of Cannabis sativa

(B) Latex of Papaver somniferum

(C) Fruits of Erythroxylum coca

(D) Flowers of Datura

Q36. In Sewage Treatment, "BOD" refers to:

(A) The amount of oxygen consumed if all organic matter in 1L of water were oxidized by bacteria.

(B) The amount of oxygen produced by algae in the secondary tank.

(C) The biological oxygen demand of the anaerobic digester.

(D) The total inorganic salts present in the water.

Q37. Which biocontrol agent is used to control butterfly caterpillars?

(A) Trichoderma

(B) Baculoviruses

(C) Bacillus thuringiensis

(D) Ladybird

Q38. Mycorrhiza does NOT help the host plant in:

(A) Phosphorus absorption.

(B) Resistance to root-borne pathogens.

(C) Nitrogen fixation from the atmosphere.

(D) Tolerance to salinity and drought.

Q39. Restriction enzymes belong to a larger class of enzymes called:

(A) Ligases

(B) Polymerases

(C) Nucleases

(D) Proteases

Q40. During the PCR process, the step of 'Annealing' occurs at approximately:

(A) 94°C

(B) 50 – 60°C

(C) 72°C

(D) 40°C

Q41. In Gel Electrophoresis, DNA fragments are separated based on:

(A) Charge only.

(B) Size only.

(C) Both charge and size.

(D) Sequence of nucleotides.

Q42. The "Sparged" stirred-tank bioreactor is better than the simple stirred-tank because:

(A) It has a foam breaker.

(B) It increases the surface area for oxygen transfer.

(C) It allows for anaerobic conditions.

(D) It uses enzymes instead of bacteria.

Q43. RNA Interference (RNAi) involves silencing of a specific mRNA due to a complementary:

(A) ssDNA molecule.

(B) dsRNA molecule.

(C) ssRNA molecule.

(D) dsDNA molecule.

Q44. Why does the Bt toxin not kill the Bacillus thuringiensis bacterium itself?

(A) The bacterium is resistant to the toxin.

(B) The toxin is produced in an inactive pro-toxin form.

(C) The toxin is activated only in acidic pH.

(D) The bacterium has a thick cell wall.

Q45. In the production of Humulin (human insulin) by Eli Lilly, the A and B chains were produced separately and then joined by:

(A) Hydrogen bonds.

(B) Peptide bonds.

(C) Disulfide bonds.

(D) Glycosidic bonds.

Q46. In an age pyramid, if the pre-reproductive population is very large compared to the reproductive and post-reproductive populations, the population is:

(A) Declining

(B) Stable

(C) Expanding

(D) Fluctuating

Q47. An interaction where one species is benefited and the other is neither harmed nor benefited (e.g., Barnacles on a whale) is:

(A) Mutualism

(B) Amensalism

(C) Commensalism

(D) Parasitism

Q48. Which of the following ecological pyramids is ALWAYS upright and can never be inverted?

(A) Pyramid of Numbers

(B) Pyramid of Biomass

(C) Pyramid of Energy

(D) None of the above

Q49. The "Evil Quartet" refers to the four major causes of:

(A) Population explosion.

(B) Biodiversity loss.

(C) Global warming.

(D) Water pollution.

Q50. Which of the following is an example of "In-situ" conservation?

(A) Zoological Parks

(B) Botanical Gardens

(C) Wildlife Sanctuaries

(D) Cryopreservation

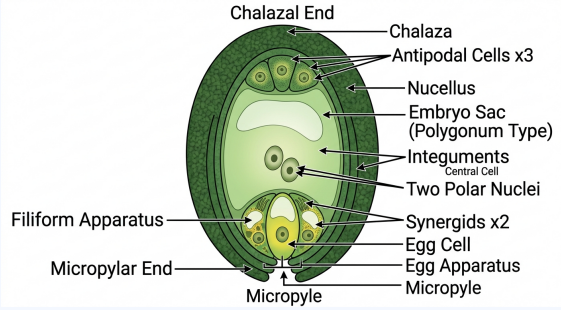
Detailed Solutions

Q1.

Solution

Concept: Structure of a mature angiosperm embryo sac (female gametophyte).

Solution:



A typical mature angiospermic embryo sac, commonly of the Polygonum type, consists of seven cells and eight nuclei. This specific count arises because the structure is composed of:

1. Three antipodal cells at the chalazal end, each containing one nucleus (3 cells, 3 nuclei).

2. Two synergids flanking the egg cell at the micropylar end, each with one nucleus (2 cells, 2 nuclei).

3. One egg cell, also at the micropylar end, containing one nucleus (1 cell, 1 nucleus).

4. One large central cell, which is centrally located and contains two polar nuclei that eventually fuse (1 cell, 2 nuclei).

Summing these up: (3+2+1+1) = 7 cells in total. And (3+2+1+2) = 8 nuclei in total. Therefore, the statement "one cell contains two polar nuclei" (referring to the central cell) correctly explains why it's 7-celled but 8-nucleate.

Final Answer : One cell contains two polar nuclei.

Answer: (A)

Q2.

Solution

Concept: Ploidy of angiosperm endosperm formation through triple fusion, contrasting with gymnosperm endosperm ploidy.

Solution: First, let's establish the context: a gymnosperm endosperm is haploid (n) because it represents the female gametophyte formed before fertilization.

In angiosperms, the endosperm is formed through a unique process called triple fusion, which is part of double fertilization. Triple fusion involves the fusion of one male gamete with two polar nuclei.

1. Ploidy of male gamete: If the pollen grain is from a tetraploid (4n) plant, meiosis in the anther will produce haploid male gametes. In this case, "haploid" relative to the parent means its chromosome number is half of the somatic cells. So, if the plant is 4n, its male gametes (pollen nuclei) will be 2n.

2. Ploidy of polar nuclei: If the embryo sac is from a diploid (2n) plant, the megaspore (from which the embryo sac develops) will be n. The polar nuclei are formed by mitotic divisions within the embryo sac, so each polar nucleus will be haploid (n).

3. Ploidy of endosperm: The fusion is (1 male gamete) + (1 polar nucleus) + (1 polar nucleus). Therefore, the ploidy of the endosperm will be 2n (from male gamete) + n (from first polar nucleus) + n (from second polar nucleus) = 4n.

Final Answer : 4n

Answer: (B)

Q3.

Solution

Concept: Characteristics of cleistogamous flowers and their impact on the mode of pollination.

Solution: Cleistogamous flowers are specialized types of flowers that exhibit a unique strategy for ensuring seed set. The defining characteristic of cleistogamy is that these flowers never open. They remain permanently closed throughout their development and life cycle.

Because the flowers do not open, the anthers (male reproductive parts) and the stigma (female receptive part) are enclosed within the same flower. This physical enclosure prevents any pollen from external sources (other flowers or other plants) from reaching the stigma. Consequently, only pollen produced by the same flower can effectively reach its own stigma and achieve fertilization. This mechanism strictly guarantees self-pollination (autogamy) and ensures seed production even in the absence of pollinators.

Final Answer : They never open.

Answer: (A)

Q4.

Solution

Concept: Megagametogenesis, the process of development of the female gametophyte (embryo sac) in angiosperms.

Solution: In angiosperms, the development of the female gametophyte, also known as the embryo sac, occurs within the ovule. This process begins with a diploid megaspore mother cell (MMC) that undergoes meiosis to produce four haploid megaspores.

In the most common type of embryo sac development (monosporic development, e.g., Polygonum type), three of these four megaspores degenerate, and only one megaspore remains functional. This functional megaspore then undergoes a series of three successive free nuclear mitotic divisions. These divisions result in an 8-nucleate stage within the single megaspore. Following these nuclear divisions, cellularization occurs, leading to the formation of the 7-celled, 8-nucleate structure that is the mature female gametophyte, or embryo sac. Therefore, the functional megaspore directly develops into the embryo sac.

Final Answer : Embryo sac

Answer: (B)

Q5.

Solution

Concept: The definition and components involved in triple fusion, a key event in angiosperm double fertilization.

Solution: Angiosperms exhibit a unique phenomenon called double fertilization, which involves two distinct fusion events. After a pollen grain lands on the stigma and germinates, the pollen tube grows down to the ovule, carrying two male gametes.

1. Syngamy (or generative fertilization): One male gamete fuses with the egg cell, forming a diploid zygote, which develops into the embryo.

2. Triple fusion (or vegetative fertilization): The second male gamete travels to the central cell of the embryo sac. Here, it fuses with the two polar nuclei (which are typically located within the central cell). This fusion of one male gamete (n) with two polar nuclei (n+n) results in the formation of a triploid (3n) primary endosperm nucleus (PEN). The PEN then develops into the endosperm, which provides nutrition to the developing embryo. Therefore, triple fusion specifically involves one male gamete and two polar nuclei.

Final Answer : One male gamete and two polar nuclei.

Answer: (B)

Q6.

Solution

Concept: The sequential stages of spermatogenesis, the process of male gamete (sperm) formation in the testes.

Solution: Spermatogenesis is a continuous process in males that occurs in the seminiferous tubules of the testes. It involves a series of stages that transform primitive germ cells into mature spermatozoa. The correct sequence is as follows:

1. Spermatogonia: These are the diploid (2n) undifferentiated germ cells found on the inner wall of the seminiferous tubules. They divide by mitosis to multiply and also differentiate into primary spermatocytes.

2. Spermatocyte (Primary & Secondary): Some spermatogonia grow in size to become diploid primary spermatocytes. These then undergo Meiosis I to form two haploid (n) secondary spermatocytes. Each secondary spermatocyte then undergoes Meiosis II to form two haploid spermatids. So, "Spermatocyte" broadly covers the cells undergoing meiotic divisions.

3. Spermatid: These are haploid (n), non-motile, and generally round cells formed after meiosis II. They are not yet fully functional sperm.

4. Spermatozoa (Sperm): Spermatids undergo a process called spermiogenesis, which involves morphological differentiation and maturation. During spermiogenesis, spermatids develop a head, a midpiece, and a tail, transforming into mature, motile spermatozoa (sperm).

Final Answer : Spermatogonia → Spermatocyte → Spermatid → Spermatozoa

Answer: (A)

Q7.

Solution

Concept: The timing of meiotic completion in oogenesis (egg formation) in human females, particularly in relation to fertilization.

Solution: Oogenesis is a complex process in human females with distinct arrests in meiotic development.

1. Meiosis I: Primary oocytes begin meiosis I during fetal development but arrest in prophase I. This arrest is lifted after puberty, and usually one primary oocyte per menstrual cycle completes meiosis I, forming a large haploid secondary oocyte and a small first polar body.

2. Meiosis II: The secondary oocyte immediately proceeds to meiosis II but arrests at metaphase II. This metaphase II-arrested secondary oocyte is what is ovulated from the Graafian follicle and travels down the fallopian tube.

3. Completion of Meiosis II: The second meiotic division in the secondary oocyte is only completed upon the entry of a sperm into the ovum. This fusion event triggers the completion of meiosis II, leading to the formation of a mature haploid ovum (egg) and a second polar body. Without fertilization, the secondary oocyte degenerates.

Final Answer : At the time of fusion of a sperm with an ovum.

Answer: (C)

Q8.

Solution

Concept: Hormonal regulation and key events during the different phases of the human menstrual cycle.

Solution: Let's analyze each statement regarding the menstrual cycle:

A) LH surge induces the development of the Corpus Luteum: The LH surge primarily triggers ovulation. After ovulation, the ruptured Graafian follicle transforms into the corpus luteum, which then develops and is maintained by LH, but the surge itself initiates ovulation rather than directly inducing the development of the corpus luteum from scratch.

B) Progesterone level is high during the Follicular phase: This is incorrect. Progesterone levels are relatively low during the follicular phase. Estrogen is the dominant hormone during this phase, promoting endometrial proliferation. Progesterone levels rise significantly during the luteal phase, after ovulation.

C) LH and FSH attain a peak level in the middle of the cycle (around day 14): This statement is correct. Both Luteinizing Hormone (LH) and Follicle-Stimulating Hormone (FSH) secreted by the anterior pituitary reach their highest concentrations around the middle of the menstrual cycle (typically day 14 in a 28-day cycle). The sharp rise in LH, known as the LH surge, is particularly critical as it directly triggers ovulation.

D) The endometrial lining builds up during the Luteal phase due to LH: This is incorrect. The endometrial lining (uterus wall) builds up and proliferates during the follicular phase, primarily under the influence of increasing estrogen levels. During the luteal phase, under the influence of both progesterone (secreted by the corpus luteum) and estrogen, the endometrium becomes secretory and highly vascularized, preparing for potential implantation. LH's role is in maintaining the corpus luteum, which in turn secretes progesterone and estrogen, but LH itself does not directly cause the build-up of the lining.

Final Answer : LH and FSH attain a peak level in the middle of the cycle (around day 14).

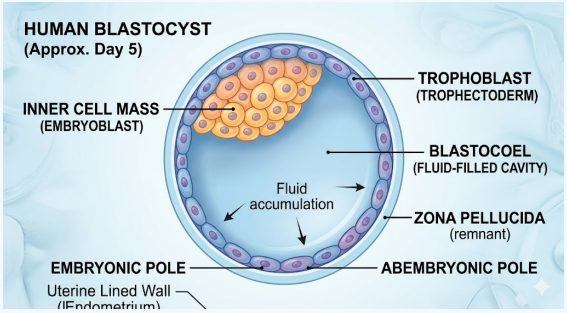
Answer: (C)

Q9.

Solution

Concept: Stages of early human embryonic development, specifically the structure of the blastocyst.

Solution:



Following fertilization, the zygote undergoes a series of rapid mitotic divisions called cleavage, forming a solid ball of cells known as a morula. The morula then continues to divide and reorganizes to form a blastocyst. The blastocyst is characterized by two distinct cell populations:
1. Trophoblast: The outer layer of cells that surrounds the cavity (blastocoel). The trophoblast cells are responsible for implantation into the uterine wall and later form the embryonic part of the placenta.
2. Inner Cell Mass (ICM) or Embryoblast: A cluster of cells located inside the blastocyst, attached to one side of the trophoblast. These cells are pluripotent and will eventually differentiate to form the embryo proper.
Therefore, the blastocyst stage is defined by the presence of these two key structures.

Final Answer : Trophoblast and Inner Cell Mass.

Answer: (A)

Q10.

Solution

Concept: The composition and immunological importance of colostrum for newborns.

Solution: Colostrum is the first form of milk produced by the mammary glands of mammals immediately following delivery of the newborn. It is a yellowish, thick fluid that is highly nutritious and crucially important for the newborn's health. Its essential nature stems from its rich content of antibodies, particularly IgA antibodies. IgA antibodies provide passive immunity to the infant, coating the lining of the immature digestive and respiratory tracts, thereby protecting the newborn from various infections and pathogens that it may encounter in the external environment. While it also contains other nutrients, its immunological components are paramount.

Final Answer : IgA antibodies.

Answer: (A)

Q11.

Solution

Concept: Different types of contraceptive methods and their specific mechanisms of action.

Solution: Let's match each contraceptive method with its correct mechanism:

(i) Lippes Loop: This is a type of non-medicated Intra Uterine Device (IUD). Its mechanism involves increasing phagocytosis of sperms within the uterus and making the uterus unsuitable for implantation. So, (i) matches with (b) Non-medicated IUD.

(ii) Multiload 375: This is a copper-releasing IUD. These IUDs release copper ions, which suppress sperm motility and their fertilizing capacity, making the uterus unsuitable for implantation. So, (ii) matches with (c) Copper releasing IUD.

(iii) Saheli: This is an oral contraceptive pill developed in India. It is a non-steroidal preparation taken once a week. It works by blocking estrogen receptors in the uterus, thereby preventing implantation. So, (iii) matches with (d) Once-a-week non-steroidal pill.

(iv) Vasectomy: This is a surgical sterilization method for males. It involves cutting and tying the vas deferens (sperm ducts), which blocks the transport of sperms from the testes, thus preventing fertilization. So, (iv) matches with (a) Blocks Gamete transport.

Combining these matches: (i)-b, (ii)-c, (iii)-d, (iv)-a.

Final Answer : i-b, ii-c, iii-d, iv-a

Answer: (A)

Q12.

Solution

Concept: Assisted Reproductive Technologies (ART) and the specific sites of gamete or embryo transfer.

Solution: Let's analyze the given ART techniques:

IUT (Intra Uterine Transfer): Embryos with more than 8 blastomeres, or blastocysts, are transferred into the uterus.

ZIFT (Zygote Intra Fallopian Transfer): In this technique, the zygote or early embryos (up to 8 blastomeres) formed in vitro (outside the body) are transferred into the Fallopian tube. This is a direct transfer of embryos to the Fallopian tube.

GIFT (Gamete Intra Fallopian Transfer): In this technique, gametes (sperm and oocytes) are transferred directly into the Fallopian tube to facilitate fertilization in vivo (inside the body). This is not an embryo transfer.

ICSI (Intra Cytoplasmic Sperm Injection): This is a specialized IVF procedure where a single sperm is directly injected into an ovum in the laboratory to achieve fertilization. The resulting embryo is then transferred (either to the uterus or Fallopian tube, depending on its stage), but ICSI itself is not a transfer to the Fallopian tube.

IUI (Intra Uterine Insemination): Sperm are directly introduced into the uterus. This is not an embryo transfer.

Based on the definitions, ZIFT is the technique specifically designed for transferring embryos into the Fallopian tube. While embryos produced by ICSI can subsequently be transferred via ZIFT, ICSI itself is a fertilization technique, not a transfer technique to the Fallopian tube. Therefore, among the given options, ZIFT is the direct answer. Considering the options as pairs, C (ICSI and ZIFT) is the most plausible choice as ZIFT fits perfectly, and ICSI is a precursor to embryo transfer.

Final Answer : ICSI and ZIFT

Answer: (C)

Q13.

Solution

Concept: Legal provisions and guidelines for Medical Termination of Pregnancy (MTP) in India, governed by the MTP Act.

Solution: In India, the Medical Termination of Pregnancy (MTP) Act, initially passed in 1971 and amended in 2021, specifies the conditions under which a pregnancy can be legally terminated. Up to 20 weeks: Opinion of one Registered Medical Practitioner (RMP) is required for certain grounds (e.g., risk to mother's health, fetal abnormality, rape, contraceptive failure). Between 20 and 24 weeks: Opinion of two RMPs is required for specific categories of women (e.g., survivors of sexual assault, minors, women with disabilities, etc.). Beyond 24 weeks: Termination is allowed only in cases of substantial fetal abnormalities diagnosed by a Medical Board.

A pregnancy of 10 weeks falls well within the first trimester (which extends up to 12 weeks). According to the MTP Act, termination is considered safe and legal up to 20 weeks with the opinion of one registered medical practitioner. Therefore, a 10-week pregnancy can be legally and safely terminated.

Final Answer : MTP is safe and legal up to 12 weeks.

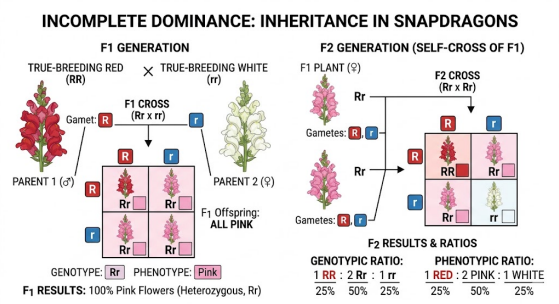
Answer: (B)

Q14.

Solution

Concept: Incomplete dominance and the phenotypic ratios observed in F2 generation.

Solution: The initial cross between a red-flowered plant and a white-flowered plant producing all pink-flowered offspring indicates incomplete dominance. In this type of inheritance, neither allele is completely dominant over the other, resulting in a heterozygous phenotype that is intermediate between the two homozygous parental phenotypes.



Let's denote the alleles:
Red flower genotype: RR
White flower genotype: WW
Pink flower genotype: RW

F1 generation cross:
Parents: RR (Red) × WW (White)
Gametes: R and W
F1 Offspring: All RW (Pink)

Self-pollination of F1 (Pink flowers):
Cross: RW (Pink) × RW (Pink)
Gametes from each parent: R and W

F2 Genotypes:
1 RR (Red)
2 RW (Pink)
1 WW (White)

F2 Phenotypes:
1 Red : 2 Pink : 1 White

The phenotypic ratio in the F2 generation will be 1:2:1.

Final Answer : 1:2:1

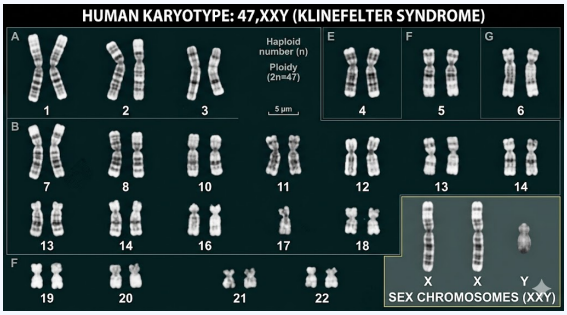
Answer: (B)

Q15.

Solution

Concept: Chromosomal abnormalities (aneuploidy) leading to genetic syndromes.

Solution:



Klinefelter's Syndrome is a genetic condition that affects males and results from the presence of an extra X chromosome. Typically, human males have a karyotype of 46, XY (44 autosomes + XY sex chromosomes). However, individuals with Klinefelter's Syndrome have an additional X chromosome, leading to a karyotype of 47, XXY. This means they have 44 autosomes and three sex chromosomes (XXY). The presence of this extra X chromosome leads to various physical and developmental characteristics, including reduced fertility, taller stature, and sometimes some female-like physical traits.

Final Answer : 44+XXY

Answer: (B)

Q16.

Solution

Concept: Gene mapping and the relationship between recombination frequency and genetic distance.

Solution: Recombination frequency (or crossing over frequency) between two genes on a chromosome is directly proportional to the physical distance separating them. A higher recombination frequency indicates that the genes are farther apart. The unit for genetic distance is the centimorgan (cM), where 1% recombination frequency equals 1 cM.

Given recombination frequencies:
A and B: 5% (5 cM)
B and C: 15% (15 cM)
A and C: 10% (10 cM)

To determine the sequence, we look for a linear arrangement where the distances add up correctly:
1. Assume sequence A-B-C:
Distance A-C should be A-B + B-C = 5 cM + 15 cM = 20 cM.
However, the given A-C distance is 10 cM. So, this sequence is incorrect.

2. Assume sequence B-A-C:
Distance B-C should be B-A + A-C = 5 cM + 10 cM = 15 cM.
This matches the given B-C distance of 15 cM. So, this sequence is correct.

3. Assume sequence A-C-B:
Distance A-B should be A-C + C-B = 10 cM + 15 cM = 25 cM.
However, the given A-B distance is 5 cM. So, this sequence is incorrect.

Therefore, the correct sequence of genes on the chromosome is B-A-C.

Final Answer : B-A-C

Answer: (B)

Q17.

Solution

Concept: Distinguishing between qualitative and quantitative genetic disorders, particularly in the context of hemoglobinopathies.

Solution: Both Thalassemia and Sickle Cell Anemia are inherited blood disorders affecting the globin chains of hemoglobin. However, they differ in the nature of the defect:

Thalassemia: This disorder is characterized by a reduced rate of synthesis of one or more of the globin chains (alpha or beta chains). This leads to an imbalance in the production of globin chains and an overall decreased amount of functional hemoglobin in red blood cells. Therefore, Thalassemia is a quantitative defect (affecting the quantity or amount of globin chains produced).

Sickle Cell Anemia: This disorder results from a specific point mutation in the gene coding for the beta-globin chain. This single nucleotide change leads to the substitution of glutamic acid by valine at the sixth position of the beta-globin chain. This alteration changes the structure or quality of the hemoglobin molecule (forming HbS), causing red blood cells to deform into a sickle shape under low oxygen conditions. Therefore, Sickle Cell Anemia is a qualitative defect (affecting the quality or structure of the globin chain).

Thus, Thalassemia is quantitative, and Sickle cell is qualitative.

Final Answer : Thalassemia is quantitative; Sickle cell is qualitative.

Answer: (C)

Q18.

Solution

Concept: Different patterns of inheritance, specifically cases where the F1 generation expresses traits from both parents.

Solution: Let's examine the different Mendelian ideas and patterns of inheritance:

Incomplete dominance: In this case, the F1 generation displays an intermediate phenotype that is a blend of the two parental phenotypes (e.g., red and white parents produce pink offspring). It does not resemble both parents, but rather a new, intermediate phenotype.

Law of dominance: According to this law, in a cross between two true-breeding parents for a single trait, the F1 generation will only express the phenotype of the dominant parent, while the recessive trait remains masked.

Co-dominance: This occurs when both alleles for a gene are fully and equally expressed in the heterozygote. As a result, the F1 generation exhibits the characteristics of both parents simultaneously and distinctly, rather than an intermediate or blended phenotype. A classic example is the AB blood group in humans, where both A and B antigens are expressed on the surface of red blood cells. Another example is roan coat color in cattle, where both red and white hairs are present.

Linkage: This refers to the tendency of genes located close together on the same chromosome to be inherited together. It describes how genes are transmitted, not necessarily the specific phenotype of the F1 generation in relation to parental traits.

Therefore, the mendelian idea depicted by an F1 generation that resembles both parents is co-dominance.

Final Answer : Co-dominance

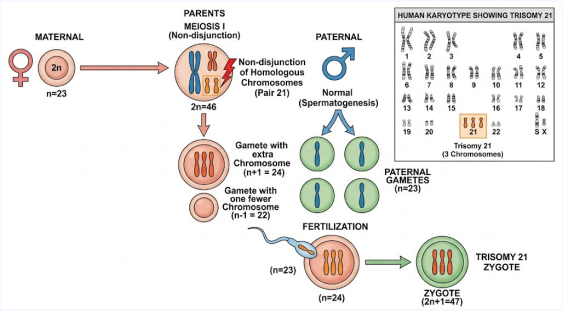
Answer: (C)

Q19.

Solution

Concept: Chromosomal abnormalities, specifically aneuploidy (changes in chromosome number), and their causes.

Solution: Down's syndrome, also known as Trisomy 21, is a genetic disorder characterized by the presence of an extra copy of chromosome number 21. Instead of the typical two copies, an individual with Down's syndrome has three copies of this chromosome, leading to a total of 47 chromosomes instead of 46. This condition is a type of aneuploidy, which refers to an abnormal number of chromosomes.



The most common cause of aneuploidy, including Trisomy 21, is non-disjunction during cell division, particularly during meiosis (gamete formation). Non-disjunction is the failure of homologous chromosomes to separate properly during anaphase I of meiosis, or the failure of sister chromatids to separate during anaphase II of meiosis.

If non-disjunction occurs during meiosis I, both homologous chromosomes go to one daughter cell, resulting in two gametes with n+1 chromosomes and two gametes with n-1 chromosomes. If non-disjunction occurs during meiosis II, sister chromatids fail to separate, leading to one gamete with n+1, one with n-1, and two normal (n) gametes.

When a gamete containing an extra chromosome 21 (n+1) fuses with a normal gamete (n), the resulting zygote will have three copies of chromosome 21 (2n+1), leading to Down's syndrome.

Let's briefly consider why other options are incorrect:

Monosomy refers to the absence of one chromosome from a pair (2n-1), which is the opposite of trisomy.

Polyploidy refers to having more than two complete sets of chromosomes (e.g., 3n, 4n), which is different from having an extra single chromosome.

Gene mutation involves changes in the DNA sequence of a single gene, not an entire chromosome.

Final Answer : Non-disjunction during gametogenesis

Answer: (B)

Q20.

Solution

Concept: The roles of various enzymes in the complex process of DNA replication.
Solution: DNA replication is the process by which a cell makes an exact copy of its DNA. While DNA polymerase is the primary enzyme responsible for synthesizing new DNA strands, it has a fundamental limitation: it can only add nucleotides to a pre-existing 3'-hydroxyl (OH) group. It cannot initiate a new DNA strand from scratch.

To overcome this, a specialized enzyme called primase is required. Primase is a type of RNA polymerase that synthesizes a short segment of RNA, typically 5-10 nucleotides long, called an RNA primer. This RNA primer is complementary to the DNA template strand and provides the necessary free 3'-OH group. Once the RNA primer is laid down, DNA polymerase can then extend this primer by adding deoxyribonucleotides, thus initiating the synthesis of the new DNA strand.

Let's clarify the roles of other enzymes mentioned:
DNA Polymerase I: In prokaryotes, it removes RNA primers and fills the gaps with DNA, and also plays a role in DNA repair.
DNA Ligase: Joins the Okazaki fragments (short DNA segments synthesized on the lagging strand) by forming phosphodiester bonds.
Helicase: Unwinds the DNA double helix at the replication fork, separating the two parental strands.

Therefore, primase is the enzyme specifically responsible for synthesizing the RNA primers that initiate DNA synthesis.

Final Answer : Primase

Answer: (C)

Q21.

Solution

Concept: The mechanism of transcription and the relationship between DNA strands and the resulting mRNA sequence.

Solution: During gene expression, the genetic information encoded in DNA is first transcribed into messenger RNA (mRNA). The DNA molecule is double-stranded, consisting of a coding strand and a template strand.

1. Template Strand (Antisense Strand): This is the DNA strand that serves as the template for RNA synthesis. RNA polymerase reads this strand in the 3' to 5' direction and synthesizes a complementary mRNA molecule in the 5' to 3' direction.
2. Coding Strand (Sense Strand): This is the non-template DNA strand. Its sequence is almost identical to the mRNA sequence, except that thymine (T) in DNA is replaced by uracil (U) in RNA.

Given the sequence of the coding strand of DNA: 5'–ATGCATGC–3'
To derive the mRNA sequence from the coding strand, we simply replace every 'T' with a 'U' while maintaining the 5' to 3' orientation.

DNA Coding strand: 5'– A T G C A T G C –3'
Replace T with U: 5'– A U G C A U G C –3'

Therefore, the sequence of the mRNA will be 5'–AUGCAUGC–3'.

Final Answer : 5'–AUGCAUGC–3'

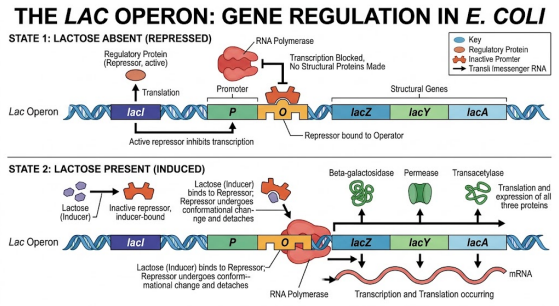
Answer: (D)

Q22.

Solution

Concept: Gene regulation in prokaryotes, specifically the inducible nature of the Lac Operon.

Solution:



The Lac Operon is a classic model for gene regulation in Escherichia coli, controlling the genes necessary for lactose metabolism. It functions as an inducible operon, meaning it is usually "off" and needs to be "turned on" by the presence of an inducer (lactose).

The key components are:
Regulatory gene (i gene): Codes for the repressor protein.
Promoter (P): Binding site for RNA polymerase.
Operator (O): Binding site for the repressor protein.
Structural genes (Z, Y, A): Code for enzymes involved in lactose metabolism.

In the absence of lactose: The repressor protein synthesized by the 'i' gene is active. It binds tightly to the operator region, physically blocking RNA polymerase from transcribing the structural genes. Thus, the operon is "off."

When lactose is present: Lactose, specifically its isomer allolactose, acts as an inducer.
1. Lactose enters the cell and is converted to allolactose.
2. Allolactose then binds directly to the repressor protein.
3. This binding causes a conformational change in the repressor protein, altering its shape.
4. The altered repressor protein can no longer bind to the operator region.
5. With the operator unblocked, RNA polymerase can now bind to the promoter and initiate transcription of the structural genes, leading to the production of enzymes for lactose metabolism.

Therefore, when lactose is present, it binds to the repressor protein, inactivating it and allowing transcription to proceed.

Final Answer : The Repressor protein, inactivating it.

Answer: (C)

Q23.

Solution

Concept: The molecular basis and specific DNA sequences utilized in DNA Fingerprinting.
Solution: DNA Fingerprinting (also known as DNA profiling or DNA typing) is a technique used to establish the identity of an individual by examining unique patterns in their DNA. The human genome contains approximately 3 billion base pairs, but only a small fraction (about 1-2%) codes for proteins. The vast majority of our DNA is non-coding.

DNA fingerprinting focuses on identifying differences in specific regions of this non-coding, repetitive DNA. These regions consist of sequences of nucleotides that are repeated many times, often in tandem. They are highly polymorphic, meaning the number of repeats (and thus the length of the region) varies significantly among individuals, making them unique to almost every person (except identical twins).

The most commonly used types of repetitive DNA for DNA fingerprinting are:
Variable Number Tandem Repeats (VNTRs): These are larger repetitive sequences.
Short Tandem Repeats (STRs): These are smaller repetitive sequences, often 2-5 base pairs long, repeated multiple times.
By analyzing multiple such repetitive regions across an individual's genome, a unique DNA profile can be generated.

In contrast: Coding DNA and Exons are the sequences that code for proteins. While they contain variations, they are generally much less polymorphic and more conserved than repetitive DNA, as mutations in these regions often have functional consequences.
Single-copy DNA refers to unique DNA sequences that appear only once in the haploid genome. While they contribute to genetic variation, the high degree of polymorphism in repetitive DNA makes it ideal for individual identification.

Final Answer : Repetitive DNA

Answer: (B)

Q24.

Solution

Concept: The characteristics and properties of the genetic code, specifically its degeneracy.

Solution: The genetic code is the set of rules by which information encoded within genetic material (DNA or mRNA sequences) is translated into proteins by living cells. It is read in triplets of nucleotides called codons. Since there are four different nitrogenous bases (A, U, G, C) in mRNA, there are $4^3 = 64$ possible codons.

The term degenerate nature of the genetic code refers to the fact that while each codon specifies only one amino acid (or a stop signal), a single amino acid can be coded for by more than one codon. For example:
Leucine is coded by six different codons (UUA, UUG, CUU, CUC, CUA, CUG).
Arginine is also coded by six different codons (CGU, CGC, CGA, CGG, AGA, AGG).
Even some common amino acids like glycine are coded by multiple codons (GGU, GGC, GGA, GGG).

This redundancy in the genetic code is a significant feature because it provides a buffer against the potentially harmful effects of point mutations. A change in a single nucleotide (a point mutation) might still result in a codon that codes for the same amino acid, thus leading to a "silent mutation" with no change in the protein sequence.

Let's look at why other options are incorrect descriptions of degeneracy:
"One codon codes for more than one amino acid" would mean the code is ambiguous, which it is not (each codon specifies only one amino acid).
"The code is read in a contiguous fashion" describes its non-overlapping nature.
"The same code applies to all organisms" describes its universality.

Final Answer : One amino acid is coded by more than one codon.

Answer: (B)

Q25.

Solution

Concept: The process of RNA splicing and the presence of introns and spliceosomes in different domains of life.

Solution: In eukaryotic cells (like those of fungi, animals, and plants), genes are often discontinuous, meaning they contain non-coding sequences called introns interspersed within the coding sequences called exons. After transcription, the newly synthesized messenger RNA (pre-mRNA) contains both introns and exons.

For this pre-mRNA to become a functional mRNA that can be translated into protein, the introns must be precisely removed, and the exons must be accurately ligated together. This crucial process is called RNA splicing, and it is carried out by large and complex molecular machinery known as spliceosomes. Spliceosomes are composed of small nuclear ribonucleoproteins (snRNPs) and numerous other proteins.

Prokaryotic cells (e.g., bacteria), in contrast to eukaryotes, generally have continuous genes that do not contain introns. Therefore, their pre-mRNA does not require splicing, and consequently, they do not possess spliceosomes. The transcription and translation processes in bacteria are often coupled and occur almost simultaneously in the cytoplasm.

Hence, spliceosomes are a characteristic feature of eukaryotic gene expression and are not found in bacteria.

Final Answer : Bacteria

Answer: (C)

Q26.

Solution

Concept: The experimental evidence identifying DNA as the genetic material (Avery, MacLeod, and McCarty experiment).

Solution: In 1944, Oswald Avery, Colin MacLeod, and Maclyn McCarty conducted a pivotal experiment that provided definitive evidence that DNA, not protein or RNA, was the "transforming principle" observed by Frederick Griffith in 1928. Griffith's experiment showed that a "transforming principle" from heat-killed virulent (S-strain) bacteria could genetically transform non-virulent (R-strain) bacteria into virulent S-strain bacteria.

Avery and his colleagues aimed to identify the chemical nature of this transforming principle. They took heat-killed S-strain bacteria and subjected them to a purification process to isolate major biochemical components: proteins, RNA, and DNA. They then tested each component for its ability to transform R-strain bacteria into S-strain bacteria. Their experimental approach involved selectively degrading each component with specific enzymes:

1. Proteases: When S-strain extract was treated with proteases (enzymes that degrade proteins), transformation still occurred. This indicated that proteins were not the transforming principle.

2. RNases: When S-strain extract was treated with RNases (enzymes that degrade RNA), transformation still occurred. This indicated that RNA was not the transforming principle.

3. DNases: When S-strain extract was treated with DNases (enzymes that degrade DNA), transformation was inhibited. This crucial result demonstrated that the integrity of DNA was essential for the transformation process to occur. Without functional DNA from the S-strain, the R-strain bacteria could not acquire the genetic information to become virulent.

Therefore, the collective findings, particularly the inhibition of transformation by DNases, conclusively proved that DNA was the genetic material responsible for heredity. All the statements (A, B, and C) represent correct observations from their experiment that collectively led to this conclusion.

Final Answer : All of the above.

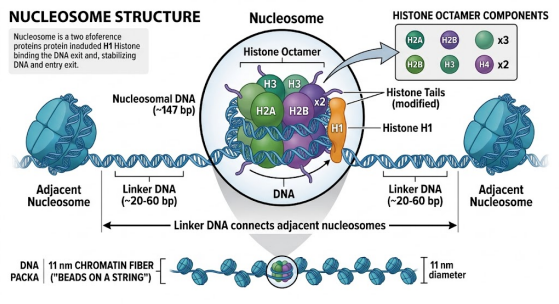
Answer: (D)

Q27.

Solution

Concept: DNA packaging in eukaryotic cells, specifically the structure and number of nucleosomes.

Solution: In eukaryotic cells, DNA is highly organized and packaged into a compact structure called chromatin. The fundamental repeating unit of chromatin is the nucleosome. Each nucleosome consists of approximately 200 base pairs (bp) of DNA tightly wrapped around a core of eight histone proteins (an octamer).



Given:

Total length of DNA in a human diploid cell = 6.6 x $10^9 basepairs(bp)$.

$Approximatelengthof DNAassociatedwithonenucleosome = 200bp.$

To calculate the number of nucleosomes, we divide the total DNA length by the DNA length per nucleosome:

Number of nucleosomes = (Total DNA length) / (DNA length per nucleosome)

Number of nucleosomes = (6.6 x $10^9 bp)/(200bp/nucleosome)$

$Numberof nucleosomes = (6.6/200)x10^9$

$Numberof nucleosomes = 0.033x10^9$

$Numberof nucleosomes = 3.3x10^7$

Final Answer : 3.3 x 10^7

Answer: (A)

Q28.

Solution

Concept: Calculation of allele frequencies in a population based on genotype frequencies, according to the Hardy-Weinberg principle.

Solution: To calculate the frequency of an allele (e.g., allele A), we consider the contribution of that allele from each genotype in the population.

Given:
Total number of individuals = 1000
Number of individuals with genotype AA = 360
Number of individuals with genotype Aa = 480
Number of individuals with genotype aa = 160 (1000 - 360 - 480)

Each individual is diploid, meaning they carry two alleles for the gene. Therefore, the total number of alleles in the population is 2 (Total number of individuals) = 2 1000 = 2000 alleles.

Now, let's count the number of 'A' alleles:
From AA individuals: Each AA individual contributes two 'A' alleles. So, 360 individuals 2 'A' alleles/individual = 720 'A' alleles.
From Aa individuals: Each Aa individual contributes one 'A' allele. So, 480 individuals 1 'A' allele/individual = 480 'A' alleles.
From aa individuals: Each aa individual contributes zero 'A' alleles.

Total number of 'A' alleles = 720 + 480 = 1200 'A' alleles.

The frequency of allele A (denoted as 'p') is calculated as:
p = (Total number of 'A' alleles) / (Total number of alleles in the population)
p = 1200 / 2000
p = 12 / 20
p = 0.6

Final Answer : 0.6

Answer: (C)

Q29.

Solution

Concept: Patterns of evolution, specifically adaptive radiation.

Solution: The description provided, "different species in a given geographical area evolve starting from a point and radiating to other areas," perfectly defines Adaptive Radiation.

Let's break down the concept:

Adaptive Radiation: This is an evolutionary process where a single ancestral species or a small group of species rapidly diversifies into many new forms, each adapted to a specific ecological niche or environment. This often occurs when a species colonizes a new, unexploited habitat (like an island or a newly formed landmass) or when a major environmental change opens up new opportunities. The species "radiates" out from a common point into different forms. Classic examples include Darwin's finches on the Galapagos Islands, which diversified from a common ancestor to fill various feeding niches.

Let's briefly look at why other options are incorrect:

Saltation: Refers to large, sudden, single-step mutations that can lead to speciation, not a pattern of widespread diversification.

Natural Selection: This is the mechanism by which evolution occurs, favoring individuals with advantageous traits, but it's not the name for the pattern of radiation itself. Convergent Evolution: This is when unrelated species evolve similar traits or adaptations independently due to similar environmental pressures, rather than diversifying from a common ancestor in a radiating pattern.

Final Answer : Adaptive Radiation

Answer: (C)

Q30.

Solution

Concept: Evolutionary history of hominids, focusing on changes in brain capacity over time.
Solution: The evolution of hominids is marked by a general trend of increasing brain capacity, reflecting enhanced cognitive abilities. To arrange the given hominids in order of increasing brain capacity, we need to recall their approximate brain sizes:

1. Homo habilis: Often referred to as "handy man," Homo habilis is one of the earliest members of the genus Homo. Their brain capacity ranged approximately from 600 to 800 cubic centimeters (cc).
2. Homo erectus: This species, known for its upright posture and migration out of Africa, had a larger brain capacity, typically ranging from 800 to 1100 cc.
3. Neanderthal man (Homo neanderthalensis): Neanderthals were a robust species that lived in Eurasia. They had an average brain capacity of about 1300 to 1600 cc, which is often larger than that of modern humans (Homo sapiens).

Therefore, the correct order of increasing brain capacity is:
Homo habilis (600-800 cc) $\rightarrow$ Homo erectus (800-1100 cc) $\rightarrow$ Neanderthal man (1300-1600 cc).

Final Answer : Homo habilis $\rightarrow$ Homo erectus $\rightarrow$ Neanderthal man

Answer: (A)

Q31.

Solution

Concept: Different types of natural selection and their effects on phenotypic distribution in a population.

Solution: Natural selection can act on phenotypic variation in a population in different ways, leading to distinct patterns of evolution.

Stabilizing selection is a type of natural selection that favors intermediate variants in a population. It acts against both extreme phenotypes, meaning individuals at either end of the phenotypic spectrum (e.g., very small or very large size) have lower fitness than those with intermediate traits. This type of selection tends to reduce phenotypic variation and maintains the status quo for a particular trait within a stable environment.

Example: Human birth weight. Babies with very low or very high birth weights have higher mortality rates, while those with average birth weights have the highest survival rates.

Let's compare this with other types of selection:
Directional selection: Favors one extreme phenotype over the other (e.g., evolution of larger body size over time).
Disruptive (or diversifying) selection: Favors individuals at both extremes of the phenotypic range over intermediate variants, which can sometimes lead to speciation.

Therefore, stabilizing selection specifically favors intermediate phenotypes.

Final Answer : Intermediate phenotypes.

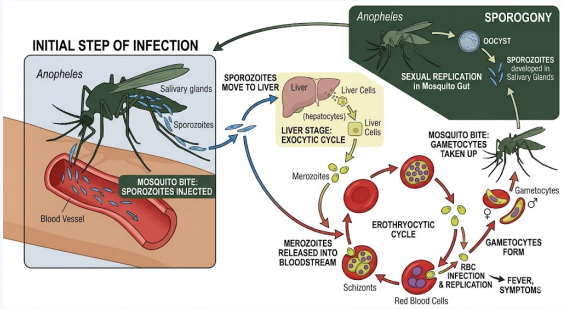
Answer: (B)

Q32.

Solution

Concept: The life cycle of Plasmodium, the parasite causing malaria, and its transmission to humans.

Solution:



Malaria is caused by the protozoan parasite Plasmodium, primarily transmitted to humans through the bite of an infected female Anopheles mosquito. The life cycle of Plasmodium is complex, involving both human and mosquito hosts.

When an infected female Anopheles mosquito bites a human, it injects the parasite in its sporozoite stage into the human bloodstream. These sporozoites are the infective stage for humans.
Once inside the human body:

1. Sporozoites travel to the liver cells, where they multiply asexually.
2. They develop into merozoites, which are then released from the liver cells.
3. Merozoites invade red blood cells (RBCs) and multiply further, leading to the characteristic fever and chills of malaria.
4. Some merozoites within RBCs differentiate into sexual stages called gametocytes.
5. If another female Anopheles mosquito bites the infected person, it ingests these gametocytes.
6. The gametocytes then develop into gametes, undergo fertilization, and form new sporozoites in the mosquito, completing the cycle.

Therefore, the infective stage of Plasmodium that enters the human body through a mosquito bite is the sporozoite.

Final Answer : Sporozoite

Answer: (B)

Q33.

Solution

Concept: Distinction between active and passive immunity.

Solution: Immunity can be broadly classified into two main types: active immunity and passive immunity.

Active Immunity: Develops when the body's own immune system is stimulated to produce antibodies and memory cells in response to exposure to an antigen. This immunity is long-lasting but takes time to develop.
Examples: Vaccination (exposure to attenuated or inactivated pathogens) and natural infection with a pathogen.

Passive Immunity: Occurs when an individual receives pre-formed antibodies from another source. This provides immediate protection but is temporary because the body does not produce its own antibodies and thus no memory cells are formed.
Examples: Transfer of maternal antibodies to a fetus via the placenta or to an infant through breast milk, and the administration of antiserum containing pre-formed antibodies.

Let's analyze the options:
A) Vaccination: Leads to active immunity as the body produces its own antibodies.
B) Natural infection with a virus: Also leads to active immunity as the body produces antibodies in response to the infection.
C) Injection of Anti-tetanus serum (ATS): ATS contains pre-formed antibodies (antitoxins) against the tetanus toxin. When injected, these antibodies provide immediate, but temporary, protection. This is a classic example of passive immunity.
D) Exposure to allergens: Typically triggers an allergic reaction, which is an exaggerated immune response, not a form of acquired immunity providing protection.

Therefore, the injection of Anti-tetanus serum (ATS) provides passive immunity.

Final Answer : Injection of Anti-tetanus serum (ATS)

Answer: (C)

Q34.

Solution

Concept: Mechanisms of carcinogenesis, specifically how physical carcinogens like radiation induce cancer.

Solution: Carcinogenic agents, such as X-rays (ionizing radiation) and UV rays (non-ionizing radiation), are known mutagens that cause damage to DNA. This DNA damage can lead to mutations in crucial genes that regulate cell growth and division.

Two main categories of genes are implicated in cancer when mutated: 1. Proto-oncogenes: These are normal genes that, under controlled conditions, stimulate cell growth and division. When proto-oncogenes are mutated (e.g., by radiation-induced DNA damage), they can become oncogenes. Oncogenes promote uncontrolled cell growth and division, essentially putting the "accelerator" on cell proliferation.
2. Tumor suppressor genes: These are normal genes that regulate the cell cycle, initiate DNA repair, or induce apoptosis (programmed cell death) when DNA damage is irreparable. They act as "brakes" on cell growth. Mutations in tumor suppressor genes (e.g., loss of function) can lead to uncontrolled cell division because the normal inhibitory signals are lost.

X-rays and UV rays primarily cause DNA mutations. These mutations can either activate proto-oncogenes into oncogenes or inactivate tumor suppressor genes. Both outcomes lead to uncontrolled cell proliferation and the development of cancer. Among the given options, "Activating proto-oncogenes to oncogenes" is a direct and well-established mechanism by which these agents cause cancer.

Let's look at why other options are incorrect:
B) Stimulating cell differentiation: Cancer cells typically lose their differentiation, becoming more generalized and proliferative.
C) Increasing contact inhibition: Cancer cells characteristically lose contact inhibition, meaning they continue to divide even when in contact with other cells, forming tumors.
D) Decreasing the rate of mitosis: Cancer is characterized by uncontrolled cell division, which means an increased rate of mitosis.

Final Answer : Activating proto-oncogenes to oncogenes.

Answer: (A)

Q35.

Solution

Concept: Sources of naturally occurring psychoactive compounds and drugs.
Solution: Morphine is a powerful opioid analgesic, primarily used for pain relief and as a sedative. It belongs to a class of drugs known as opiates.

Morphine is naturally extracted from the latex of the opium poppy plant, Papaver somniferum. The milky sap (latex) collected from the unripe seed pods of this plant contains a mixture of alkaloids, including morphine (which is the most abundant), codeine, and thebaine. Opium itself is the dried latex of the opium poppy.

Let's examine the other options:
Leaves of Cannabis sativa: This plant is the source of cannabinoids, such as THC (tetrahydrocannabinol), which is responsible for the psychoactive effects of marijuana. Fruits of Erythroxylum coca: The leaves of this plant (not primarily the fruits) are the source of cocaine, a powerful stimulant.
Flowers of Datura: Various species of Datura contain tropane alkaloids (like atropine, scopolamine, hyoscyamine) that have hallucinogenic and deliriant effects, but they are not sources of morphine.

Therefore, morphine is specifically derived from the latex of Papaver somniferum.

Final Answer : Latex of Papaver somniferum

Answer: (B)

Q36.

Solution

Concept: Water pollution indicators and terms used in sewage treatment.

Solution: In the context of sewage treatment and water quality assessment, "BOD" stands for Biochemical Oxygen Demand (or Biological Oxygen Demand). It is a crucial parameter used to measure the amount of organic pollution in a water sample.

The definition of BOD is: the amount of dissolved oxygen consumed by aerobic microorganisms (mainly bacteria) when they metabolize or oxidize organic matter present in a given volume of water (typically 1 liter) at a specific temperature (usually 20°C) over a fixed period (usually 5 days).

A high BOD value indicates a large amount of biodegradable organic matter in the water, which implies severe pollution. Such water would require a significant amount of oxygen for its decomposition by microbes, leading to depletion of dissolved oxygen available for other aquatic life.
A low BOD value indicates cleaner water with less organic pollution.

Let's look at why other options are incorrect:
BOD measures consumption, not production of oxygen by algae.
While anaerobic digestion is part of sewage treatment, BOD specifically refers to the aerobic decomposition capacity.
BOD focuses on organic matter degradation, not inorganic salts.

Therefore, BOD directly refers to the amount of oxygen consumed by bacteria for organic matter oxidation.

Final Answer : The amount of oxygen consumed if all organic matter in 1L of water were oxidized by bacteria.

Answer: (A)

Q37.

Solution

Concept: Biological control agents used for pest management in agriculture.

Solution: Biological control involves using natural enemies (predators, parasites, pathogens) to suppress pest populations. For controlling butterfly caterpillars (which belong to the order Lepidoptera), several biocontrol agents are effectively used.

Bacillus thuringiensis (Bt): This is a bacterium that produces protein crystals (Bt toxins) during sporulation. These toxins are insect-specific. When ingested by certain insect larvae, including butterfly and moth caterpillars, the alkaline pH of the insect's gut activates the pro-toxin, which then binds to receptors on the gut epithelial cells, creating pores and causing cell lysis and eventually the death of the larva. Bt formulations are widely used as biopesticides.
Baculoviruses: These are insect-specific viruses, often nucleopolyhedrovirus (NPV), that are excellent candidates for species-specific narrow-spectrum insecticidal applications. Many baculoviruses naturally infect and are highly effective against lepidopteran larvae (caterpillars), causing a fatal disease.

Both Bacillus thuringiensis and Baculoviruses are effective biocontrol agents against butterfly caterpillars. However, among the given options, Bacillus thuringiensis is a very commonly cited and commercially used agent for this purpose. If a single best answer is required, both B and C are valid, but Bt is often highlighted for caterpillars. Let's consider common textbook examples.

A) Trichoderma: This is a fungus used as a biocontrol agent against various plant pathogens, not typically insect pests.
D) Ladybird: Ladybird beetles are predators, specifically known for preying on aphids and soft-bodied insects, not typically caterpillars.

Given the choices, both Baculoviruses and Bacillus thuringiensis are appropriate. However, Bacillus thuringiensis is a more broadly recognized and often tested example for caterpillar control. In multiple-choice questions, sometimes one answer is considered more 'direct' or 'best-fit' given typical curricula. Both are correct biocontrol agents for caterpillars. If the question implies a common microbial agent, Bt is very prominent.

Let's re-evaluate. Both are indeed correct. Without further context, it's hard to definitively pick one over the other if only one option is allowed. However, in many curricula, Bacillus thuringiensis is the primary example for microbial control of caterpillars.

Considering typical curriculum emphasis, Bacillus thuringiensis is a very prominent answer for caterpillar control.

Final Answer : Bacillus thuringiensis

Answer: (C)

Q38.

Solution

Concept: The symbiotic relationship between mycorrhizal fungi and plants, and its various benefits.

Solution: Mycorrhiza is a mutualistic symbiotic association between a fungus and the roots of a vascular plant. The fungus colonizes the root system, providing several benefits to the host plant, while the plant supplies carbohydrates to the fungus.

Let's examine the listed functions:

A) Phosphorus absorption: Mycorrhizal fungi significantly enhance the plant's ability to absorb phosphorus from the soil. Fungal hyphae extend far beyond the root depletion zone, increasing the surface area for nutrient uptake, especially for immobile nutrients like phosphate. This is a primary benefit.

B) Resistance to root-borne pathogens: Mycorrhizal colonization can induce systemic resistance in plants and can also create a physical barrier or produce antimicrobial compounds that protect the roots from various soil-borne pathogens.

C) Nitrogen fixation from the atmosphere: Nitrogen fixation is the biological process by which atmospheric nitrogen (N2) is converted into ammonia (NH3), a form usable by plants. This process is carried out primarily by certain bacteria, such as Rhizobium in legume root nodules, and free-living nitrogen-fixing bacteria (e.g., Azotobacter, Cyanobacteria). Mycorrhizal fungi do not have the enzymatic machinery (nitrogenase complex) required for nitrogen fixation.

D) Tolerance to salinity and drought: Mycorrhizal associations can improve a plant's tolerance to various environmental stresses, including drought (by improving water uptake) and salinity (by regulating ion uptake and accumulation).

Therefore, mycorrhiza does NOT help the host plant in nitrogen fixation from the atmosphere.

Final Answer : Nitrogen fixation from the atmosphere.

Answer: (C)

Q39.

Solution

Concept: Classification and function of restriction enzymes in molecular biology.

Solution: Restriction enzymes, also known as restriction endonucleases, are crucial tools in biotechnology. Their primary function is to recognize specific palindromic nucleotide sequences within a DNA molecule and cleave the phosphodiester bonds of the DNA backbone at or near these recognition sites.

Enzymes that cut nucleic acids (DNA or RNA) are broadly classified as nucleases.
Endonucleases cut within the DNA strand.
Exonucleases cut from the ends of the DNA strand.

Restriction enzymes are a type of endonuclease because they cleave internal phosphodiester bonds within the DNA molecule.

Let's consider the other options:
Ligases: Enzymes that join DNA fragments together by forming phosphodiester bonds.
Polymerases: Enzymes that synthesize new DNA or RNA strands using a template (e.g., DNA polymerase, RNA polymerase).
Proteases: Enzymes that break down proteins by cleaving peptide bonds.

Since restriction enzymes specifically cut DNA (a nucleic acid), they belong to the larger class of enzymes called nucleases.

Final Answer : Nucleases

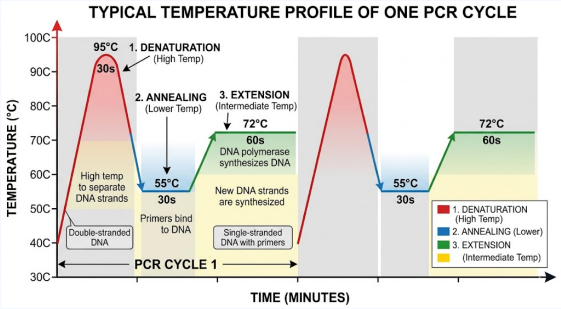
Answer: (C)

Q40.

Solution

Concept: The steps and optimal temperature ranges for each stage of the Polymerase Chain Reaction (PCR).

Solution:



The Polymerase Chain Reaction (PCR) is a molecular biology technique used to amplify specific DNA segments. It involves a cyclical repetition of three main temperature-dependent steps:

1. Denaturation: The reaction mixture is heated to a high temperature (typically 94-98°C) to break the hydrogen bonds between the complementary DNA strands, separating them into single strands.

2. Annealing: The temperature is then lowered to allow the short, single-stranded DNA primers to bind (anneal) to their complementary sequences on the template DNA strands. This step is crucial for specificity. The annealing temperature is typically in the range of 50-60°C, but it can vary depending on the specific primers used (their length and GC content).

3. Extension (or Elongation): The temperature is raised to an optimal temperature for the heat-stable DNA polymerase (e.g., Taq polymerase), which is usually around 72°C. At this temperature, the polymerase synthesizes new DNA strands by adding nucleotides complementary to the template, starting from the annealed primers.

Therefore, the step of 'Annealing' in PCR occurs at approximately 50-60°C.

Final Answer : 50-60°C

Answer: (B)

Q41.

Solution

Concept: The principle and mechanism of DNA fragment separation using gel electrophoresis.
Solution: Gel electrophoresis is a widely used laboratory technique for separating macromolecules like DNA, RNA, and proteins based on their physical properties. In the case of DNA fragments:

1. Charge: DNA molecules are inherently negatively charged due to the phosphate groups in their sugar-phosphate backbone. When placed in an electric field (with a negative electrode at one end and a positive electrode at the other), DNA fragments will migrate towards the positive electrode.

2. Size (and Shape): The gel matrix (typically agarose for DNA) acts as a molecular sieve. As the negatively charged DNA fragments move through the gel, they encounter resistance from the gel matrix. Smaller DNA fragments can navigate through the pores of the gel more easily and quickly than larger fragments. Consequently, smaller fragments travel further down the gel towards the positive electrode, while larger fragments move slower and remain closer to the starting point.

Therefore, DNA fragments are separated primarily based on their size. While their uniform negative charge is essential for their movement through the electric field, it is the difference in their sizes that allows for their separation from one another within the gel matrix. All DNA fragments possess the same charge-to-mass ratio, so charge alone doesn't differentiate them, but size does.

Final Answer : Size only.

Answer: (B)

Q42.

Solution

Concept: Design and functional advantages of different types of bioreactors in industrial biotechnology.

Solution: Bioreactors (fermenters) are vessels designed to provide an optimal environment for the growth of microorganisms or cells to produce desired products. Stirred-tank bioreactors are commonly used for large-scale production.

A "sparged" stirred-tank bioreactor is an improvement over a simple stirred-tank, especially for aerobic processes (where organisms require oxygen for growth).
Sparging: In this design, air or pure oxygen is bubbled (sparged) into the bioreactor medium from the bottom. The sparger disperses the gas into fine bubbles.
Stirring: Impellers (stirrers) mix the contents, ensuring uniform distribution of nutrients, cells, and dissolved gases, and preventing sedimentation. The stirring also helps to break down larger gas bubbles into smaller ones.

The combination of sparging and stirring significantly increases the surface area for oxygen transfer from the gas bubbles into the liquid culture medium. This is a critical factor for the efficient growth of aerobic microorganisms, as oxygen often becomes a limiting factor in large-scale fermentations. A greater oxygen transfer rate allows for higher cell densities and metabolic activity, leading to higher product yields.

Let's look at other options:
A) It has a foam breaker: While important for preventing foam overflow, it's not the primary distinguishing advantage over a simple stirred tank in terms of efficiency for aerobic processes.
C) It allows for anaerobic conditions: Sparging introduces gas, typically air or oxygen, which promotes aerobic conditions, not anaerobic.
D) It uses enzymes instead of bacteria: The type of biocatalyst (enzymes or whole cells/bacteria) is independent of the sparging mechanism.

Therefore, the main advantage of a sparged stirred-tank bioreactor is its enhanced oxygen transfer capability.

Final Answer : It increases the surface area for oxygen transfer.

Answer: (B)

Q43.

Solution

Concept: The molecular mechanism of RNA Interference (RNAi).

Solution: RNA Interference (RNAi) is a powerful, conserved biological process in which RNA molecules inhibit gene expression or translation, by neutralizing targeted mRNA molecules. It serves as a natural defense mechanism against viruses and transposable elements, and is also involved in gene regulation.

The core principle of RNAi involves the introduction of a double-stranded RNA (dsRNA) molecule into the cell. This dsRNA molecule is then processed by an enzyme called Dicer into shorter double-stranded fragments known as small interfering RNAs (siRNAs) or microRNAs (miRNAs).

These small dsRNAs then associate with a protein complex called the RNA-induced silencing complex (RISC). The RISC complex unwinds the dsRNA, retaining one strand (the guide strand) and discarding the other. The guide strand then directs the RISC complex to locate and bind to a complementary messenger RNA (mRNA) molecule. Once bound, the RISC complex cleaves or inhibits the translation of the target mRNA, effectively "silencing" the gene.

Therefore, RNA Interference involves the silencing of a specific mRNA due to a complementary dsRNA molecule.

Final Answer : dsRNA molecule.

Answer: (B)

Q44.

Solution

Concept: The mechanism of action and specificity of Bt toxin in relation to the producing bacterium.

Solution: Bacillus thuringiensis (Bt) is a soil bacterium that produces protein crystals (known as Cry proteins or Bt toxins) during its sporulation phase. These Bt toxins are highly effective insecticides against specific insect orders, particularly lepidopterans (moths and butterflies), coleopterans (beetles), and dipterans (flies and mosquitoes).

The reason Bt toxin does not kill the Bacillus thuringiensis bacterium itself, nor does it typically harm humans or other mammals, lies in its specific activation mechanism:

1. Pro-toxin form: The Bt toxin is initially produced in an inactive form called a pro-toxin. This crystal pro-toxin is insoluble and harmless to the bacterium.

2. Activation in alkaline pH: For the pro-toxin to become active, it needs to be ingested by a susceptible insect. In the highly alkaline pH environment of the insect's midgut, the insoluble pro-toxin crystals are solubilized.

3. Proteolytic cleavage: Once solubilized, specific proteases in the insect gut cleave the pro-toxin, releasing the active toxin fragment.

4. Specific binding and action: This activated toxin then binds to specific receptor sites present only on the epithelial cells lining the insect's midgut. This binding creates pores in the cell membrane, leading to osmotic lysis of the cells and ultimately the death of the insect.

Since Bacillus thuringiensis itself does not have an alkaline gut environment where the pro-toxin can be activated, the toxin remains in its inactive form within the bacterium, causing no harm to the producer. Similarly, in humans and other mammals, the gut pH is generally acidic, and the specific receptors for the toxin are absent, making it harmless.

Final Answer : The toxin is produced in an inactive pro-toxin form.

Answer: (B)

Q45.

Solution

Concept: Recombinant DNA technology and the industrial production of human insulin (Humulin).
Solution: Human insulin consists of two short polypeptide chains: an A chain (21 amino acids) and a B chain (30 amino acids). These two chains are linked together by disulfide bonds. In the body, insulin is synthesized as a single polypeptide precursor called proinsulin, which is then processed by enzymatic cleavage to remove a connecting C-peptide, leaving the A and B chains linked by disulfide bonds.

Eli Lilly, in 1983, was the first company to produce human insulin (Humulin) using recombinant DNA technology. Their approach involved:
1. Synthesizing separate DNA sequences corresponding to the A and B chains of human insulin.
2. Inserting these DNA sequences into separate plasmids of E. coli bacteria.
3. Producing the A chain and B chain separately in E. coli as fusion proteins.
4. Extracting and purifying the A and B chains from the bacterial cultures.
5. Chemically joining the purified A and B chains in vitro (outside the bacterial cell) by forming disulfide bonds to create functional human insulin.

This method was necessary because E. coli cannot perform the complex post-translational modifications, like the precise proteolytic cleavage of proinsulin to form mature insulin, that occurs in eukaryotic cells. The formation of disulfide bonds is crucial for the correct tertiary structure and biological activity of insulin.

Final Answer : Disulfide bonds.

Answer: (C)

Q46.

Solution

Concept: Population age structure and its implications for population growth dynamics, as depicted by age pyramids.

Solution: An age pyramid (or age-sex pyramid) graphically represents the distribution of various age groups in a population (typically by sex). The shape of the pyramid indicates the growth status of the population.

Expanding Population (Triangular shape): If the pre-reproductive age group (youngest individuals) is very large compared to the reproductive and post-reproductive age groups, the base of the pyramid will be broad. This indicates a high birth rate and a large number of individuals entering reproductive age in the near future, leading to a projected increase in population size.

Stable Population (Bell-shaped or Urn-shaped): The pre-reproductive and reproductive age groups are roughly equal in size, with a tapering post-reproductive group. This indicates a relatively stable birth rate and a population that is not expected to grow or decline significantly.

Declining Population (Urn-shaped or Constrictive): The pre-reproductive age group is smaller than the reproductive age group, with a smaller base. This indicates a lower birth rate than the death rate, leading to a projected decrease in population size. Fluctuating: This is not a standard shape for long-term population trends but implies irregular changes.

In the given scenario, a "very large" pre-reproductive population signifies a broad base, which is characteristic of an expanding population.

Final Answer : Expanding

Answer: (C)

Q47.

Solution

Concept: Types of interspecific (between species) ecological interactions.

Solution: Ecological interactions describe the ways in which species interact with each other in an ecosystem. Let's define the given options:

Mutualism: An interaction where both interacting species benefit from the association (e.g., lichens, mycorrhizae). Denoted as (+/+).

Amensalism: An interaction where one species is harmed, and the other is neither benefited nor harmed (e.g., penicillin secreting mold inhibiting bacterial growth). Denoted as (-/0).

Commensalism: An interaction where one species benefits, while the other species is neither harmed nor benefited. The benefitting species is called the commensal, and the other is the host. Denoted as (+/0).

Example: Barnacles living on the back of a whale. The barnacles get a stable habitat, access to food as the whale moves through water, and dispersal. The whale is generally unaffected by the presence of the barnacles.

Parasitism: An interaction where one species (the parasite) benefits at the expense of the other species (the host), causing harm but usually not immediate death (e.g., ticks on dogs, human tapeworms). Denoted as (+/-).

The description "one species is benefited and the other is neither harmed nor benefited" perfectly matches the definition of Commensalism.

Final Answer : Commensalism

Answer: (C)

Q48.

Solution

Concept: Types of ecological pyramids and their shapes in different ecosystems.

Solution: Ecological pyramids are graphical representations showing the relationship between different trophic levels in an ecosystem. They can be of three types:

1. Pyramid of Numbers: Shows the number of individual organisms at each trophic level. This pyramid can be inverted (e.g., a single large tree [producer] supporting thousands of insects [primary consumers]), or spindle-shaped (e.g., many trees supporting fewer deer, which support many parasites).

2. Pyramid of Biomass: Shows the total dry weight or biomass of organisms at each trophic level. This pyramid can also be inverted (e.g., in some aquatic ecosystems, a small biomass of rapidly reproducing phytoplankton [producers] supports a larger biomass of long-lived zooplankton [primary consumers]).

3. Pyramid of Energy: Shows the total amount of energy at each trophic level. This pyramid is always upright. This is because, according to the second law of thermodynamics, there is a substantial loss of energy (as heat) at each successive trophic level transfer (typically only about 10% of energy is transferred to the next level). Therefore, the energy content always decreases as one moves up the trophic levels, making it impossible for the pyramid of energy to be inverted.

Hence, the pyramid of energy is the only ecological pyramid that is always upright.

Final Answer : Pyramid of Energy

Answer: (C)

Q49.

Solution

Concept: Major drivers of biodiversity loss on Earth.

Solution: The "Evil Quartet" is a widely recognized term in conservation biology, coined to describe the four most significant and interconnected causes that lead to biodiversity loss and species extinctions globally. These four major causes are:

1. Habitat loss and fragmentation: The destruction and division of natural habitats is the single most important cause of animal and plant extinctions.

2. Over-exploitation: The unsustainable harvesting of species (e.g., overfishing, overhunting, excessive logging) beyond their capacity to replenish, leading to population declines and extinction.

3. Alien (or invasive) species invasions: The introduction of non-native species into new ecosystems, where they can outcompete native species, disrupt food webs, introduce diseases, or prey on native species, often leading to their decline or extinction.

4. Co-extinctions: When one species becomes extinct, it can lead to the extinction of another species that is closely associated with it (e.g., a parasite going extinct with its host, or a plant pollinator going extinct with the plant).

These four factors collectively exert immense pressure on the world's biodiversity, making them the primary threats leading to the current biodiversity crisis.

Final Answer : Biodiversity loss.

Answer: (B)

Q50.

Solution

Concept: Different strategies for biodiversity conservation.

Solution: Biodiversity conservation strategies are broadly categorized into two main types:

1. In-situ (on-site) Conservation: This approach involves the conservation of genetic resources, species, and ecosystems in their natural habitats. The idea is to protect the entire ecosystem, thereby protecting the species within it.
Examples: National Parks, Wildlife Sanctuaries, Biosphere Reserves, Sacred Groves, Reserved Forests.
2. Ex-situ (off-site) Conservation: This approach involves the conservation of components of biological diversity outside their natural habitats, in controlled environments. This is often done for species facing high threats in their natural environment.
Examples: Zoological Parks (zoos), Botanical Gardens, Seed Banks, Gene Banks, Cryopreservation, tissue culture propagation.
Let's evaluate the given options:

A) Zoological Parks: These are facilities where animals are housed in enclosures, displayed to the public, and conserved outside their natural habitat. This is ex-situ conservation.

B) Botanical Gardens: These are institutions where collections of living plants are cultivated and displayed for scientific, educational, and conservation purposes, again outside their natural habitat. This is ex-situ conservation.

C) Wildlife Sanctuaries: These are protected areas designated for the conservation of wildlife and their habitats. Human activities like harvesting timber or minor forest produce are sometimes allowed, but strict protection is provided to wildlife. This is an example of conservation in the natural habitat. This is in-situ conservation.

D) Cryopreservation: This is a technique where biological materials (like gametes, embryos, or seeds) are preserved by cooling them to very low temperatures (e.g., in liquid nitrogen). This is a form of ex-situ conservation.

Therefore, Wildlife Sanctuaries are an example of In-situ conservation.

Final Answer : Wildlife Sanctuaries

Answer: (C)

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	A	4	B	5	B
6	A	7	C	8	C	9	A	10	A
11	A	12	C	13	B	14	B	15	B
16	B	17	C	18	C	19	B	20	C
21	D	22	C	23	B	24	B	25	C
26	D	27	A	28	C	29	C	30	A
31	B	32	B	33	C	34	A	35	B
36	A	37	C	38	C	39	C	40	B
41	B	42	B	43	B	44	B	45	C
46	C	47	C	48	C	49	B	50	C