

CUET UG Biology Sample Paper - 20

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 there are 8 nuclei, it is 7-celled because:

- (A) Two polar nuclei fuse to form a diploid secondary nucleus before fertilization.
- (B) One synergid degenerates before the entry of the pollen tube.
- (C) The antipodals are not considered true cells.
- (D) The egg cell contains two nuclei.

Q2. Which of the following represents the correct sequence of cells the pollen tube passes through to reach the egg?

- (A) Stigma → Style → Central Cell → Egg
- (B) Stigma → Style → Synergid → Egg
- (C) Stigma → Style → Antipodal → Egg
- (D) Stigma → Style → Filiform apparatus → Central Cell

Q3. Even in the absence of pollinating agents, seed-setting is assured in:

- (A) Commelina
- (B) Zostera
- (C) Salvia



(D) Fig

Q4. Double fertilization is considered a unique event in angiosperms because it involves:

(A) Fusion of two polar nuclei.

(B) Fusion of one male gamete with the egg and another with the secondary nucleus.

(C) Fusion of two male gametes with the egg.

(D) Fusion of one male gamete with the synergid and another with the egg.

Q5. What is the ploidy level of the cells of the nucellus, MMC, functional megaspore, and female gametophyte respectively?

(A) $2n$, $2n$, n , n

(B) n , $2n$, n , $2n$

(C) $2n$, n , $2n$, n

(D) n , n , $2n$, $2n$

Q6. Which hormone level reach a peak during the luteal phase of the menstrual cycle?

(A) LH

(B) FSH

(C) Progesterone

(D) Estrogen

Q7. The process of release of spermatozoa from the seminiferous tubules is called:

(A) Spermiogenesis

(B) Spermiation

(C) Spermatogenesis



(D) Capacitation

Q8. Identify the correct sequence of spermatogenesis:

(A) Spermatogonia → Spermatocyte → Spermatid → Spermatozoa

(B) Spermatogonia → Spermatid → Spermatocyte → Spermatozoa

(C) Spermatocyte → Spermatogonia → Spermatid → Spermatozoa

(D) Spermatid → Spermatocyte → Spermatogonia → Spermatozoa

Q9. The blastocyst becomes embedded in the endometrium of the uterus by a process called:

(A) Fertilization

(B) Cleavage

(C) Implantation

(D) Gastrulation

Q10. In the absence of fertilization, the corpus luteum:

(A) Stops secreting LH.

(B) Degenerates into corpus albicans.

(C) Secretes high amounts of FSH.

(D) Triggers ovulation.

Q11. Match the following contraceptive methods and devices with their specific types or categories:



Column I	Device/Pill	Column II	Category
(a)	Lippes Loop	(i)	Non-phagocytic IUD
(b)	Multiload 375	(ii)	Hormone releasing IUD
(c)	Progestasert	(iii)	Non-medicated IUD
(d)	Saheli	(iv)	Copper releasing IUD
		(v)	Once-a-week pill

- (A) a-iii, b-iv, c-ii, d-v
(B) a-i, b-ii, c-iii, d-iv
(C) a-iv, b-iii, c-ii, d-v
(D) a-ii, b-iv, c-i, d-v

Q12. A procedure in which the embryo with more than 8 blastomeres is transferred into the uterus is:

- (A) ZIFT
(B) GIFT
(C) IUT
(D) ICSI

Q13. Transfer of an ovum collected from a donor into the fallopian tube of another female who cannot produce one is called:

- (A) ZIFT
(B) GIFT
(C) IUI
(D) IVF

Q14. A cross between a tall plant with yellow seeds (TtYy) and a tall plant with green seeds (Tt yy) will yield what proportion of tall-green offspring?



- (A) $1/8$
- (B) $3/8$
- (C) $5/8$
- (D) $3/4$

Q15. In a dihybrid cross, if the recombination frequency between two genes is 50%, it indicates:

- (A) The genes are tightly linked.
- (B) The genes show independent assortment.
- (C) The genes are located on the same chromosome very close to each other.
- (D) No crossing over has occurred.

Q16. Klinefelter's Syndrome is characterized by a karyotype of:

- (A) 45, XO
- (B) 47, XXY
- (C) 47, +21
- (D) 44 + XY

Q17. Down's syndrome is caused by the trisomy of chromosome number:

- (A) 21
- (B) 18
- (C) 13
- (D) 22

Q18. If a color-blind woman marries a normal vision man, their sons will be:

- (A) All normal
- (B) All color-blind



- (C) 50% color-blind
- (D) 75% color-blind

Q19. If the sequence of the coding strand in a transcription unit is 5'-ATGCATGC-3', the sequence of mRNA will be:

- (A) 3'-UACGUACG-5'
- (B) 5'-UACGUACG-3'
- (C) 5'-AUGCAUGC-3'
- (D) 3'-AUGCAUGC-5'

Q20. Which enzyme is responsible for the removal of RNA primers during DNA replication?

- (A) DNA Polymerase I
- (B) DNA Polymerase III
- (C) Primase
- (D) Helicase

Q21. In the Lac Operon, the 'i' gene codes for:

- (A) Inducer
- (B) Repressor
- (C) β -galactosidase
- (D) Permease

Q22. Satellite DNA is important because it:

- (A) Codes for proteins needed for cell cycle.
- (B) Shows a high degree of polymorphism and does not code for proteins.
- (C) Codes for enzymes needed for DNA replication.



(D) Is present only in prokaryotes.

Q23. The amino acid is attached to the tRNA at its:

- (A) 5' end
- (B) 3' end
- (C) Anticodon loop
- (D) DHU loop

Q24. In a population of 1000 individuals, 360 belong to genotype AA, 480 to Aa and the remaining 160 to aa. Based on this data, the frequency of allele A in the population is:

- (A) 0.4
- (B) 0.5
- (C) 0.6
- (D) 0.7

Q25. The appearance of different forms of beaks in finches on the Galapagos Islands is an example of:

- (A) Convergent Evolution
- (B) Adaptive Radiation
- (C) Parallel Evolution
- (D) Saltation

Q26. Which of the following was the first hominid-like being with a brain capacity between 650-800cc?

- (A) Homo erectus
- (B) Homo habilis
- (C) Australopithecus



(D) Neanderthal man

Q27. A flowering plant has 24 chromosomes in its leaf cells. What will be the number of chromosomes in its endosperm, pollen grain, and nucellus respectively?

(A) 36, 12, 24

(B) 24, 12, 24

(C) 36, 12, 12

(D) 24, 12, 12

Q28. In an embryo sac, the filiform apparatus is a characteristic feature of:

(A) Egg cell

(B) Synergids

(C) Antipodal cells

(D) Central cell

Q29. Which of the following is an example of a polyembryony condition?

(A) Mango

(B) Citrus

(C) Groundnut

(D) Castor

Q30. The phenomenon where the ovary develops into a fruit without fertilization is called:

(A) Parthenogenesis

(B) Apomixis

(C) Parthenocarpy

(D) Polyembryony



- Q31.** During oogenesis, the first meiotic division is completed within the:
- (A) Primary follicle
 - (B) Secondary follicle
 - (C) Tertiary follicle
 - (D) Graafian follicle
- Q32.** The part of the fallopian tube closest to the ovary is the:
- (A) Isthmus
 - (B) Ampulla
 - (C) Infundibulum
 - (D) Cervix
- Q33.** Which of the following secretions constitute the seminal plasma?
- (A) Prostate, Pancreas, Bulbourethral glands
 - (B) Seminal vesicle, Prostate, Bulbourethral glands
 - (C) Seminal vesicle, Liver, Bulbourethral glands
 - (D) Prostate, Seminal vesicle, Kidneys
- Q34.** The signal for parturition originates from:
- (A) Placenta only
 - (B) Fully developed fetus only
 - (C) Both placenta and fully developed fetus
 - (D) Oxytocin released from maternal pituitary
- Q35.** The "Saheli" oral contraceptive pill works by:
- (A) Inhibiting ovulation



- (B) Preventing implantation by blocking estrogen receptors
- (C) Increasing the thickness of cervical mucus
- (D) Killing the sperms in the uterus

Q36. In which of the following techniques are the sperms directly injected into the ovum?

- (A) GIFT
- (B) ZIFT
- (C) ICSI
- (D) IUI

Q37. MTP (Medical Termination of Pregnancy) is considered relatively safe up to how many weeks of pregnancy?

- (A) 8 weeks
- (B) 12 weeks
- (C) 18 weeks
- (D) 20 weeks

Q38. In a pedigree analysis, a solid symbol (shaded) represents:

- (A) Normal individual
- (B) Affected individual
- (C) Carrier individual
- (D) Death of individual

Q39. The distance between genes and the percentage of recombination shows:

- (A) Inverse relationship
- (B) Direct relationship



- (C) No relationship
- (D) Parallel relationship

Q40. Which of the following is a result of "nullisomy" ($2n - 2$)?

- (A) Turner's Syndrome
- (B) Klinefelter's Syndrome
- (C) Down's Syndrome
- (D) Not viable in humans (usually plants)

Q41. A pleiotropic gene:

- (A) Controls only one phenotype
- (B) Controls multiple phenotypes
- (C) Is expressed only in the presence of another gene
- (D) Is located on the Y-chromosome

Q42. During DNA replication, the Okazaki fragments are joined by the enzyme:

- (A) DNA Polymerase I
- (B) DNA Ligase
- (C) Helicase
- (D) Topoisomerase

Q43. Which of the following codons acts as a dual-function codon (codes for Methionine and acts as a Start codon)?

- (A) UAA
- (B) UGA
- (C) AUG
- (D) UUU



- Q44.** In DNA fingerprinting, VNTRs stand for:
- (A) Very Narrow Tandem Repeats
 - (B) Variable Number of Tandem Repeats
 - (C) Visualized Number of Tandem Regions
 - (D) Variable Non-Transcription Regions
- Q45.** If the DNA contains 20% Adenine, what will be the percentage of Guanine?
- (A) 20%
 - (B) 30%
 - (C) 40%
 - (D) 80%
- Q46.** The structural gene in a transcription unit is polycistronic in:
- (A) Eukaryotes
 - (B) Prokaryotes
 - (C) Both A and B
 - (D) None of the above
- Q47.** The process of splicing in eukaryotes involves:
- (A) Removal of exons and joining of introns
 - (B) Removal of introns and joining of exons
 - (C) Addition of a methyl guanosine cap
 - (D) Addition of a poly-A tail
- Q48.** In the Hardy-Weinberg equation, the term $2pq$ represents:
- (A) Frequency of homozygous dominant individuals



- (B) Frequency of homozygous recessive individuals
- (C) Frequency of heterozygous individuals
- (D) Total number of alleles in the population

Q49. Industrial melanism, as observed in the peppered moth (*Biston betularia*), is an example of:

- (A) Natural Selection
- (B) Mutation
- (C) Genetic Drift
- (D) Anthropogenic Evolution

Q50. According to Hugo de Vries, the mechanism of evolution is:

- (A) Multiple step mutations
- (B) Saltation (single-step large mutation)
- (C) Phenotypic variations
- (D) Minor variations



Detailed Solutions

Q1.

Solution

Concept: The typical angiospermic embryo sac (the female gametophyte) develops through a process called **megagametogenesis**. At maturity, the embryo sac contains 8 nuclei distributed among specific cells, but the total number of cells is 7 due to the unique structure of the central cell.

Solution: The distribution of the 8 nuclei within the embryo sac is as follows:

- **Egg Apparatus:** Located at the micropylar end, consisting of one egg cell and two synergids (3 cells, each with 1 nucleus).
- **Antipodals:** Located at the chalazal end, consisting of three cells (3 cells, each with 1 nucleus).
- **Central Cell:** A single large cell located in the center that contains the remaining **two polar nuclei**.

Since the two polar nuclei remain within the cytoplasm of a single, large **central cell** until they fuse (often just before fertilization to form a diploid secondary nucleus), the embryo sac is described as being **8-nucleate but 7-celled**.

Final Answer: The correct option is A.

Answer: (A)



Q2.

Solution

Concept: The journey of the pollen tube from the surface of the carpel to the female gamete is a highly directed process. After germination on the **stigma**, the pollen tube grows through the tissues of the **style** to reach the ovary.

To enter the embryo sac, the pollen tube is guided by the **filiform apparatus** located at the micropylar end of the **synergids**. The pollen tube enters one of the synergids, where it ruptures to release the male gametes, which then move toward the egg cell and the central cell.

Solution: The sequential pathway followed by the pollen tube is:

- (a) **Stigma:** The site of pollen deposition and germination.
- (b) **Style:** The elongated tube through which the pollen tube grows.
- (c) **Synergid:** The pollen tube enters the embryo sac specifically through one of the synergids (guided by the filiform apparatus).
- (d) **Egg:** Once inside the synergid, the male gamete is released to fuse with the egg cell (Syngamy).

Therefore, the correct sequence is Stigma → Style → Synergid → Egg. Note that while the filiform apparatus is part of the entry mechanism, option B provides the correct cellular sequence ending at the egg.

Final Answer: The correct option is B.

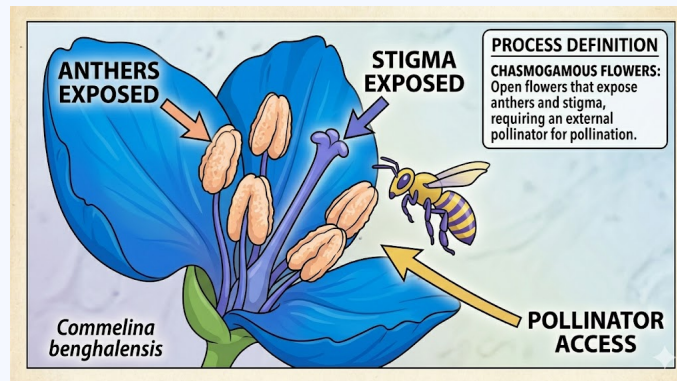
Answer: (B)



Q3.

Solution

Concept: Seed-setting without the need for external pollinators occurs in plants that possess **cleistogamous flowers**. These are flowers that do not open at all. In such flowers, the anthers and stigma lie close to each other; when anthers dehisce in the flower buds, pollen grains come in contact with the stigma to effect pollination. This is a form of guaranteed **autogamy** (self-pollination).



Solution: Among the given options:

- **Commelina:** Produces two types of flowers: chasmogamous (open flowers) and **cleistogamous** (closed flowers). The cleistogamous flowers ensure seed-set even in the absence of pollinators.
- **Zostera:** A marine angiosperm that requires water as a pollinating agent (hydrophily).
- **Salvia:** Highly adapted for insect pollination (entomophily) using a lever mechanism.
- **Fig:** Depends entirely on a specific species of wasp for pollination (mutualism).

Since *Commelina* possesses flowers that never open, it provides an assured seed-set regardless of the availability of pollinating agents.

Final Answer: The correct option is A.

Answer: (A)



Q4.

Solution

Concept: **Double fertilization** is a complex fertilization mechanism unique to angiosperms (flowering plants). It involves the participation of two male gametes brought by a single pollen tube into the embryo sac.

The process consists of two distinct fusion events:

- (a) **Syngamy:** One male gamete (n) fuses with the egg cell (n) to form a diploid **zygote** ($2n$).
- (b) **Triple Fusion:** The second male gamete (n) fuses with the two polar nuclei (or the diploid **secondary nucleus**) ($2n$) in the central cell to form a triploid **Primary Endosperm Nucleus (PEN)** ($3n$).

Solution: The uniqueness of this event lies in the fact that both male gametes are functional and participate in two different types of fusion within the same embryo sac.

- Option A describes only a part of the preparation for triple fusion.
- Option C and D are biologically incorrect as male gametes do not fuse with two eggs or synergids.
- **Option B** accurately captures both components of double fertilization: generative fertilization (egg) and vegetative fertilization (secondary nucleus).

Final Answer: The correct option is B.

Answer: (B)



Q5.

Solution

Concept: Ploidy refers to the number of sets of chromosomes in a cell. In the life cycle of an angiosperm, there is an alternation of generations between the diploid **sporophyte** ($2n$) and the haploid **gametophyte** (n).

- **Sporophytic tissues** ($2n$): Any part of the main plant body, such as the nucellus and the Megaspore Mother Cell (MMC).
- **Meiosis:** The MMC undergoes meiosis to produce haploid spores.
- **Gametophytic tissues** (n): The functional megaspore and the resulting embryo sac (female gametophyte) are haploid.

Solution: By analyzing each part mentioned:

- (a) **Nucellus:** This is the diploid sporophytic tissue ($2n$) surrounding the embryo sac.
- (b) **MMC (Megaspore Mother Cell):** A specialized diploid cell ($2n$) in the nucellus that is destined to undergo meiosis.
- (c) **Functional Megaspore:** The product of meiosis; out of four megaspores formed, one remains functional and is haploid (n).
- (d) **Female Gametophyte:** Also known as the embryo sac, it develops from the functional megaspore through mitosis, thus maintaining the haploid (n) state.

The resulting ploidy sequence is $2n, 2n, n, n$.

Final Answer: The correct option is A.

Answer: (A)

Q6.

Solution

Concept: The luteal phase (secretory phase) occurs after ovulation. The ruptured Graafian follicle transforms into the **corpus luteum**, which acts as a temporary endocrine gland. Its primary function is to secrete large amounts of hormones to prepare the endometrium for potential implantation.

Solution: During the luteal phase, **Progesterone** levels rise significantly and reach a peak. This hormone is essential for maintaining the thickened uterine lining. While Estrogen also has a smaller second peak during this phase, Progesterone is the dominant hormone characteristic of the luteal phase. LH and FSH peak earlier, specifically during the ovulatory surge.

Final Answer: The correct option is C.

Answer: (C)



Q7.

Solution

Concept: The process of sperm formation and release involves several distinct stages with specific terminology:

- **Spermatogenesis:** The entire process of sperm production.
- **Spermiogenesis:** The transformation of non-motile spermatids into motile spermatozoa.
- **Spermiation:** The final release of mature spermatozoa from the Sertoli cells into the lumen of the seminiferous tubules.

Solution: The specific term for the release of spermatozoa from the seminiferous tubules is ****Spermiation****.

Final Answer: The correct option is B.

Answer: (B)

Q8.

Solution

Concept: Spermatogenesis is the stepwise development of male gametes within the testes. It follows a specific order of cellular differentiation and division.

Solution: The correct sequence is:

- (a) **Spermatogonia:** Diploid stem cells at the periphery of the seminiferous tubule.
- (b) **Spermatocytes:** Primary spermatocytes undergo meiosis I, and secondary spermatocytes undergo meiosis II.
- (c) **Spermatids:** Haploid, non-motile cells produced after meiosis.
- (d) **Spermatozoa:** Mature, motile sperm cells formed after spermiogenesis.

Final Answer: The correct option is A.

Answer: (A)



Q9.

Solution

Concept: Following fertilization in the ampulla of the fallopian tube, the zygote undergoes rapid mitotic divisions called **cleavage** as it moves toward the uterus. It develops into a morula and then a **blastocyst**.

Solution: The process where the blastocyst attaches to and becomes embedded within the nutrient-rich thick wall (endometrium) of the uterus is called **Implantation**. This typically occurs about 6–9 days after fertilization.

Final Answer: The correct option is C.

Answer: (C)

Q10.

Solution

Concept: The survival of the corpus luteum depends on the presence of Human Chorionic Gonadotropin (hCG), which is secreted by the developing embryo if fertilization occurs.

Solution: In the absence of fertilization, there is no hCG to maintain the corpus luteum. Consequently, it begins to regress and **degenerates** into a white scar-like tissue called the **corpus albicans**. This leads to a drop in progesterone levels, triggering the breakdown of the endometrium and the start of menstruation.

Final Answer: The correct option is B.

Answer: (B)



Q11.

Solution

Concept: Contraceptive methods are categorized based on their mechanism of action. Intrauterine Devices (IUDs) are inserted by doctors into the uterus and are further classified into non-medicated, copper-releasing, and hormone-releasing types. Oral contraceptives (pills) are another common method.

Solution: Matching the items from Column I to Column II:

- **(a) Lippes Loop:** A **Non-medicated IUD** (iii) that increases phagocytosis of sperm within the uterus.
- **(b) Multiload 375:** A **Copper releasing IUD** (iv). Copper ions suppress sperm motility and fertilizing capacity.
- **(c) Progestasert:** A **Hormone releasing IUD** (ii) which makes the uterus unsuitable for implantation and the cervix hostile to sperm.
- **(d) Saheli:** A non-steroidal oral contraceptive pill developed by CDRI, Lucknow, which is taken as a **Once-a-week pill** (v).

Matching results: a-iii, b-iv, c-ii, d-v.

Final Answer: The correct option is A.

Answer: (A)

Q12.

Solution

Concept: In Vitro Fertilization (IVF) is followed by **Embryo Transfer (ET)**. Depending on the stage of the embryo, there are two main transfer techniques:

- (a) **ZIFT (Zygote Intra Fallopian Transfer):** The zygote or early embryo (up to 8 blastomeres) is transferred into the fallopian tube.
- (b) **IUT (Intra Uterine Transfer):** The embryo at a later stage (**more than 8 blastomeres**) is transferred directly into the uterus.

Solution: Since the question specifies an embryo with more than 8 blastomeres being transferred into the uterus, the procedure is identified as **IUT**.

Final Answer: The correct option is C.

Answer: (C)



Q13.

Solution

Concept: Assisted Reproductive Technologies (ART) include various methods to help couples conceive. When a female cannot produce an ovum but can provide a suitable environment for fertilization and further development, specific transfer techniques are used.

Solution: The transfer of an ovum collected from a donor into the ****fallopian tube**** of another female is called ****GIFT (Gamete Intra Fallopian Transfer)****.

- **ZIFT** involves transferring a zygote.
- **IUI** involves artificial insemination of semen.
- **IVF** refers to fertilization occurring outside the body.

Final Answer: The correct option is B.

Answer: (B)

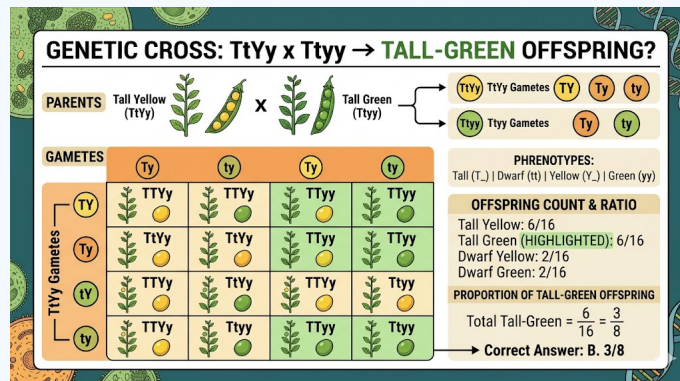


Q14.

Solution

Concept: To find the proportion of offspring in a cross involving two genes, we can use a Punnett square or the product rule of probability. We are crossing:

- **Parent 1:** $TtYy$ (Tall, Yellow)
- **Parent 2:** $Ttyy$ (Tall, Green)



Solution: We break this into two monohybrid crosses:

- Height ($Tt \times Tt$):** The offspring proportions are $\frac{3}{4}$ Tall (TT, Tt, Tt) and $\frac{1}{4}$ dwarf (tt).
- Seed Color ($Yy \times yy$):** This is a test cross. The offspring proportions are $\frac{1}{2}$ Yellow (Yy) and $\frac{1}{2}$ Green (yy).

To find the proportion of ****Tall-Green**** offspring:

$$\text{Proportion} = \text{Probability of Tall} \times \text{Probability of Green}$$

$$\text{Proportion} = \frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$$

Final Answer: The correct option is B.

Answer: (B)

Q15.

Solution

Concept: Recombination frequency measures the distance between genes on a chromosome.

- If genes are close together, they are linked and recombination frequency is low.
- A recombination frequency of **50%** is the maximum possible value.

Solution: When the recombination frequency is 50%, it means the genes are either on different chromosomes or very far apart on the same chromosome. In both cases, the genes behave as if they are segregating independently. This is the hallmark of **independent assortment**.

Final Answer: The correct option is B.

Answer: (B)

Q16.

Solution

Concept: Chromosomal disorders arise due to the gain or loss of autosomes or sex chromosomes. Klinefelter's syndrome is a genetic condition where a male is born with an extra copy of the X chromosome.

Solution: The karyotype for Klinefelter's syndrome is **47, XXY**. This means the individual has a total of 47 chromosomes (one extra X), resulting in a masculine development that often includes sterile testes and some feminine characteristics (like gynaecomastia).

- 45, XO is Turner's Syndrome.
- 47, +21 is Down's Syndrome.

Final Answer: The correct option is B.

Answer: (B)



Q17.

Solution

Concept: Aneuploidy is the condition of having an abnormal number of chromosomes. **Tri-somy** refers to the presence of three copies of a specific chromosome instead of the usual two.

Solution: **Down's syndrome** is a well-known genetic disorder caused by the presence of an extra copy of **chromosome number 21**. It was first described by Langdon Down in 1866 and results in physical and mental developmental delays.

Final Answer: The correct option is A.

Answer: (A)

Q18.

Solution

Concept: Color-blindness is an **X-linked recessive** disorder.

- X^c = chromosome carrying the color-blind allele.
- X = chromosome carrying the normal allele.

Solution: Let's analyze the genotypes of the parents:

- **Color-blind woman:** $X^c X^c$ (Both X chromosomes carry the mutation).
- **Normal vision man:** XY (His single X chromosome is normal).

When we look at the male offspring (sons), they inherit the **Y chromosome from the father** and one **X chromosome from the mother**. Since the mother only has X^c to give, every son will have the genotype $X^c Y$. Because males only have one X chromosome, the recessive allele will express itself.

Therefore, **all sons will be color-blind**.

Final Answer: The correct option is B.

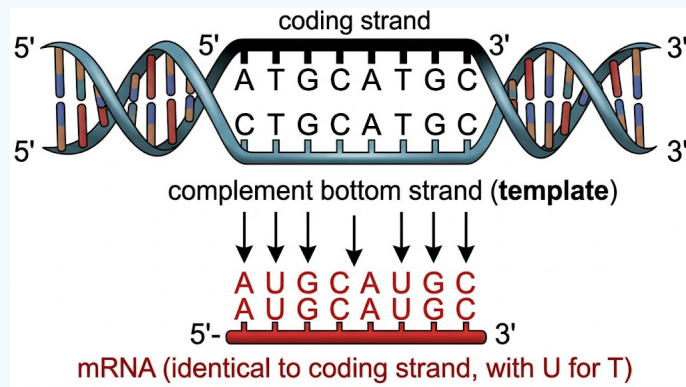
Answer: (B)



Q19.

Solution

Concept: In transcription, the DNA has two strands: the **template strand** and the **coding strand**. The mRNA sequence is complementary to the template strand. However, the coding strand (also called the sense strand) has the exact same sequence as the mRNA, with the only difference being that **Thymine (T)** in DNA is replaced by **Uracil (U)** in RNA.



Solution: Given the coding strand: 5'-ATGCATGC-3' The mRNA will have the same sequence and polarity, swapping T for U: 5'-AUGCAUGC-3'

Final Answer: The correct option is C.

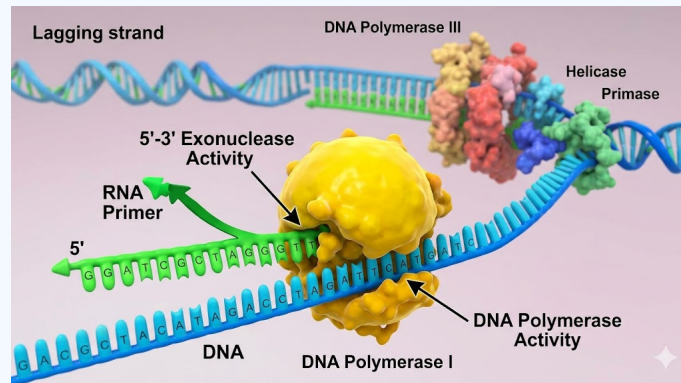
Answer: (C)



Q20.

Solution

Concept: DNA replication requires an RNA primer to initiate synthesis. Once replication is underway, these primers must be removed and replaced with DNA nucleotides to maintain a continuous DNA strand.



Solution: In prokaryotes like *E. coli*:

- **DNA Polymerase III** does the bulk of the synthesis.
- **DNA Polymerase I** (also known as Kornberg enzyme) possesses 5' → 3' exonuclease activity, which allows it to **remove RNA primers** and fill the gaps with DNA.

Final Answer: The correct option is A.

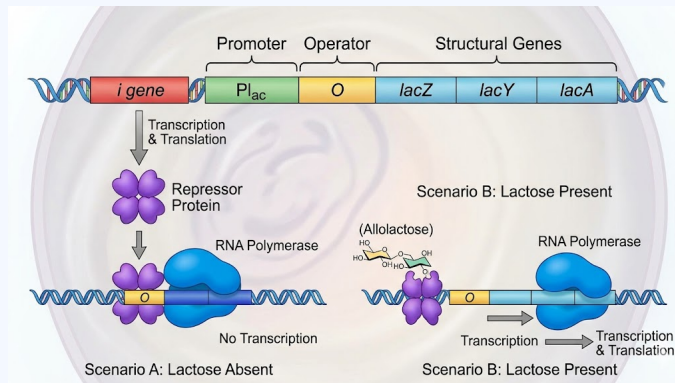
Answer: (A)



Q21.

Solution

Concept: The Lac Operon is a classic model for gene regulation. It consists of regulatory genes and structural genes. The 'i' gene (inhibitor) is a constitutive gene, meaning it is expressed all the time.



Solution: The *'i' gene* codes for the repressor protein. This repressor binds to the operator region in the absence of an inducer (lactose), preventing RNA polymerase from transcribing the structural genes (*z*, *y*, *a*).

Final Answer: The correct option is B.

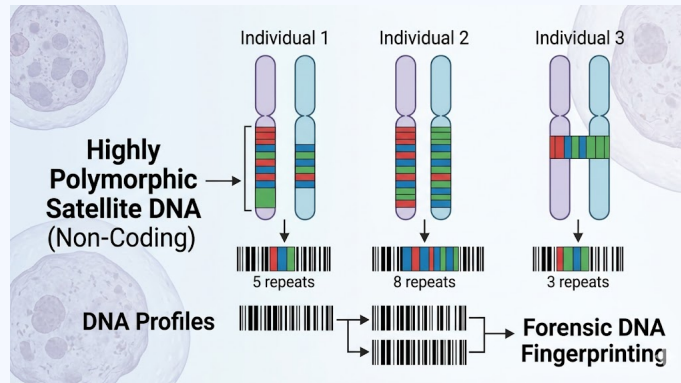
Answer: (B)



Q22.

Solution

Concept: DNA fingerprinting relies on specific regions of the genome called Satellite DNA. These consist of repetitive sequences that do not code for any proteins but make up a large portion of the human genome.



Solution: **Satellite DNA** is significant because it shows a **high degree of polymorphism** (variation at the genetic level). This variation is inherited from parents to children, making it an ideal tool for forensic identification and paternity testing.

Final Answer: The correct option is B.

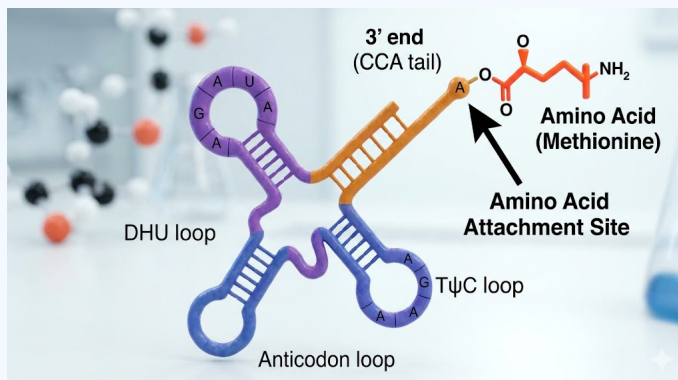
Answer: (B)



Q23.

Solution

Concept: The tRNA (transfer RNA) molecule acts as an adapter, matching specific amino acids to their corresponding codons on mRNA during translation. It has a specific "clover-leaf" secondary structure.



Solution: Every tRNA molecule has a specific sequence (CCA) at its 3' end. This is known as the amino acid acceptor end, where the amino acid is covalently attached through the action of aminoacyl-tRNA synthetase.

Final Answer: The correct option is B.

Answer: (B)

Q24.

Solution

Concept: According to the Hardy-Weinberg principle, the frequency of genotypes in a population is given by $p^2 + 2pq + q^2 = 1$, where p is the frequency of the dominant allele (A) and q is the frequency of the recessive allele (a).

Solution: Total individuals = 1000.

- $AA = 360 \implies \text{Frequency } (p^2) = 360/1000 = 0.36.$
- $Aa = 480 \implies \text{Frequency } (2pq) = 480/1000 = 0.48.$

To find the frequency of allele A (p):

$$p = \sqrt{p^2} = \sqrt{0.36} = 0.6$$

Alternatively, using the allele counting method:

$$p = \frac{2(AA) + (Aa)}{2(\text{Total})} = \frac{2(360) + 480}{2000} = \frac{720 + 480}{2000} = \frac{1200}{2000} = 0.6$$

Final Answer: The correct option is C.

Answer: (C)



Q25.

Solution

Concept: Evolutionary processes describe how species change over time to suit their environments. When a single ancestral species evolves into multiple diverse forms to occupy different ecological niches, it is a specific phenomenon.

Solution: The finches of the Galapagos Islands started from a common ancestral seed-eating bird and radiated into different forms (insectivorous, fruit-eating, etc.) with different beak shapes. This is the classic example of **Adaptive Radiation**.

Final Answer: The correct option is B.

Answer: (B)

Q26.

Solution

Concept: Human evolution is traced through various hominid stages, defined largely by brain capacity (cranial capacity) and tool-making abilities.

Solution:

- **Australopithecus:** Early hominids, brain capacity around 400-600cc.
- **Homo habilis:** Known as the 'handy man' (first tool maker). Their brain capacity was between **650-800cc**.
- **Homo erectus:** Larger brain, around 900cc.
- **Neanderthal man:** Very large brain, around 1400cc.

Final Answer: The correct option is B.

Answer: (B)



Q27.

Solution

Concept: The ploidy level of various plant parts is determined by their origin in the life cycle:

- **Leaf cells/Nucellus:** Diploid ($2n$) - Part of the main sporophyte.
- **Pollen grain/Male gamete:** Haploid (n) - Part of the gametophyte.
- **Endosperm:** Triploid ($3n$) - Result of triple fusion ($n + n + n$).

Solution: Given that leaf cells ($2n$) = 24, then $n = 12$.

- **Endosperm ($3n$):** $3 \times 12 = 36$.
- **Pollen grain (n):** $1 \times 12 = 12$.
- **Nucellus ($2n$):** $2 \times 12 = 24$.

The sequence is 36, 12, 24.

Final Answer: The correct option is B.

Answer: (B)

Q28.

Solution

Concept: The **filiform apparatus** consists of finger-like projections or cellular thickenings located at the micropylar tip of the synergids.

Solution: The filiform apparatus plays a crucial role in guiding the pollen tube into the embryo sac by secreting chemical attractants. It is a characteristic feature of the **synergids**.

Final Answer: The correct option is B.

Answer: (B)



Q29.

Solution

Concept: **Polyembryony** is the occurrence of more than one embryo in a seed. In many plants, nucellar cells surrounding the embryo sac start dividing and protrude into the embryo sac to develop into embryos.

Solution: This condition is most commonly observed in **Citrus** species (like oranges and lemons) and Mango. In these cases, a single seed contains multiple embryos of different genetic makeups.

Final Answer: The correct option is B.

Answer: (B)

Q30.

Solution

Concept: There are several terms for "asexual" reproduction in plants:

- **Apomixis:** Production of seeds without fertilization.
- **Parthenocarpy:** Development of **fruit** without fertilization (results in seedless fruits).

Solution: The phenomenon where the ovary directly develops into a fruit without the fertilization of ovules is called **Parthenocarpy**. Bananas are a natural example.

Final Answer: The correct option is C.

Answer: (C)

Q31.

Solution

Concept: Oogenesis is the process of formation of a mature female gamete. Unlike spermatogenesis, it begins during the embryonic development stage.

Solution: The primary oocyte within the **tertiary follicle** completes its first meiotic division. This division is unequal, resulting in a large haploid secondary oocyte and a tiny first polar body.

Final Answer: The correct option is C.

Answer: (C)



Q32.

Solution

Concept: The fallopian tube (oviduct) consists of several sections: the isthmus (near the uterus), the ampulla (middle wide part), and the infundibulum (near the ovary).

Solution: The part closest to the ovary is the funnel-shaped **infundibulum**, which possesses finger-like projections called fimbriae to collect the ovum after ovulation.

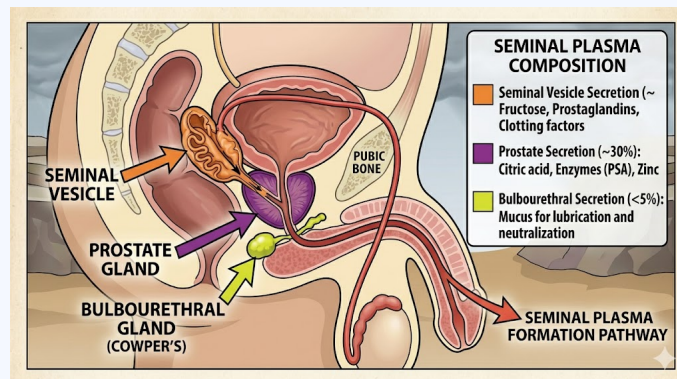
Final Answer: The correct option is C.

Answer: (C)

Q33.

Solution

Concept: Seminal plasma is the fluid part of the semen that provides nutrition and a medium for sperm transport. It is rich in fructose, calcium, and certain enzymes.



Solution: The seminal plasma is constituted by the secretions of the male accessory glands:

- (a) **Seminal vesicles** (paired)
- (b) **Prostate gland** (single)
- (c) **Bulbourethral glands** (paired, also known as Cowper's glands)

Final Answer: The correct option is B.

Answer: (B)



Q34.

Solution

Concept: Parturition (childbirth) is induced by a complex neuroendocrine mechanism. The signals are referred to as the ****fetal ejection reflex****.

Solution: The signals for parturition originate from ****both the fully developed fetus and the placenta****, which induce mild uterine contractions. This triggers the release of oxytocin from the maternal pituitary, leading to stronger contractions.

Final Answer: The correct option is C.

Answer: (C)

Q35.

Solution

Concept: "Saheli" is a unique oral contraceptive because it is non-steroidal and has very few side effects.

Solution: Saheli contains Centchroman. It works by ****blocking the estrogen receptors**** in the uterus, which prevents the eggs from getting implanted. Because it interferes with the preparation of the endometrium rather than preventing ovulation entirely, it is highly effective with a "once-a-week" dosage.

Final Answer: The correct option is B.

Answer: (B)

Q36.

Solution

Concept: In cases of severe male infertility (very low sperm count or inability of sperm to penetrate the egg), specialized IVF procedures are used.

Solution: ****ICSI (Intracytoplasmic Sperm Injection)**** is a specialized procedure in which a single sperm is manually and directly injected into the cytoplasm of the ovum in the laboratory.

Final Answer: The correct option is C.

Answer: (C)



Q37.

Solution

Concept: **Medical Termination of Pregnancy (MTP)**, or induced abortion, is the intentional or voluntary termination of pregnancy before full term. It plays a significant role in decreasing the human population and is used to terminate unwanted pregnancies or those that could be harmful to the mother or the fetus.

Solution: The safety of the MTP procedure depends heavily on the gestational age of the fetus:

- **First Trimester (up to 12 weeks):** MTP is considered relatively safe during this period. The surgical or medical procedures involved are less complex and carry lower risks of complications for the mother.
- **Second Trimester (after 12 weeks):** The procedure becomes significantly more risky and complicated as the fetus becomes more intimately associated with the maternal tissues.

According to the Medical Termination of Pregnancy Act, an abortion is considered safest and involves the least legal restriction when performed within the first **12 weeks** (the first trimester).

Final Answer: The correct option is B.

Answer: (B)

Q38.

Solution

Concept: Pedigree analysis is a record of inheritance of specific traits for several generations presented in the form of a family tree. Standard symbols are used to represent gender, relationships, and phenotypes.

Solution: In a standard pedigree chart:

- **Open symbols** (circles/squares) represent unaffected or normal individuals.
- **Solid/Shaded symbols** represent **affected individuals** who express the trait being studied.
- **Horizontal lines** between a square and circle represent mating.

Final Answer: The correct option is B.

Answer: (B)



Q39.

Solution

Concept: Alfred Sturtevant used the frequency of recombination between gene pairs on the same chromosome as a measure of the distance between genes.

Solution: The relationship is defined as follows:

- When genes are close together (tightly linked), the chance of crossing over is low, resulting in a low recombination percentage.
- When genes are far apart, the chance of crossing over increases, resulting in a higher recombination percentage.

Thus, the distance between genes and the percentage of recombination shows a **direct relationship**.

Final Answer: The correct option is B.

Answer: (B)

Q40.

Solution

Concept: Aneuploidy involves the loss or gain of chromosomes. **Nullisomy** ($2n - 2$) is a condition where a specific homologous pair of chromosomes is missing entirely from the diploid set.

Solution: In humans, the loss of an entire pair of chromosomes (nullisomy) is almost always lethal during embryonic development because too much essential genetic information is lost. While plants can often tolerate nullisomy, it is **not viable in humans**.

- Turner's ($2n - 1$) is Monosomy.
- Klinefelter's and Down's ($2n + 1$) are Trisomy.

Final Answer: The correct option is D.

Answer: (D)



Q41.

Solution

Concept: While most genes influence a single trait, some genes have a more widespread effect on the organism's phenotype.

Solution: A **pleiotropic gene** is a single gene that **controls multiple phenotypes** or distinct clinical features. An example is Phenylketonuria (PKU), where a single gene mutation results in mental retardation as well as reduction in hair and skin pigmentation.

Final Answer: The correct option is B.

Answer: (B)

Q42.

Solution

Concept: On the lagging strand, DNA is synthesized in small, discontinuous stretches known as Okazaki fragments because DNA polymerase can only synthesize in the 5' → 3' direction.

Solution: To create a continuous daughter strand, these fragments must be linked together. **DNA Ligase** acts as "molecular glue" to catalyze the formation of phosphodiester bonds between the fragments.

Final Answer: The correct option is B.

Answer: (B)

Q43.

Solution

Concept: The genetic code is the set of rules used by living cells to translate information encoded within genetic material into proteins. Certain codons have specialized roles.

Solution: The codon **AUG** has dual functions:

- (a) It acts as the **Initiator (Start) codon**, signaling the beginning of translation.
- (b) It codes for the amino acid **Methionine** (*met*).

UAA and UGA are stop codons and do not code for any amino acids.

Final Answer: The correct option is C.

Answer: (C)



Q44.

Solution

Concept: DNA fingerprinting involves identifying differences in specific regions of DNA sequence called repetitive DNA.

Solution: A specific class of satellite DNA used as a probe in DNA fingerprinting is **VNTR**, which stands for **Variable Number of Tandem Repeats**. The number of repeats varies from person to person, providing a unique genetic "barcode."

Final Answer: The correct option is B.

Answer: (B)

Q45.

Solution

Concept: According to **Chargaff's Rule**, in a double-stranded DNA molecule, the ratio of Adenine (A) to Thymine (T) is equal, and the ratio of Guanine (G) to Cytosine (C) is equal. This means $A = T$ and $G = C$. Therefore, the sum of all four bases is 100%:

$$(A + T) + (G + C) = 100\%$$

Solution: Given that Adenine (A) = 20%.

- (a) Since $A = T$, then $T = 20\%$.
- (b) Sum of $A + T = 20\% + 20\% = 40\%$.
- (c) The remaining percentage belongs to $G + C$: $100\% - 40\% = 60\%$.
- (d) Since $G = C$, the percentage of Guanine is half of the remaining sum: $60\%/2 = 30\%$.

Final Answer: The correct option is B.

Answer: (B)



Q46.

Solution

Concept: Transcription units vary between different types of organisms. A **polycistronic** gene is one where a single mRNA molecule contains the coding sequences for multiple proteins, usually belonging to a single metabolic pathway.

Solution:

- **Prokaryotes:** Structural genes are usually **polycistronic**. For example, in the *lac* operon, one promoter initiates the transcription of *z*, *y*, and *a* genes together.
- **Eukaryotes:** Structural genes are almost always **monocistronic**, meaning one mRNA molecule codes for only one polypeptide.

Final Answer: The correct option is B.

Answer: (B)

Q47.

Solution

Concept: In eukaryotes, the primary transcript (hnRNA) is longer than the functional mRNA because it contains non-functional sequences. To become functional, it must undergo post-transcriptional processing.

Solution: The process of **splicing** involves:

- The **removal of introns** (intervening, non-coding sequences).
- The **joining of exons** (expressed, coding sequences) in a defined order.

Other processes mentioned like capping (adding methyl guanosine) and tailing (adding poly-A tail) are distinct from splicing but also occur during hnRNA processing.

Final Answer: The correct option is B.

Answer: (B)



Q48.

Solution

Concept: The Hardy-Weinberg equilibrium is represented by the equation $p^2 + 2pq + q^2 = 1$. This mathematical model describes the distribution of genotypes in a non-evolving population where p and q are the frequencies of individual alleles.

Solution: In this equation:

- p^2 : Represents the frequency of **homozygous dominant** individuals (AA).
- q^2 : Represents the frequency of **homozygous recessive** individuals (aa).
- $2pq$: Represents the frequency of **heterozygous** individuals (Aa).

Final Answer: The correct option is C.

Answer: (C)

Q49.

Solution

Concept: Industrial melanism refers to the evolution of dark-colored (melanic) organisms in an environment affected by industrial pollution.

Solution: In pre-industrial England, light-colored moths were better camouflaged against lichens on trees. After the industrial revolution, soot killed lichens and blackened trees, making dark moths better camouflaged. This led to a survival advantage for dark moths, which is a classic demonstration of **Natural Selection** in action.

Final Answer: The correct option is A.

Answer: (A)

Q50.

Solution

Concept: Hugo de Vries conducted experiments on evening primrose (*Oenothera lamarckiana*) and proposed a theory of evolution that differed significantly from Darwin's gradualism.

Solution: De Vries believed that evolution is caused by sudden, large-scale changes in the genetic makeup rather than the accumulation of minor variations. He coined the term **Saltation** (single-step large mutation) to describe this mechanism. According to him, mutations are random and directionless, whereas Darwinian variations are small and directional.

Final Answer: The correct option is B.

Answer: (B)



Answer Key

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

