



- 1. Which genetic phenomenon occurs when the phenotypic expression of one gene is masked by the alleles of another distinct gene?**
 - a. Dominance
 - b. Epistasis
 - c. Pleiotropy
 - d. Co-dominance
- 2. What is the tendency of genes located closely on the same chromosome to be inherited together during meiosis?**
 - a. Independent assortment
 - b. Segregation
 - c. Linkage
 - d. Crossing over
- 3. What genetic condition describes a single gene influencing multiple, seemingly unrelated phenotypic traits?**
 - a. Pleiotropy
 - b. Polygeny
 - c. Multiple alleles
 - d. Incomplete dominance
- 4. Quantitative traits such as crop yield and plant height are typically controlled by what type of genetic inheritance?**
 - a. Single major genes
 - b. Maternal inheritance
 - c. Cytoplasmic inheritance
 - d. Polygenes
- 5. What term refers to a sudden, heritable change in the DNA sequence of an organism that can create new alleles?**
 - a. Recombination
 - b. Mutation
 - c. Segregation
 - d. Translocation
- 6. Which parameter measures the proportion of total phenotypic variance in a population that is attributable to genetic variance?**
 - a. Combining ability
 - b. Heterosis
 - c. Heritability
 - d. Genetic advance
- 7. What is the term for the superior performance of an F1 hybrid progeny compared to its homozygous parents?**
 - a. Heterosis
 - b. Inbreeding depression
 - c. Transgressive segregation
 - d. Epistasis
- 8. The loss of vigor and fitness resulting from the mating of closely related individuals in cross-pollinated crops is called:**
 - a. Hybrid vigor
 - b. Inbreeding depression
 - c. Genetic drift
 - d. Gene silencing
- 9. Which breeding method is most appropriate for developing a highly uniform variety from a self-pollinated crop?**
 - a. Recurrent selection
 - b. Mass selection
 - c. Pure line selection
 - d. Synthetics breeding

10. Which method involves selecting a large number of superior plants based on phenotype and compositing their seeds without progeny testing?

- a. Mass selection
- b. Pedigree method
- c. Backcross method
- d. Bulk method

11. In which breeding method are individual plant selections made in the F₂ generation with detailed record-keeping of their parentage?

- a. Bulk method
- b. Mass selection
- c. Single-seed descent
- d. Pedigree method

12. Which handling method allows F₂ and subsequent generations to be grown in a commercial environment subject to natural selection before making individual plant selections?

- a. Pedigree method
- b. Bulk method
- c. Backcross method
- d. Pure line selection

13. What is the primary objective of the backcross breeding method?

- a. To transfer a single specific trait into an otherwise adapted cultivar
- b. To create maximum genetic variability in a population
- c. To develop a multi-line variety
- d. To break genetic linkage blocks

14. For a crop like sugarcane or cassava that does not produce true botanical seeds readily, what is the standard breeding method?

- a. Pure line selection
- b. Hybridization
- c. Clonal selection
- d. Recurrent selection

15. What type of variety is developed by intercrossing a number of specific inbred lines that have good general combining ability?

- a. Pure line variety
- b. Synthetic variety
- c. Multiline variety
- d. Clonal variety

16. Which chemical is commonly used by plant breeders to induce polyploidy by disrupting spindle fiber formation during mitosis?

- a. Ethylene
- b. Gibberellic acid
- c. Ethyl methanesulfonate
- d. Colchicine

17. What term describes the genetic variability that arises spontaneously among plants regenerated from in vitro tissue culture?

- a. Somaclonal variation
- b. Transgressive segregation
- c. Epigenetic mutation
- d. Horizontal gene transfer

18. Which non-conventional breeding technique is used to prevent the abortion of a hybrid zygote formed from a distant interspecific cross?

- a. Protoplast fusion
- b. Embryo rescue
- c. Anther culture
- d. Micropropagation

19. What genetic mechanism is widely utilized by breeders to prevent self-pollination and facilitate large-scale commercial hybrid seed production?

- a. Cleistogamy
- b. Apomixis
- c. Cytoplasmic male sterility
- d. Parthenocarpy

- 20. Which breeding scheme is a cyclical process designed to systematically increase the frequency of favorable alleles in a cross-pollinated population?**
- a. Pure line selection
 - b. Backcrossing
 - c. Pedigree method
 - d. Recurrent selection
- 21. The concept of designing a theoretical model plant with ideal architectural traits for a specific environment is known as:**
- a. Ideotype breeding
 - b. Mutation breeding
 - c. Transgenic breeding
 - d. Heterosis breeding
- 22. What physiological mechanism prevents a plant with functional pollen and ovules from setting seed when self-pollinated?**
- a. Male sterility
 - b. Self-incompatibility
 - c. Dichogamy
 - d. Heterostyly
- 23. Which common chemical mutagen is frequently used in crop improvement to induce point mutations?**
- a. Sodium azide
 - b. Nitrous acid
 - c. Ethyl methanesulfonate (EMS)
 - d. Colchicine
- 24. The technique that uses DNA markers tightly linked to a gene of interest to select for favorable traits indirectly is called:**
- a. Marker-assisted selection (MAS)
 - b. Genomic selection
 - c. Transformation
 - d. Phenotypic selection
- 25. Which biotechnology tool allows the hybridization of two sexually incompatible species by merging their cellular contents without cell walls?**
- a. Embryo rescue
 - b. Protoplast fusion
 - c. Genetic engineering
 - d. Anther culture
- 26. In recombinant DNA technology, what enzymes act as 'molecular scissors' to cut DNA at specific recognition sequences?**
- a. DNA ligases
 - b. Polymerases
 - c. Helicases
 - d. Restriction endonucleases
- 27. Which soil bacterium is widely utilized as a natural vector to transfer foreign genes into plant genomes?**
- a. Agrobacterium tumefaciens
 - b. Bacillus thuringiensis
 - c. Escherichia coli
 - d. Rhizobium leguminosarum
- 28. What is the alternative direct gene transfer method often used for monocots involving microprojectiles coated with DNA?**
- a. Electroporation
 - b. Biolistics (Gene gun)
 - c. Microinjection
 - d. Sonication
- 29. Which revolutionary laboratory technique is used to exponentially amplify specific target DNA segments in vitro?**
- a. Southern blotting
 - b. Microarray
 - c. Polymerase Chain Reaction (PCR)
 - d. Gel electrophoresis

30. Genetically modified crops engineered with cry genes to resist lepidopteran insect pests are commonly referred to as:

- a. Bt crops
- b. Roundup Ready crops
- c. Flavr Savr crops
- d. Terminator crops

31. Golden Rice was developed through biotechnology primarily to address the widespread human deficiency of:

- a. Iron
- b. Vitamin A (Beta-carotene)
- c. Vitamin C
- d. Zinc

32. Which modern biotechnology tool allows precise, targeted genome editing without necessarily introducing foreign DNA?

- a. RNA interference
- b. Recombinant DNA
- c. Agrobacterium transformation
- d. CRISPR-Cas9

33. Which cellular mechanism is harnessed in biotechnology to suppress the expression of specific viral genes, conferring virus resistance to crops like papaya?

- a. RNA interference (RNAi)
- b. Transcription activation
- c. Alternative splicing
- d. Reverse transcription

34. What type of molecular marker represents a variation in a single nucleotide base pair in the DNA sequence?

- a. RFLP
- b. AFLP
- c. SNP (Single Nucleotide Polymorphism)
- d. SSR (Microsatellite)

35. Small, circular, extrachromosomal DNA molecules found in bacteria that are used as vectors in genetic engineering are called:

- a. Chromosomes
- b. Plasmids
- c. Organelles
- d. Centromeres

36. Which rapid biochemical test is widely used to determine the viability of a seed lot without performing a standard germination test?

- a. Tetrazolium test
- b. Cold test
- c. Accelerated aging test
- d. Electrical conductivity test

37. In the Tetrazolium test, living seed tissues respire and reduce the chemical to form a red, stable compound known as:

- a. Carotene
- b. Anthocyanin
- c. Chlorophyll
- d. Formazan

38. How is the Pure Live Seed (PLS) percentage calculated for a given seed lot?

- a. $(\text{Purity \%} + \text{Germination \%}) / 2$
- b. $(\text{Purity \%} - \text{Germination \%}) / 100$
- c. $(\text{Purity \%} \times \text{Germination \%}) / 100$
- d. $(\text{Germination \%} / \text{Purity \%}) \times 100$

39. Seeds that can be safely dried to a low moisture content (around 5-8%) and stored at low temperatures are classified as:

- a. Recalcitrant seeds
- b. Orthodox seeds
- c. Viviparous seeds
- d. Intermediate seeds

40. Seeds of crops like mango and rubber that lose viability quickly if dried below a critical moisture level are called:

- a. Recalcitrant seeds
- b. Orthodox seeds
- c. Hard seeds
- d. Dormant seeds

41. What pre-sowing seed treatment involves controlled hydration to initiate early germination processes without allowing radicle emergence?

- a. Scarification
- b. Stratification
- c. Pelleting
- d. Seed priming

42. The physical removal of off-types, diseased plants, and weeds from a seed production field to maintain genetic purity is called:

- a. Detasseling
- b. Roguing
- c. Threshing
- d. Emasculation

43. To prevent mechanical mixing and cross-pollination from unwanted pollen sources, seed production fields require a specific:

- a. Planting density
- b. Fertilizer rate
- c. Isolation distance
- d. Row spacing

44. Which class of seed is directly controlled by the originating plant breeder or institution and serves as the source for all subsequent certified seed classes?

- a. Breeder seed
- b. Foundation seed
- c. Registered seed
- d. Certified seed

45. According to standard international seed certification schemes, what color tag is designated for Foundation seed?

- a. Blue
- b. White
- c. Purple
- d. Red

46. According to standard international seed certification schemes, what color tag is designated for Registered seed?

- a. Yellow
- b. Green
- c. Purple
- d. Blue

47. What tag color universally denotes Certified seed, which is the class typically sold to farmers for general crop production?

- a. White
- b. Purple
- c. Red
- d. Blue

48. Which physiological seed treatment involves exposing moistened seeds to cold temperatures to break physiological dormancy?

- a. Stratification
- b. Scarification
- c. Priming
- d. Vernalization

49. What is the process of physically or chemically scratching the hard seed coat to allow water inhibition and break physical dormancy?

- a. Stratification
- b. Scarification
- c. Inoculation
- d. Coating

50. In the seed certification process, which body is responsible for conducting field inspections and laboratory tests to verify quality standards?

- a. The plant breeder
- b. The seed retailer
- c. The Seed Certification Agency
- d. The local farmers cooperative

Detailed Answer Key

Q1: (b) Epistasis - Masking of one gene by another.

Q3: (a) Pleiotropy - Single gene influencing multiple traits.

Q5: (b) Mutation - Sudden heritable DNA sequence change.

Q7: (a) Heterosis - Superior performance of F1 hybrid.

Q9: (c) Pure line selection - For self-pollinated uniformity.

Q11: (d) Pedigree method - Individual F2 plant selection with records.

Q13: (a) Backcross method - Transferring single specific trait.

Q15: (b) Synthetic variety - Intercrossing specific good general combining inbreds.

Q17: (a) Somaclonal variation - Variability from tissue culture.

Q19: (c) Cytoplasmic male sterility - Prevents self-pollination for hybrids.

Q21: (a) Ideotype breeding - Designing theoretical model plant.

Q23: (c) Ethyl methanesulfonate (EMS) - Common chemical mutagen.

Q25: (b) Protoplast fusion - Merging cellular contents without walls.

Q27: (a) Agrobacterium tumefaciens - Natural vector for gene transfer.

Q29: (c) Polymerase Chain Reaction (PCR) - Amplifies target DNA in vitro.

Q31: (b) Vitamin A (Beta-carotene) - Golden Rice nutritional target.

Q33: (a) RNA interference (RNAi) - Suppresses viral gene expression.

Q35: (b) Plasmids - Extrachromosomal circular bacterial DNA.

Q37: (d) Formazan - Red stable compound from live tissue respiration.

Q39: (b) Orthodox seeds - Can be dried low and stored cold.

Q41: (d) Seed priming - Controlled hydration without radicle emergence.

Q43: (c) Isolation distance - Prevents cross-pollination/mixing.

Q45: (b) White - Foundation seed tag color.

Q47: (d) Blue - Certified seed tag color.

Q49: (b) Scarification - Scratching seed coat for water inhibition.

Q2: (c) Linkage - Genes close on chromosome inherited together.

Q4: (d) Polygenes - Controlled by multiple minor genes.

Q6: (c) Heritability - Proportion of phenotypic variance due to genetics.

Q8: (b) Inbreeding depression - Loss of vigor from close mating.

Q10: (a) Mass selection - Phenotypic selection without progeny test.

Q12: (b) Bulk method - Natural selection in commercial environment.

Q14: (c) Clonal selection - Standard for vegetatively propagated crops.

Q16: (d) Colchicine - Disrupts spindle fiber to induce polyploidy.

Q18: (b) Embryo rescue - Prevents abortion of distant hybrid zygote.

Q20: (d) Recurrent selection - Systematically increasing favorable alleles.

Q22: (b) Self-incompatibility - Prevents self-seed setting.

Q24: (a) Marker-assisted selection (MAS) - Indirect selection via DNA markers.

Q26: (d) Restriction endonucleases - Molecular scissors cutting DNA.

Q28: (b) Biolistics (Gene gun) - DNA-coated microprojectiles for monocots.

Q30: (a) Bt crops - Engineered with cry genes against lepidopteran pests.

Q32: (d) CRISPR-Cas9 - Precise targeted genome editing.

Q34: (c) SNP - Single nucleotide polymorphism variation.

Q36: (a) Tetrazolium test - Rapid seed viability assessment.

Q38: (c) $(\text{Purity \%} \times \text{Germination \%}) / 100$ - PLS formula.

Q40: (a) Recalcitrant seeds - Lose viability quickly if dried.

Q42: (b) Roguing - Physical removal of off-types and weeds.

Q44: (a) Breeder seed - Directly controlled by originating breeder.

Q46: (c) Purple - Registered seed tag color.

Q48: (a) Stratification - Cold treatment to break dormancy.

Q50: (c) Seed Certification Agency - Conducts inspections and tests.