A-LEVEL

Multiple-choice questions on Inheritance and Genetics

1. Which of the following represents the genotype of an individual with Down syndrome?
A) XX
B) XY
C) Trisomy 21
D) Monosomy 23
Answer: C Explanation: Down syndrome is caused by the presence of an extra copy of chromosome 21, known as trisomy 21.

2. In a dihybrid cross involving two heterozygous individuals (AaBb x AaBb), what is the probability of producing offspring with the AABB genotype?
A) 1/16
B) 1/4

C) 3/16
D) 1/2
Answer: A Explanation: The probability of obtaining AABB from a dihybrid cross is 1/4, and when multiplied by the probability of obtaining AaBb offspring (1/4), the overall probability is 1/16.

3. Which genetic disorder is caused by a deletion in chromosome 15 and is characterized by Prader-Willi syndrome and Angelman syndrome?
A) Cystic fibrosis
B) Duchenne muscular dystrophy
C) Huntington's disease
D) Genomic imprinting disorders
Answer: D Explanation: Prader-Willi syndrome and Angelman syndrome are examples of genomic imprinting disorders resulting from the deletion of genes in the same region on chromosome 15.

4. Mendel's Law of Segregation states that:
A) Alleles of different genes segregate independently during gamete formation.
B) Alleles of a gene segregate into different gametes during meiosis.
C) Homologous chromosomes segregate

independently during mitosis.
D) Genes located on the same chromosome segregate independently.
Answer: B Explanation: Mendel's Law of Segregation states that alleles of a gene segregate into different gametes during meiosis.

5. What is the role of tRNA in protein synthesis?
A) Carries amino acids to the ribosome
B) Forms the ribosomal subunits
C) Transcribes DNA into RNA
D) Carries genetic information to the cytoplasm
Answer: A Explanation: tRNA carries amino acids to the ribosome, where they are used in protein synthesis.

6. A test cross involves crossing an individual with a homozygous recessive individual to determine:
A) The genotype of the homozygous recessive individual.
B) The genotype of the heterozygous individual.
C) The phenotype of the heterozygous individual.
D) The phenotype of the homozygous recessive individual.
Answer: B Explanation: A test cross is performed to

determine whether an individual with a dominant phenotype is homozygous or heterozygous by crossing it with a homozygous recessive individual.

7. In incomplete dominance, the phenotypic ratio resulting from a cross between two heterozygous individuals is:
A) 1:1
B) 2:1
C) 3:1
D) 1:2:1
Answer: D Explanation: In incomplete dominance, the phenotypic ratio resulting from a cross between two heterozygous individuals is 1:2:1.

8. Which enzyme is responsible for unwinding and separating DNA strands during replication?
A) DNA polymerase
B) Helicase
C) Ligase
D) RNA polymerase
Answer: B Explanation: Helicase is the enzyme responsible for unwinding and separating DNA strands during replication.

9. What is the probability of having a child with a recessive genetic disorder when both parents are carriers (heterozygous) for the trait?
A) 0%
B) 25%
C) 50%
D) 75%
Answer: B Explanation: When both parents are carriers (heterozygous) for a recessive genetic disorder, there is a 25% probability of having an affected child.

10. Which of the following represents a sex-linked recessive trait?
A) Hemophilia
B) Huntington's disease
C) Marfan syndrome
D) Cystic fibrosis
Answer: A Explanation: Hemophilia is an example of a sex-linked recessive trait, carried on the X chromosome.

11. If an individual has blood type AB, what are the possible genotypes for this blood type?
A) IAIA

B) IBIB
C) IAIB
D) ii
Answer: C Explanation: Blood type AB is the result of having both A and B alleles (IAIB) on the same chromosome.

12. Which of the following is an example of polygenic inheritance?
A) Albinism
B) Huntington's disease
C) Skin color in humans
D) Cystic fibrosis
Answer: C Explanation: Skin color in humans is influenced by multiple genes, making it an example of polygenic inheritance.

13. What is the function of the enzyme topoisomerase during DNA replication?
A) Unwinds DNA strands
B) Joins Okazaki fragments
C) Relieves tension in the DNA helix
D) Adds nucleotides to the growing DNA strand
Answer: C Explanation: Topoisomerase relieves tension in the DNA helix by inducing temporary breaks in the DNA strands.

14. The term "epistasis" refers to:
A) The interaction between alleles at multiple loci.
B) The interaction between genes and the environment.
C) The masking of one gene's effect by another gene.
D) The presence of more than two alleles for a gene.
Answer: C Explanation: Epistasis refers to the masking of one gene's effect by another gene.

15. Which of the following is true regarding the relationship between genes and chromosomes?
A) Genes are made of chromosomes.
B) Chromosomes are made of genes.
C) Genes and chromosomes are unrelated.
D) Genes and chromosomes are both made of DNA.
Answer: D Explanation: Genes and chromosomes are both made of DNA, and genes are located on chromosomes.

16. What is the purpose of the polymerase chain reaction (PCR) in molecular biology?
A) To produce recombinant DNA
B) To replicate DNA in vitro
C) To transcribe RNA into DNA

D) To synthesize proteins
Answer: B Explanation: PCR is used to replicate DNA in vitro, generating multiple copies of a specific DNA sequence.

17. Which of the following is an example of a sex-linked trait in humans?
A) Color blindness
B) Hitchhiker's thumb
C) Widows peak
D) Free earlobes
Answer: A Explanation: Color blindness is an example of a sex-linked trait, often associated with the X chromosome.

18. Mendel's Law of Independent Assortment applies to genes that are located on:
A) Homologous chromosomes
B) Different chromosomes
C) The same chromosome
D) Non-homologous chromosomes
Answer: B Explanation: Mendel's Law of Independent Assortment applies to genes located on different chromosomes.

19. Which of the following represents a

codominant inheritance pattern?
A) ABO blood group system
B) Huntington's disease
C) Hemophilia
D) Sickle cell anemia
Answer: A Explanation: The ABO blood group system is an example of codominant inheritance, where both A and B alleles are expressed.

20. What is the term for a change in the DNA sequence that results in the premature termination of protein synthesis?
A) Deletion
B) Insertion
C) Nonsense mutation
D) Frameshift mutation
Answer: C Explanation: A nonsense mutation is a change in the DNA sequence that results in the premature termination of protein synthesis.

21. In a pedigree analysis, a trait that is more commonly observed in males and often skips generations is likely:
A) Autosomal dominant
B) Autosomal recessive
C) X-linked dominant

D) X-linked recessive
Answer: D Explanation: X-linked recessive traits are more commonly observed in males, and they may skip generations when carried by carrier females.

22. The process of meiosis results in the production of:
A) Identical daughter cells
B) Haploid daughter cells
C) Diploid daughter cells
D) Somatic cells
Answer: B Explanation: Meiosis results in the production of haploid daughter cells, each with half the number of chromosomes as the parent cell.

23. What is the purpose of the enzyme ligase during DNA replication?
A) Unwinds DNA strands
B) Joins Okazaki fragments
C) Relieves tension in the DNA helix
D) Adds nucleotides to the growing DNA strand
Answer: B Explanation: Ligase joins Okazaki fragments, sealing the gaps in the lagging strand during DNA replication.

24. An individual with Klinefelter syndrome has the sex chromosome composition:
A) XX
B) XY
C) XXY
D) XYY
Answer: C Explanation: Klinefelter syndrome results from an extra X chromosome, resulting in the sex chromosome composition XXY.

25. Which of the following statements is true about the concept of genetic linkage?
A) Genes located close together on a chromosome tend to be inherited independently.
B) Genes located close together on a chromosome tend to be inherited together.
C) Genes located on different chromosomes always assort independently.
D) Linked genes always exhibit a 1:1:1:1 phenotypic ratio.
Answer: B Explanation: Genes located close together on a chromosome tend to be inherited together due to genetic linkage.

26. The phenotype of an organism is determined by:

A) Genotype only
B) Environment only
C) Both genotype and environment
D) Neither genotype nor environment
Answer: C Explanation: The phenotype of an organism is determined by both its genotype and environmental factors.

27. What is the term for the exchange of genetic material between homologous chromosomes during meiosis?
A) Crossing over
B) Segregation
C) Replication
D) Mutation
Answer: A Explanation: Crossing over is the exchange of genetic material between homologous chromosomes during meiosis.

28. Which of the following genetic disorders results from a trinucleotide repeat expansion in a specific gene?
A) Cystic fibrosis
B) Huntington's disease
C) Duchenne muscular dystrophy
D) Phenylketonuria (PKU)

Answer: B Explanation: Huntington's disease is caused by a trinucleotide repeat expansion in the HTT gene.

29. If a trait is influenced by multiple genes and environmental factors, it is considered:
A) Polygenic
B) Mendelian
C) Monogenic
D) Autosomal
Answer: A Explanation: If a trait is influenced by multiple genes and environmental factors, it is considered polygenic.

30. A mutation that results in the insertion or deletion of nucleotides, shifting the reading frame of a gene, is known as a:
A) Missense mutation
B) Nonsense mutation
C) Frameshift mutation
D) Silent mutation
Answer: C Explanation: A frameshift mutation results from the insertion or deletion of nucleotides, causing a shift in the reading frame of a gene.

31. Which of the following represents a trait that

is influenced by both genetic and environmental factors?
A) Eye color
B) Blood type
C) Sickle cell anemia
D) Height
Answer: D Explanation: Height is a trait influenced by both genetic and environmental factors.

32. In a population of flowering plants, red flowers (RR or Rr) are dominant to white flowers (rr). If 75% of the population has red flowers, what is the frequency of the R allele?
A) 0.25
B) 0.5
C) 0.75
D) 1.0
Answer: B Explanation: If 75% of the population has red flowers, and red is dominant, then the frequency of the dominant allele (R) is 0.5.

33. Which of the following statements is true about the process of translation in protein synthesis?
A) It occurs in the nucleus.
B) tRNA carries the genetic code to the ribosome.

C) It involves the synthesis of RNA from a DNA template.
D) It occurs on the ribosomes in the cytoplasm.
Answer: D Explanation: Translation in protein synthesis occurs on the ribosomes in the cytoplasm.