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Chapter 02
The Study of Heredity

Multiple Choice Questions

1. The blending theory is the idea that:
A. inherited characteristics of offspring are intermediate between maternal and paternal characteristics
B. individuals inherit some traits from the mother and some from the father
C. inherited traits can be altered by the environment
D. none of these

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2. Pangenesis is:
A. based on the principle that acquired characteristics can be passed on
B. a "Noah's Ark" explanation for the origin of life
C. an explanation for the origin of all life
D. none of these

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3. The basic principles of heredity were first worked out by:
A. Charles Darwin
B. Gregor Mendel
C. Carolus Linnaeus
D. Jean Lamarck

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4. Gregor Mendel's work, published in 1866, was:
A. not generally known until 1900
B. immediately accepted by Mendel's contemporaries
C. footnoted extensively by Charles Darwin in *The Origin of Species*
D. used by Francis Galton in his studies on human heredity

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5. Gregor Mendel's success was the result, in part, of the fact that he:
A. used pairs of sharply contrasting features
B. precisely defined the traits he studied
C. quantified the results of the breeding experiments
D. all of these

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6. True-breeding means:
A. hybrid
B. bred only with the same kind and shows the same trait or traits over many generations
C. only the dominant characteristics will express themselves
D. only the recessive traits will express themselves

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7. One of Gregor Mendel's major contributions to science was his:
A. explanation of the mechanisms of heredity
B. discovery of the process of mutation
C. description of chromosomes
D. discovery of DNA within the nucleus of the cell

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8. Gregor Mendel demonstrated that the hereditary units:
A. are discrete
B. blend with one another
C. are composed of DNA
D. all of these

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9. Male sex cells are called:
A. pollen
B. sperm
C. ova
D. pollen and sperm

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10. In the production of sex cells, paired hereditary units separate into different sex cells. This is termed the principle of:
A. segregation
B. hybridization
C. independent assortment
D. heterozygosity

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11. When Mendel crossed a true-breeding tall plant with a true-breeding dwarf plant, all of the F_1 generation was tall. Therefore, we may conclude that the allele for dwarfism in the plant is:
A. recessive
B. codominant
C. dominant
D. intermediate in expression

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12. The inheritance patterns of differing traits are unconnected. This is the principle of:
A. segregation
B. independent assortment
C. dominance
D. recessiveness

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13. "A simplified representation of a real-world phenomenon" best defines a(n):
A. theory
B. model
C. experiment
D. control

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14. In 1900, important differences among red blood cells were discovered by:
A. Gregor Mendel
B. Karl Landsteiner
C. James Watson
D. Francis Galton

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15. Proteins whose primary function is to destroy or neutralize foreign substances that have entered the body are called:
A. enzymes
B. antigens
C. antibodies
D. hormones

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16. A substance that stimulates the production or mobilization of antibodies is called a(n):
A. antigen
B. allele
C. nucleotide
D. enzyme

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17. How many major alleles are involved in the inheritance of ABO blood types?
A. one
B. two
C. three
D. four

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18. In the presence of anti-A, type A red blood cells will undergo:
A. agglutination
B. hydrolysis
C. lysis
D. fusion

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19. If a person with type A blood receives a transfusion of type B blood, the recipient's blood would experience:
A. heavy agglutination of the donor's cells
B. light agglutination of the donor's cells
C. no agglutination of the recipient's cells
D. no agglutination of the donor's cells

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20. An individual whose blood contains the antibodies anti-A and anti-B would be of the blood type:
A. A
B. B
C. AB
D. O

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21. In the context of the ABO blood-type system, when two different alleles of the same gene are present, both alleles are expressed in the phenotype. Such alleles are called:
A. codominant alleles
B. recessive alleles
C. polymorphic alleles
D. dominant alleles

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22. Which of the following is true of erythroblastosis fetalis?
A. It is a recessive genetic abnormality in which the retina of the eye lacks the cones that are necessary for color vision and for seeing fine details.
B. It is a late-onset genetic disease characterized by a loss of motor control resulting in jerky movements and is associated with psychiatric symptoms.
C. It is a hemolytic disease affecting unborn or newborn infants and is caused by the destruction of the infant's Rh+ blood by the mother's anti-Rh antibodies.
D. It is a genetic disease caused by the absence of the enzyme responsible for the conversion of the amino acid phenylalanine to tyrosine.

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23. Which of the following is true of the relationship between the ABO and Rh blood-type systems?
A. Individuals who are O are always Rh-.
B. Individuals who are O are more likely to be Rh-.
C. The genes for the two blood systems are linked.
D. The two systems are inherited independently.

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24. The phenotype is the result of:
A. the genotype
B. the environment
C. traits
D. the genotype and the environment

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25. The term phenotype refers to:
A. physical traits
B. physiological traits
C. personality traits
D. all of these

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26. An individual's phenotype would include that individual's:
A. stature
B. blood type
C. skin color
D. all of these

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27. A trait is:
A. one aspect of the phenotype
B. one aspect of the genotype
C. not influenced by the environment
D. one aspect of the genotype and not influenced by the environment

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28. Which of the following characteristics is least influenced by the environment?
A. skin color
B. stature
C. PTC tasting
D. intelligence

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29. The term genotype refers to:
A. an individual's appearance
B. an individual's genetic makeup
C. an individual's observable and measurable characteristics
D. all of these

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30. An allele is:
A. a specific type of trait
B. an alternate form of a gene
C. the dominant form of a gene only
D. the recessive form of a gene only

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31. Cytogenetics is defined as the study of:
A. cells
B. zygotes
C. hereditary mechanisms within the cell
D. the genetics of cytoplasm

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32. The chromosomes are located within the cell's:
A. cytoplasm
B. nucleus
C. ribosome
D. endoplasm

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33. The standardized classification and arrangement of photographed chromosomes is known as a:
A. karyotype
B. cytoplasm
C. cytology
D. chromotype

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34. Different organisms:
A. may have different number of chromosomes, ranging from 2 to 1,260
B. usually have over 1,000 chromosomes per cell
C. have between 40 and 50 chromosomes per cell
D. have half of their chromosomes in the nuclei and half in the cytoplasm of their cells

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35. A human body cell has the following number of chromosomes:
A. 48
B. 46
C. 44
D. 23

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36. A human body cell has the following number of autosomes:
A. 48
B. 46
C. 44
D. 23

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37. The chromosomes that make up a pair are called:
A. homologous
B. linked
C. associated
D. homozygous

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38. Genes that are located on the same chromosome are said to be:
A. associated
B. linked
C. homologous
D. homozygous

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39. The Y chromosome:
A. carries no genes
B. is larger than the X chromosome
C. is smaller than the X chromosome
D. carries no genes and is smaller than the X chromosome

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40. X-linked means:
A. the site of the gene is unknown
B. the gene lies on "x" number of chromosomes
C. the gene lies on the X chromosome
D. the gene is only inherited by women

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41. Mitosis is the process by which:
A. single-cell organisms reproduce
B. growth and replacement of cells occur in multicellular animals
C. gametes are produced
D. single-cell organisms reproduce and growth and replacement of cells occur in multicellular animals
E. all of these

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42. A chromosome consists of two strands held together by the:
A. nucleolus
B. centromere
C. centriole
D. spindle

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43. The proper sequence of phases of division in mitosis is:
A. prophase, anaphase, telophase, metaphase
B. prophase, metaphase, anaphase, telophase
C. prophase, telophase, anaphase, metaphase
D. metaphase, prophase, telophase, anaphase

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44. In mitosis, the chromosomes first become visible during:
A. anaphase
B. prophase
C. metaphase
D. telophase
E. interphase

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45. Which of the following statements about meiosis is correct?
A. Meiosis takes place only in the testes and the ovaries.
B. The chromosome number is cut in half.
C. There are two cycles of division.
D. All of these are correct.

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46. Meiosis differs from mitosis in that in meiosis:
A. there are two cycles of division
B. the chromosome number is cut in half
C. crossing-over can occur
D. all of these

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47. The cell produced by meiosis in humans contains the following number of chromosomes:
A. 23
B. 24
C. 46
D. 48

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48. At the end of the first division of meiosis, each second-generation cell contains:
A. 46 double-stranded chromosomes
B. 46 single-stranded chromosomes
C. 23 double-stranded chromosomes
D. 23 single-stranded chromosomes

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49. In meiosis, crossing-over refers to:
A. one type of chromosomal mutation
B. a process whereby alleles from homologous chromosomes are exchanged
C. a process that occurs only on the X chromosome
D. a type of gene mutation

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50. New combinations of alleles on the same chromosomes as a result of crossing-over is referred to as:
A. recombination
B. linkage
C. mitosis
D. homology

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51. Like the production of ova, the production of sperm:
A. begins during fetal development
B. is a product of meiosis
C. is a product of ovogenesis
D. none of these

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52. Oogenesis differs from spermatogenesis in that oogenesis:
A. leads to sex cells that, if fertilized, will contribute mtDNA to the zygote
B. begins in fetal life
C. usually produces only one mature ovum at any one time
D. all of these

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53. Cytogenetics shows that Mendel's principle of segregation:
A. does not work on the molecular level
B. is based on the separation of chromosomes during meiosis
C. is based on the separation of chromosomes during mitosis
D. is based on the linkage of genes on a single chromosome

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54. The study of cytogenetics:
A. contradicts Mendelian inheritance
B. is unrelated to Mendelian inheritance
C. grounds Mendelian genetics in biology
D. contradicts Mendelian inheritance and is unrelated to Mendelian inheritance

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55. In general, half of the human babies born are males and half are females because:
A. the sex chromosomes segregate in the formation of sperm in males
B. the sex chromosomes segregate in the formation of ova in females
C. one half of the ova carry the male-determining gene
D. none of these

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56. Which of the following statements is *correct* about human chromosomes?
A. A human karyotype shows 46 chromosomes.
B. Humans and chimpanzees possess the same number of chromosomes in each body cell.
C. DNA, a special coding protein, is located within the chromosome.
D. In humans, an individual who possesses a sex chromosome count of XXY is a female.

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57. Large molecules, characteristic of living organisms, are based upon the tendency to form long chains of the atom:
A. nitrogen
B. hydrogen
C. carbon
D. oxygen

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58. The genetic material is classified chemically as a:
A. nucleic acid
B. protein
C. carbohydrate
D. lipid

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59. The basic building blocks of the nucleic acids are:
A. amino acids
B. nucleotides
C. fatty acids
D. peptides

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60. A nucleotide is composed of:
A. a five-carbon sugar
B. a phosphate
C. a nitrogenous base
D. all of these

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61. Ribose and deoxyribose are:
A. sugars
B. lipids
C. amino acids
D. fatty acids

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62. The nucleotides that make up the RNA contain the pyrimidines uracil and cytosine and the purines guanine and:
A. thymine
B. proline
C. adenine
D. tyrosine

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63. In the DNA molecule, bonding can take place only between an adenine and a thymine and between a cytosine and a guanine. These are said to be:
A. polar bodies
B. chromatids
C. hybrids
D. base pairs

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64. In the DNA molecule, the base adenine always forms a complementary pair with:
A. another adenine
B. guanine
C. thymine
D. cytosine

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65. The basic sugar-phosphate-base unit is called a(n):
A. polypeptide
B. protein
C. nucleotide
D. amino acid

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66. The two categories of bases are:
A. purines and pyrimidines
B. proteins and lipids
C. ribose and deoxyribose
D. peptides and phosphates

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67. Physically, the nuclear DNA molecule can be described as a:
A. single-stranded chain
B. double helix
C. two-dimensional ladder
D. sphere

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68. Proteins are chains of:
A. nucleotides
B. amino acids
C. lipids
D. nucleic acids

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69. Chains of amino acids are referred to as:
A. polypeptides
B. carbohydrates
C. lipids
D. nucleic acids

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70. In DNA replication:
A. messenger RNA translates each triplet into the corresponding amino acid
B. transfer RNA translates each triplet into the corresponding amino acid
C. the bonds holding the bases together are broken and the exposed bases attract complementary bases
D. mitochondrial DNA is formed based on the template of nuclear DNA

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71. Proteins are manufactured within the cell in structures called:
A. mitochondria
B. nuclei
C. nucleoli
D. ribosomes

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72. Enzymes are:
A. nucleic acids
B. proteins
C. carbohydrates
D. lipids

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73. Which of the following sequences is correct in relationship to protein synthesis?
A. nDNA-mRNA-tRNA-protein synthesis
B. mRNA-nDNA-tRNA-protein synthesis
C. nDNA-tRNA-mRNA-protein synthesis
D. tRNA-nDNA-mRNA-protein synthesis

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74. The nuclear DNA molecule controls the manufacture of proteins by the following process:
A. pieces of the DNA molecule break off and travel to the site of protein manufacture
B. the appropriate code is copied and transported by messenger RNA to the site of protein manufacture
C. the appropriate code is copied and transported by transfer RNA to the site of protein manufacture
D. none of these

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75. Each amino acid is determined by specific three-base units called:
A. ribosomes
B. nucleotides
C. proteins
D. codons

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76. Identify the codons that code for the amino acid alanine.
A. GCT, GCC, GCA, GCG
B. GGT, GGC, GGA, GGG
C. ATT, ATC, ATA
D. TTT, TTC, TTA, TTG

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77. Mitochondrial DNA is found in the:
A. nucleus of the cell
B. fat cells only
C. cytoplasm
D. X and Y chromosomes

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78. Mitochondrial DNA is inherited from:
A. the father only
B. the mother only
C. both the mother and the father
D. neither the mother nor the father; it develops after conception

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79. The body uses amino acids:
A. to build protein molecules
B. to build nucleic acids
C. both of these
D. neither of these

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80. When Mendel crossed a true-breeding violet with a true-breeding white plant, all of the F_1 generation were violet. Therefore, we may conclude that the allele for violet in the pea plant is:
A. recessive
B. dominant
C. codominant
D. intermediate in expression

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Gradable: automatic

81. The term phenotype refers to:
A. a trait that is dominant
B. a trait that is recessive
C. an individual's genetic makeup
D. an observable or measurable characteristic of an individual

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Gradable: automatic

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82. The principle of independent assortment:
A. states that inheritance patterns of differing traits are independent of one another
B. states that paired hereditary factors separate and form sex cells containing either one or the other factor
C. applies only to humans
D. states that paired hereditary factors separate and form sex cells containing either one or the other factor and applies only to humans only

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Gradable: automatic

83. Polymorphism refers to:
A. the presence of several distinct forms of a gene or a trait within a population
B. a trait in which two alleles are codominant
C. a single gene that affects multiple aspects of the phenotype
D. multiple genes that affect a single aspect of the phenotype

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Gradable: automatic

84. An allele is:
A. the complementary base to thymine
B. the dominant form of a gene
C. an alternate form of a gene
D. an X-linked gene

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Gradable: automatic

85. The chromosomes are located within the cell's:
A. nucleus
B. chromatids
C. DNA
D. cytoplasm

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Gradable: automatic

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86. Meiosis is the process by which:
A. single-cell organisms reproduce
B. growth and replacement of cells occur in multicellular animals
C. gametes are produced
D. all of these

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Gradable: automatic

87. In the DNA molecule, the base cytosine always forms a complementary pair with:
A. another cytosine
B. guanine
C. thymine
D. adenine

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Gradable: automatic

88. Physically, the nuclear DNA molecule can be described as:
A. circular, like a snake eating its own tail
B. many spheres linked end to end
C. a two-dimensional ladder
D. a double helix

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True / False Questions

89. The blending theory of inheritance correctly describes the mechanisms by which offspring resemble their parents.
FALSE

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Gradable: automatic

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90. The principles of heredity worked out by Gregor Mendel apply to all living organisms.
TRUE

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Gradable: automatic

91. A human body cell has 44 autosomes.
TRUE

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Gradable: automatic

92. X-linked traits will be expressed more commonly in females than males.
FALSE

Accessibility: Keyboard Navigation
Gradable: automatic

93. Proteins are chains of nucleotides.
FALSE

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Gradable: automatic

94. The correct sequence for protein synthesis is nDNA-mRNA-tRNA-protein synthesis.
TRUE

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Gradable: automatic

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Matching Questions

95. Match the concept to its definition:

1. independent assortment	bred only with the same kind and shows the same trait over many generations	**2**
2. true-breeding	in the production of sex cells, the paired hereditary units separate into different sex cells	**3**
3. segregation	the inheritance patterns of differing traits are independent of one another	**1**

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96. Match each term to its description:

1. autosomes	holds strands together	**2**
2. centromere	standardized arrangement of chromosomes	**3**
3. karyotype	chromosomal strand	**5**
4. sex chromosomes	22 pairs in humans	**1**
5. chromatid	X and Y chromosomes	**4**

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97. Match each phase of mitosis with what occurs during that phase:

1. metaphase	the chromosomes line up	**1**
2. interphase	chromosomes becoming visible	**4**
3. telophase	chromatids pulled to opposite poles	**5**
4. prophase	interim period	**2**
5. anaphase	new nuclear membrane forming	**3**

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98. Match each nucleic acid with its description:

1. mtDNA	located in the nucleus	**3**
2. mRNA	located in the mitochondria	**1**
3. nDNA	copies segments of the genetic code for protein manufacture	**2**
4. tRNA	transports amino acids into position	**4**

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Essay Questions

99. Although Charles Darwin's concept of natural selection was partially based on the observation of variability within a species, Darwin did not develop an acceptable mechanism to explain this variability. How did the work of Gregor Mendel help explain a mechanism of biological evolution?

Answers will vary.

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100. Charles Darwin attempted to explain variability in terms of the blending theory. Describe the blending theory and contrast it to the concepts developed by Gregor Mendel.

Answers will vary.

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101. How does the concept of segregation differ from the concept of blending?

Answers will vary.

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102. Although the basic Mendelian principles of genetics were discovered through experiments on pea plants, they also apply to all organisms, including humans. Illustrate the concepts of segregation, dominance, and independent assortment using human characteristics.

Answers will vary.

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103. The construction of karyotypes has become a routine diagnostic medical tool. What kind of information does a karyotype provide?

Answers will vary.

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104. Describe the processes that occur during meiosis that demonstrate the physical basis of independent assortment and segregation.

Answers will vary.

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105. In what ways do mitosis and meiosis differ from each other?

Answers will vary.

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106. What is the essential difference between a male and a female in cellular terms?

Answers will vary.

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107. What has the study of cytogenetics added to our understanding of Mendelian genetics?

Answers will vary.

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108. In molecular terms, describe the differences between proteins and nucleic acids.

Answers will vary.

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109. What are the two main types of DNA? In what ways do they differ in structure, function, and mode of inheritance?

Answers will vary.

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110. What is the concept of independent assortment? Are all traits independent from each other?

Answers will vary.

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111. What are antigens and antibodies? Use the ABO blood-type system to explain these terms.

Answers will vary.

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Gradable: manual

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112. What are some of the major principles and facts about genetics that have been discovered since Mendel's time?

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