

Unit 5

Heredity

1. A scientist planted 800 seeds in containers of damp soil. Half the seeds were placed in direct sunlight. The other 400 seeds were kept in total darkness. All other conditions were the same for both groups of plants. After seven days, all 800 seeds sprouted and produced leaves. The 400 seeds that were kept in total darkness had white leaves. Of the plants grown in sunlight, green leaves developed on 296 of them and white leaves developed on 104 of them. All 800 plants were placed in sunlight for an additional two weeks. After 14 days in sunlight, the leaves of 305 of the 400 plants that had originally been kept in darkness turned green. The other 95 plants in this group remained white.

Figure 1

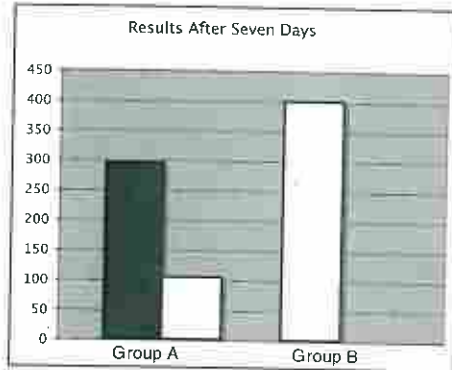
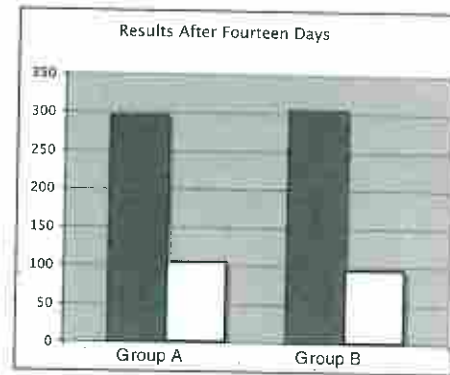


Figure 2



What is the BEST explanation for the observations in the experiment described above?

- A Green leaf color is not an inherited characteristic in these plants.
- B The presence or absence of light does not affect the development of green leaf color.
- C The color of these plants depends on both the environmental conditions and the genetic makeup of the plant.
- D The white leaf color is a dominant trait, because some plants remained white even when placed in lighted conditions.
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2. Which of the following statements about changes in DNA that result in a mutation is true?
- A Mutations in the DNA of body cells cannot affect the individual in which they happen.
- B A mutation in the DNA of a body cell can cause the cell to produce a protein that does not function.
- C A mutation in the DNA of a gamete affects the body cells of the individual that produced the gamete.
- D Mutations in the DNA of body cells can cause the offspring to produce a protein that does not function.

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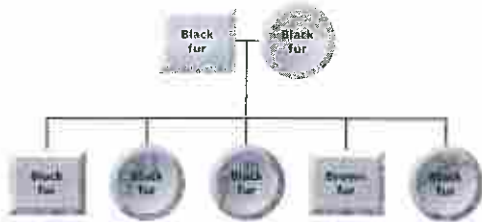
3. Genetic variability within organisms within a species increases the chance that a species will survive changing environmental conditions. What kind of reproduction produces the MOST genetic variability within a species?

- A asexual reproduction
 B budding
 C parthenogenesis
 D sexual reproduction

4. During meiosis, homologous chromosomes line up next to each other. In some cases, one arm of a chromatid crosses over the arm of another chromatid. What is the result of this process?

- A additional variation in the DNA of each sex cell formed
 B the independent assortment of genetic material
 C the creation of an additional sex cell
 D continuity in the offspring cell's DNA

5. For the species depicted in the pedigree below, black fur color is dominant over brown fur color.



Which of the following must be true?

- A Both parents are homozygous for the black-fur trait.
 B Both parents are heterozygous for the black-fur trait.
 C The offspring that has brown fur must have a mutant gene for fur color.
 D One parent is homozygous for fur color and one parent is heterozygous for fur color.
6. Agricultural scientists develop a way to insert a third chromosome into the diploid body cells of a watermelon plant to create a seedless fruit. Infer how this extra chromosome could affect watermelon offspring.
- A With three chromosomes, the watermelon would produce three times as many offspring as a normal watermelon plant.
 B Because the chromosome was inserted into a diploid body cell, it would not be passed to offspring through meiosis.
 C The extra chromosome would be passed to offspring through meiosis, so each generation would produce seedless fruit.
 D More experiments are needed to determine how cells with three chromosomes reproduce and affect offspring.

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7. A lily has one allele for spotted pink petals and one allele for solid pink petals. The resulting flower has spotted pink petals. What is the phenotype of the lily?
- A The alleles for spotted and solid pink petals are the phenotype.
 - B The trait of spotted pink petals is the phenotype.
 - C The allele for spotted pink petals is the phenotype.
 - D The allele for solid pink petals is the phenotype.
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8. A gardener crossed a plant with red flowers with a plant that had white flowers. The offspring plants had pink flowers. What is the MOST LIKELY genetic reason for these differences in color?
- A polygenic inheritance
 - B codominance
 - C recessive pink genes
 - D incomplete dominance
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9. If the sequence of the nucleotides in a portion of one strand of DNA is CCTATGGCC, what is the order of the nucleotides in the complementary strand?
- A AAGCGTTAA
 - B CCTATGGCC
 - C GGATACCGG
 - D TTCGCAATT
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10. What evidence in pea plant crosses supported Mendel's law of independent assortment?
- A When crossing true-breeding pea plants, all of the offspring exhibit traits that are exhibited in the parents.
 - B When crossing hybrid pea plants, some of the offspring exhibit traits that are not exhibited in the parents.
 - C When crossing pea plants that differ in two characteristics, traits produced by dominant factors always appear together.
 - D When crossing pea plants that differ in two characteristics, traits produced by dominant factors do not necessarily appear together.
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11. A genetic engineer wants to cut a DNA molecule into smaller pieces in order to isolate the insulin gene. What tool should the engineer use?
- A plasmids
 - B restriction enzymes
 - C cloning vectors
 - D sticky ends

12. The following chart shows the number of $2n$ chromosomes in various organisms.

Organism	Number of $2n$ Chromosomes
Mosquito	6
Corn	20
Human	46
Dog	78

Calculate the number of chromosomes in each gamete of a mosquito, corn, a human, and a dog.

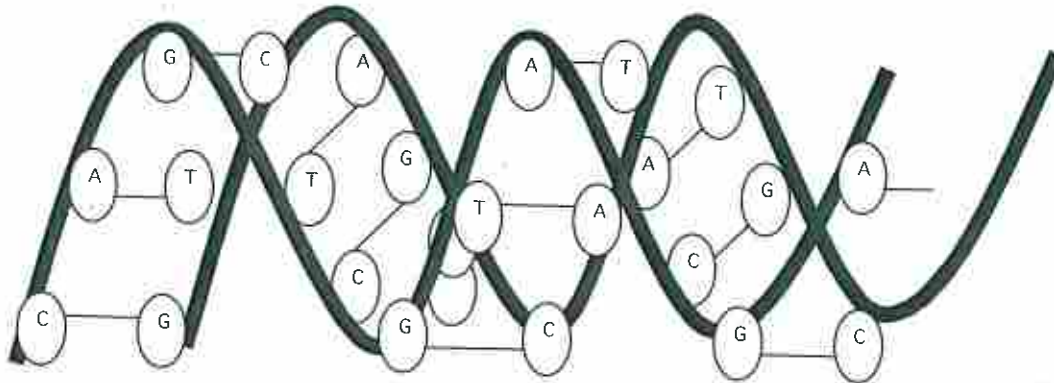
- A 3, 10, 23, 39
 - B 6, 20, 46, 78
 - C 3, 15, 22, 46
 - D 6, 20, 23, 39
13. Inheriting two copies of a recessive allele causes an individual to die before reaching sexual maturity. How is it that this recessive allele can be passed on from one generation to the next?
- A Homozygous dominant individuals usually live past sexual maturity to pass on the dominant allele to their offspring.
 - B Heterozygous individuals can pass on the recessive allele because they do not die from having only one copy of the allele.
 - C Two homozygous dominant parents will not give the recessive allele to their offspring, so all will reach sexual maturity.
 - D Two heterozygous parents who have reached sexual maturity will not give the recessive allele to their offspring, so all will reach sexual maturity.

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14. Which work did James Watson and Francis Crick NOT build on directly in order to work out the structure of the DNA molecule?
- A Frederick Griffith's discovery that genetic material could be transferred from harmful bacterial cells to formerly harmless bacteria
 - B work by Matthias Schleiden and Theodor Schwann that led to the formation of the cell theory
 - C Oswald Avery's discovery that DNA was the agent that transformed bacteria
 - D the Hershey-Chase experiment with radioactively labeled viruses, which confirmed that DNA, not protein, was the transforming agent

15. Errors sometimes happen during DNA replication. If a DNA nucleotide that contains guanine is accidentally substituted for a DNA nucleotide that contains thymine, which of the following will always happen as a result of the error in DNA replication?
- A The cell will die when it divides.
 - B The cell will become a rapidly dividing cancer cell.
 - C The cell will have a better chance of surviving under different conditions.
 - D The cell will produce mRNA with a mutated nucleotide sequence.

16. The diagram represents an incomplete model of the DNA molecule.



Which base should be used to make a complete base pair at the right end of the model?

- A guanine
- B cytosine
- C adenine
- D thymine

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17. What would **MOST LIKELY** happen if tRNA malfunctioned during the assembly of a protein molecule?
- A Mutations would happen in the segment of mRNA as it formed.
 - B Amino acids would no longer be transported into the cell.
 - C The wrong amino acids would be added to the new protein molecule.
 - D Bonds between the amino acids would no longer form inside the ribosome.
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18. Which of the following identifies the process of forming a nucleic acid by using another molecule as a template and identifies its **MOST** common form?
- A transcription—the synthesis of RNA using one strand of DNA
 - B translation—the synthesis of RNA using one strand of DNA
 - C protein synthesis—the synthesis of proteins using one strand of DNA
 - D transference—the synthesis of proteins using one strand of RNA
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19. Which statement **BEST** compares mutations in genes with chromosomal mutations?
- A Gene mutations always involve point mutations, and chromosomal mutations always happen during crossing-over.
 - B Gene mutations result from deletions and inversions, but chromosomal mutations result from duplication and translocation.
 - C Gene mutations involve codons, while chromosomal mutations involve pieces of chromosomes.
 - D Gene mutations happen during crossing-over, while chromosomal mutations happen during replication.
-

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20. The population of crabs living on a sandy beach exhibits three colors: dark brown, light brown, and speckled. The genotypes for these colors are BB for dark brown, bb for light brown, and Bb for speckled. The speckled color blends in extremely well with the color of the sand on the beach. The pattern appears to provide the speckled crabs with some protection from predatory birds.

PHENOTYPES AND GENOTYPES OF CRABS



Speckled (Bb)



Dark Brown (BB)



Light Brown (bb)

Which of the following conclusions can be drawn from this information?

- A Only the speckled crabs will survive, and all of their offspring will be speckled.
- B The allele for light brown color will be lost because of predatory birds eating light brown crabs.
- C The allele for dark brown color will be lost because of predatory birds eating dark brown crabs.
- D Both the allele for dark brown color and the allele for light brown color continue to be passed on in the crab population.
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21. Sickle cell anemia is caused by a defect in the allele that codes for hemoglobin—the protein that enables red blood cells to carry oxygen. Sickle cell anemia results from which type of mutation?
- A a point mutation
- B a silent mutation
- C a chromosomal mutation
- D a gene rearrangement
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22. The Human Genome Project found that less than 2% of human DNA codes for proteins. Which of the following makes up more than 98% of human DNA?
- A introns
- B exons
- C operons
- D transposons
-
23. Some people have trouble digesting milk products containing the chemical lactose, a condition called lactose intolerance. Which factor leads to lactose intolerance?
- A defects in the *lac* operon gene regulation system in bacteria
- B overactive *lac* operon gene regulation in the human intestinal walls
- C a defect in transcription factors involving the *lac* genes
- D expression of noncoding interons in the *lac* operon

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24. The chart below represents how anticodons pair with codons during protein synthesis.

CODON AND ANTICODON PAIRING

Transfer RNA	UGA	CUG	CAG	
Messenger RNA	ACU	GAC	GUC	GAA

A strand of messenger RNA is attached to a ribosome and is directing protein synthesis. The next exposed codon of this messenger RNA has the code GAA. It is most likely to bond with a transfer RNA that has which anticodon?

- A CTT
- B CUU
- C GAA
- D TUU

25. The drawing below shows a partial strand of DNA.



Which of the following statements **BEST** describes the structure of DNA?

- A Two strands of proteins are held together by sugar molecules, nitrogen bases, and phosphate groups.
 - B Two strands composed of sugar molecules and phosphate groups are linked together by proteins.
 - C Nitrogen bases and phosphate groups link together to form the backbone of a strand. Two such strands are linked together by sugar molecules.
 - D Sugar molecules and phosphate groups link together to form the backbone of a strand. Two such strands are linked together by matched nitrogen bases.
26. Two structures are characteristic of all viruses: nucleic acid and a capsid. What is the function of the nucleic acid?
- A The nucleic acid contains the genetic information needed to bind with a host cell.
 - B The nucleic acid gives the virus the shape needed to invade a host cell.
 - C The nucleic acid contains the genetic information needed to reproduce itself.
 - D The nucleic acid contains the genetic information needed to avoid detection.