*Biology for a Changing World 2e,* Chapter 7 Test Bank

1. An individual’s DNA is

1. different in every cell.
2. varies depending on cell type.
3. identical in all cells.
4. identical only in some cells.
5. identical to their mother’s DNA.

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Hard

Important Words/Concepts: cells, DNA

2. Liver cells and kidney cells do different tasks because they

1. start off with the same DNA, but destroy unnecessary genes.
2. start off with the same DNA, but gain different genes from stem cells.
3. contain completely different DNA and genes.
4. contain the same DNA but use different genes.
5. have different sequences of DNA in their genes.

Answer: D

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: gene expression, all cells in an individual contain the full genome

3. Cells in your kidneys produce different proteins and carry out different tasks than cells in your brain. How is that possible?

1. Kidney and brain cells have completely different DNA.
2. Kidney and brain cells have some DNA that’s the same and some that’s different.
3. Kidney and brain cells have the same DNA but use different genes.
4. Kidney cells have Mom’s DNA, but brain cells have Dad’s DNA.
5. Kidney cells use only some of the genes in the DNA, but brain cells use all of the genes.

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: gene expression, all cells in an individual contain the full genome

4. Where are chromosomes located in eukaryotic cells?

1. cytoplasm
2. nucleus
3. specialized protein sacs
4. tightly wrapped together
5. centromeres

Answer: B

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: chromosome, nucleus

5. While studying the cells of a newly discovered fungus, you notice that its organelles resemble those of most eukaryotes, but some of their shapes are a little different. Although you’re pretty sure you can identify each organelle, you analyze its chemical composition just to make sure. One organelle is shaped like a ball, and it is composed of proteins, membranes, and nucleic acids. That organelle is most likely the

1. nucleus.
2. endoplasmic reticulum.
3. chromosome.
4. Golgi body.
5. lysosome.

Answer: A

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: nucleus, nucleic acids, DNA, organelle structure and function

6. Red blood cells go through some special modifications as they mature. As a final step, the cells lose their nucleus. Which of the following is a likely consequence?

1. Red blood cells have extra genes not found in other cells.
2. Red blood cells have less DNA than other cells.
3. Red blood cells have less carbohydrate than other cells.
4. Red blood cells have more DNA than other cells.
5. Red blood cells are larger than most other cells.

Answer: B

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA, nucleus, organelle structure and function

7. What is a genome?

1. the complete set of genetic material encoded within the DNA of an organism
2. the total number of base pairs within a DNA sequence
3. a short sequence of DNA that codes for a particular characteristic
4. the total amount of RNA within an organism
5. strands of DNA wound around proteins; humans have 23 pairs

Answer: A

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA, genome

8. What is DNA?

1. a molecule that is passed down to children from the father but not the mother
2. a molecule found only in blood
3. a molecule common to all life forms
4. a molecule found only in mammals
5. a molecule made of a single strand of nucleotides

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA, inheritance

9. What is a chromosome?

1. a large piece of DNA found within the cytoplasm of a cell
2. a large protein that surrounds and protects DNA
3. a large, tightly bound piece of DNA and protein found in the nucleus of cells
4. a starting material used for producing DNA in a cell
5. a term used to describe all the genetic material found within a person’s cells

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: chromosome, DNA organization

10. Explain how DNA is organized. Why is it necessary for DNA to be organized in this way?

*Answer:* DNA is organized into structures called chromosomes. The DNA is wound around proteins and packed together tightly to condense the length of the molecule. If DNA were not organized like this, it would be impossible to fit our entire genome into the nucleus of a cell.

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Hard

Important Words/Concepts: chromosome, DNA structure

11. Choose the statement(s) that correctly describe the organization of DNA.
\_\_\_\_\_\_ is/are made of \_\_\_\_\_\_, and \_\_\_\_\_\_ contain(s) many \_\_\_\_\_\_

1. DNA; chromosomes; chromosomes; genes
2. Chromosomes; DNA; chromosomes; genes
3. DNA; genes; genes; chromosomes
4. Genes; DNA; chromosomes; gene
5. Both B and D

Answer: E

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA organization, chromosome structure, genes

12. You are hired as a research assistant to help determine the genome of a wild onion plant. At the end of this project, you expect to have the

1. sequence of all of its genes.
2. sequence of all of its DNA.
3. sequence of all of its proteins.
4. total amount of RNA, DNA, and protein in its cells.
5. number of chromosomes in its nucleus.

Answer: B

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: genome

13. Which of the following statements does NOT accurately describe human DNA?

1. Human DNA is a unique combination of DNA inherited from both parents.
2. Males receive one X chromosome from their mother.
3. Females receive two X chromosomes from their mother.
4. Humans have 22 pairs of chromosomes and two gender chromosomes.
5. Human DNA is located within the nucleus.

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: Chromosomes, nucleus, sex chromosomes

14. What is the significance of the “23rd pair” of chromosomes in humans?

1. It is inherited only from the mother.
2. It is inherited only from the father.
3. It doesn’t exist; there are only 22 pairs.
4. It doesn’t contain thymine.
5. It determines a person’s sex.

Answer: E

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Hard

Important Words/Concepts: chromosome, inheritance, sex chromosomes

15. Humans inherit chromosomes from each parent; and a male inherits the chromosome from his father.

*Answer:* 23; Y

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Hard

Important Words/Concepts: chromosomes, inheritance, sex chromosomes

16. In humans, a male’s 23rd pair of chromosomes are called \_\_\_ and \_\_\_, which is in contrast to a female’s \_\_\_ and \_\_\_.

*Answer:* X, Y; X, X

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: chromosomes, sex determination, inheritance

17. Human DNA is located in the \_\_\_\_\_\_\_ and is divided into \_\_\_\_\_\_ chromosomes.

*Answer:* nucleus, 46

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: nucleus, chromosomes

18. If the defective gene for color blindness is carried on the X chromosome, and a colorblind mother’s 23rd pair of chromosomes carries the defect on both X chromosomes, what is the likelihood that her son will have color blindness? Why?

*Answer:* 100%; either of the mother’s defective X chromosomes will be passed onto her son, resulting in color blindness.

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Hard

Important Words/Concepts: chromosomes, DNA inheritance, sex chromosomes

19. Explain how and why males should be able to trace a direct lineage of male ancestors through analysis of their Y chromosome.

*Answer:* The Y chromosome is only passed from father to son. Therefore, Y chromosomes will be most similar among related males.

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Hard

Important Words/Concepts: chromosomes, inheritance, sex chromosomes

20. A boy’s Y chromosome will generally NOT be identical to that of his

1. father.
2. grandfather on father’s side of family.
3. great-grandfather on mother’s side of family.
4. brothers.
5. All of the above.

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Hard

Important Words/Concepts: chromosomes, sex chromosomes, inheritance of sex chromosomes

21. Explain how gender is related to the X and Y chromosomes.

*Answer:* Females have two X chromosomes, and males have one X and one Y.

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: Gender, sex chromosomes

22. Explain which parent determines the gender of a child.

*Answer:* Females have two X chromosomes, so they always contribute an X to a child. Males, however, have one X and one Y. If the sperm contains an X, the child will have two X chromosomes and be female. If the sperm contains a Y, the child will have one X and one Y and will be male.

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Hard

Important Words/Concepts: Sex chromosomes, gender

23. DNA is a type of molecule called a \_\_\_\_\_\_\_\_\_. Its smaller parts are called \_\_\_\_\_\_\_\_\_\_.

1. protein; amino acids
2. deoxyribonucleic acid; amino acids
3. deoxyribonucleic acid; nucleotides
4. nucleotide; deoxyribonucleic acids
5. protein; nucleotides

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA structure, nucleic acid, nucleotides

24. Bases holding two single strands of DNA together into a double strand of DNA interact through \_\_\_\_\_\_\_\_\_\_\_ bonds.

1. covalent
2. hydrogen
3. ionic
4. chemical
5. carbon

Answer: B

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA structure, DNA base pairing, hydrogen bonds

25. True or False. The width (diameter) of the DNA helix normally varies a lot, depending on which bases are paired together at that location.

 *Answer:* False

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA structure, DNA base pairing

26. Which of the following base pairs would be found in normal DNA?

1. A and T
2. G and G
3. C and A
4. T and C
5. All of the above are correct.

Answer: A

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Important Words/Concepts: DNA structure, DNA base pairing

27. A science museum hires an interior designer to create a spiral staircase that will represent DNA. The model must be as accurate as possible, but also allow people to climb. You are asked to evaluate the model for scientific accuracy. Which of the following design suggestions would you accept?

A. The steps in the staircase are painted to look like phosphates and sugars.

B. People climbing the stairs will hold onto handrails made of sugars.

C. A support post runs down the very center, representing a string of phosphates.

D. People climbing the staircase will step on pairs of bases.

E. All of the above.

Answer: D

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA structure, DNA base pairing

28. DNA is called a double helix because

1. two bases are the rungs.
2. the bases are complementary paired.
3. two DNA strands twist together.
4. one DNA strand binds to a sugar.
5. a DNA strand folds into an alpha helix.

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA structure

29. DNA can be visualized as a ladder. Which parts would be the rungs (where you step) and which would be the stringers (the sides where you hold on)?

A. The sugars and bases are rungs, and the phosphates are stringers.

B. The phosphates and bases are rungs, and the sugars are stringers.

C. The H-bonded sugars are rungs, and the phosphate bases are stringers.

D. The bases are rungs, and the sugars and phosphates are stringers.

E. The bases are the rungs, and the sugars the stringers.

Answer: D

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA structure

30. What are nucleotides?

A. enzymes that copy DNA

B. molecules that make up the information contained in DNA

C. molecules that consist of a sugar, a protein, and a base

D. molecules around which chromosomes coil

E. enzymes that split DNA apart so that the DNA can be copied

Answer: B

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: base pairing, DNA structure, nucleotide

31. What are nucleotides?

A. subunits found in proteins

B. subunits that combine to make DNA

C. molecules made of a sugar, a protein, and a base

D. molecules around which chromosomes coil

E. machinery the cell uses to copy its DNA

Answer: B

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: base pairing, DNA structure, nucleotide

32. How is the structure of a DNA molecule arranged?

* 1. Each nucleotides’ phosphate group binds to the corresponding phosphate group of another nucleotide.
	2. Each nucleotides’ sugar group binds to the corresponding sugar group of another nucleotide.
	3. Each nucleotides’ phosphate group binds to the sugar group of the next nucleotide.
	4. Each nucleotides’ base binds to the next nucleotide base.
	5. Each nucleotides’ base binds to the phosphate group of another nucleotide.

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA structure

33. Which is the best description of how nucleotides are attached to make DNA?
 Nucleotides are attached to each other \_\_\_\_\_\_\_\_.

1. phosphate to phosphate
2. sugar to sugar
3. phosphate to sugar
4. base to base
5. base to phosphate

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA structure, DNA subunits

34. What is the “double helix” when referring to the structure of DNA?

 A. two strands of linked nucleotides that are twisted around each other

B. two strands of linked nucleotides that fold back and forth like an accordion

C. four strands of linked nucleotides that are bound by phosphate groups

D. four strands of linked nucleotides that are bound by sugar groups

E. two chromosomes that twisted around each other

Answer: A

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA structure, double helix, nucleotide

35. Why is DNA called a “double helix”?

1. It has two strands of nucleotides twisted around each other.
2. It has two strands of nucleotides, folded back and forth like an accordion.
3. It has helical bases, arranged together in complementary pairs.
4. It has four strands of nucleotides bound together with sugars.
5. It has two chromosomes, linked and twisted together.

Answer: A

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA structure

36. What is the correct pattern of nucleotide base pairing?

* 1. adenine-cytosine; guanine-thymine
	2. adenine-guanine; cytosine-thymine
	3. adenine-thymine; guanine-cytosine
	4. adenine-adenine; thymine-thymine
	5. adenine-guanine; adenine-cytosine

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: base pairing, DNA replication, nucleotide

37. Identify the correct nucleotide base pairing.

A. A-C; G-T

B. A-G; C-T

C. A-T; G-C

D. A-A; T-T

E. A-G; A-C

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: base pairing, DNA replication, nucleotide

38. What is the complementary base-pairing rule?

1. Adenine will always pair with guanine.
2. Guanine will always pair with thymine.
3. Adenine can pair with either guanine or thymine.
4. A nucleotide can base-pair to any other nucleotide using hydrogen bonds.
5. Adenine will always pair with thymine, and cytosine will always pair with guanine.

Answer: E

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: base pairing, DNA replication, nucleotide

39. You have a segment of DNA with a nucleotide sequence reading AATAGC on one strand. Which of the following nucleotide sequences would match it on the opposite strand?

A. AATAGC

B. CCGCTA

C. GGCGAT

D. TTATCG

E. AAGACG

Answer: D

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA sequence, complementarity, base pairing

40. What are the four nucleotide bases that make up the “rungs” of the nucleotide ladder of DNA?

A. adenine, thymine, guanine, cytosine

B. adenine, uracil, guanine, cytosine

C. adenine, thymine, cytosine, phosphate

D. adenine, cytosine, nitrogen, phosphate

E. adenine, cytosine, sugar, phosphate

Answer: A

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA structure, nucleotide

41. DNA is made of the following nucleotide bases, EXCEPT

A. adenine.

B. guanine.

C. phosphate.

D. cytosine.

E. thymine.

Answer: C

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA structure, nucleotide

42. Which of the following is a nucleotide?

A. polymerase

B. guanine

C. phosphate

D. DNA

E. STR region

Answer: B

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA structure, nucleotide

43. Nucleotide bases are noncovalently held together in the DNA helix by .

*Answer:* hydrogen bonds

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA structure, nucleotide

44. Two strands of nucleotides pair up and twist around each other to form the shape of DNA, called a .

*Answer:* double helix

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA structure, double helix

45. To condense DNA into a smaller size, it is wrapped around \_\_\_\_\_\_\_ molecules.

*Answer:* protein

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA structure, proteins

46. A nucleotide is composed of a sugar, a \_\_\_\_ and a \_\_\_\_\_\_.

*Answer:* phosphate; base

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA structure, nucleotide

47. If a strand of DNA has the sequence ATTCGGC, the complementary strand would be .

*Answer:* TAAGCCG

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: base pairing, DNA structure, nucleotide

48. Find the sequence that would base pair correctly with ATTCGGC.

1. ATTCGGC
2. TAAGCCG
3. AUUCGGC
4. UAAGCCG
5. None of the above.

Answer: B

DQ: What is the structure of DNA, and how is DNA organized in cells?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA base pairing

49. DNA can generally be extracted from

1. hair.
2. blood.
3. saliva.
4. skin cells.
5. All of the above.

Answer: E

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA, sources of DNA, forensics, DNA profiling

50. When one DNA molecule is duplicated, the resulting two DNA molecules contain

A. one new and one old strand in each.

B. two new strands in one and two old strands in the other.

C. four new strands in each.

D. four old strands in each.

E. four new strands in one and four old strands in the other.

Answer: A

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA replication

51. How does complementary base pairing make DNA replication more efficient?

*Answer:* Complementary base pairing (A to T and G to C) allows each strand of DNA to be used as a template for replication. After unwinding the DNA, DNA polymerase uses the parental strand to make a complementary copy of the DNA sequence. This allows replication to be semiconservative and increases efficiency.

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Hard

Important Words/Concepts: base pairing, DNA structure, nucleotide

52. The process of DNA replication requires

A. breaking of hydrogen bonds.

B. unwinding of the DNA.

C. enzymes.

D. nucleotides.

E. All of the above.

Answer: E

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA replication

53. DNA replication results in \_\_\_\_\_\_\_\_\_\_ copies of a cell’s genome.

A. two similar

B. two identical

C. four similar

D. four identical

E. None of the above.

Answer: B

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA replication

54. DNA replication occurs

A. in the Golgi.

B. in the cytoplasm.

C. in the nucleus.

D. in lysosomes.

E. in vesicles.

Answer: C

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA replication, location

55. What is DNA polymerase?

A. an enzyme that breaks DNA down into fragments

B. an enzyme that deletes specific regions of DNA

C. an enzyme involved in DNA replication that binds to DNA and facilitates the formation of a new strand of DNA

D. an enzyme that allows the chromosomes to coil around proteins so that the chromosomes can fit into the nucleus

E. an enzyme that removes the sugar molecule from a nucleotide so that the phosphate groups can be linked together

Answer: C

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA replication, polymerase

 56. DNA polymerase is an enzyme that

A. breaks DNA down into fragments.

B. deletes specific regions of DNA.

C. makes copies of DNA.

D. tightly winds DNA into chromosomes.

E. removes sugars from nucleotides to link them together.

Answer: C

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA replication, polymerase

57. What is meant by “semiconservative” replication?

A. As the new strands of DNA are formed, the old strands are broken down and recycled.

B. As the new strands of DNA are formed, one of the old strands is broken down and recycled while the other is used as a template for the creation of a new strand.

C. The original strands of DNA are used to make newer strands, resulting in two copies of the DNA, one made entirely of new DNA, the other entirely of old DNA.

D. As DNA replication occurs, two new strands of DNA are produced without use of the original strands.

E. Each newly replicated strand of DNA consists of one original strand and one newly formed strand.

Answer: E

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA replication

58. When DNA is copied to make more DNA before cell division, what happens to the original DNA molecule?

A. The original DNA goes to one cell; the new DNA goes to the other cell.

B. Only new DNA is passed on; original DNA is broken down and recycled.

C. Each of the cells contains half of the original DNA and half new DNA.

D. The original DNA is twisted into a double helix and passed to one of the daughter cells.

E. Either A or C are true, depending on the organism.

Answer: C

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Hard

Important Words/Concepts: semiconservative replication of DNA

59. The original strand of DNA used for DNA replication is known as the

A. coding strand.

B. nonconservative strand.

C. messenger strand.

D. template strand.

E. transcription strand.

Answer: D

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA replication

60. To make a copy of DNA, all of the following must occur EXCEPT

A. hydrogen bonds break.

B. adenine pairs with thymine.

C. DNA polymerase binds to the DNA.

D. the old strand is used as a template.

E. the DNA coils to form a replication helix.

Answer: E

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Easy

Important Words/Concepts: base pairing, DNA replication, DNA structure

61. Mark each statement as true (T) or false (F).

\_\_\_ DNA is copied through conservative replication. (F)

\_\_\_ DNA replication requires DNA polymerase. (T)

\_\_\_ DNA replication uses complementary base pairing. (T)

\_\_\_ DNA replication is required for cell reproduction. (T)

\_\_\_ DNA replication makes four new strands of identical DNA. (F)

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA replication location

62. DNA replication is called because it results in one original strand paired with one newly synthesized strand.

*Answer:* semiconservative

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA structure, double helix

63. Before DNA can be duplicated, it must be \_\_\_\_\_\_\_\_ so that DNA polymerase can access the DNA strands.

*Answer:* unwound from around the proteins

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA replication

64. Explain base pairing in DNA.

*Answer:* DNA nucleotides pair up according to base-pairing rules and form hydrogen bonds. Adenine bonds to thymine; cytosine bonds to guanine.

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Easy

Important Words/Concepts: base pairing

65. Explain what is meant by semiconservative duplication of DNA.

*Answer:* Semiconservative duplication of DNA means that each new molecule of DNA will contain one template strand and one new strand.

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Hard

Important Words/Concepts: replication, semiconservative

66. PCR stands for

A. polymers confer reactants.

B. polymerase chain reaction.

C. polymerase cell reproduction.

D. potential chain reaction.

E. polynucleotide cycling reaction.

Answer: B

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Easy

Important Words/Concepts: PCR

67. You start a PCR process with two copies of a DNA molecule. After three cycles of PCR, how many copies of the DNA will be present?

A. 5

B. 6

C. 8

D. 16

E. 27

Answer: D

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Hard

Important Words/Concepts: PCR, DNA replication

68. Which statement about PCR is FALSE?

A. PCR will amplify DNA, even from just a single DNA molecule.

B. Amplification of DNA in a PCR reaction is exponential.

C. PCR works on only a single strand of DNA at a time.

D. PCR uses primers to amplify both DNA strands simultaneously.

E. PCR requires DNA, primers, DNA polymerase, and nucleotides.

Answer: C

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Hard

Important Words/Concepts: PCR, DNA amplification

69. Why is heating a first step in PCR amplification of extracted DNA?

A. The enzyme DNA polymerase works at a higher temperature.

B. The nucleotides bind together at high heat.

C. It is necessary for DNA strands to anneal to each other.

D. It permits hydrogen bonds between DNA strands to dissociate.

E. It is required for primers to bind permanently to the DNA.

Answer: D

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Hard

Important Words/Concepts: PCR, DNA amplification

70. PCR amplification of DNA requires

A. DNA, primers, RNA polymerase, and deoxyribonucleotides.

B. DNA polymerase and deoxyribonucleotides.

C. DNA, primers, DNA polymerase, and deoxyribonucleotides.

D. DNA polymerase, deoxyribonucleotides, and primers.

E. DNA, primers, RNA polymerase, and ribonucleotides.

Answer: C

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Hard

Important Words/Concepts: PCR

71. PCR amplification of DNA is a useful technique when

A. there is limited sample.

B. there is abundant sample.

C. there is no other evidence.

D. dental evidence is excluded.

E. contamination of evidence occurred.

Answer: A

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Hard

Important Words/Concepts: PCR

72. Which of the following describes the pattern of increasing copies of DNA during PCR amplification?

A. 1→2→3→4

B. 1→2→4→8

C. 1→10→100→1000

D. 1→100→10000→1000000

E. The number of increasing copies does not follow a pattern.

Answer: B

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Hard

Important Words/Concepts: PCR

73. If you start with one copy of a DNA fragment, how many rounds of PCR amplification will it take to end up with a total of 16 copies?

A. 1

B. 4

C. 7

D. 10

E. 15

Answer: B

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Hard

Important Words/Concepts: PCR

74. Which of the following shows the steps of PCR amplification in the correct order?

A. extract DNA, add nucleotides, heat, add polymerase, cool

B. extract DNA, add polymerase, cycles of heating and cooling, add nucleotides

C. extract DNA, add polymerase, heat, add nucleotides, cool

D. extract DNA, heat, add nucleotides, cool, add polymerase, repeat

E. extract DNA, add nucleotides and polymerase, cycles of heating and cooling

Answer: E

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Hard

Important Words/Concepts: PCR

75. What is the name of the laboratory technique used to amplify DNA?

A. DNA replication

B. RNA replication

C. polymerase chain reaction

D. short tandem repetition

E. gel electrophoresis

Answer: C

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA amplification, PCR

76. The nucleotides used in DNA replication during PCR \_\_\_\_ compared to the nucleotides used during DNA replication within a cell.

A. are exactly the same

B. are somewhat different

C. are completely different

D. contain the base U instead of A

E. contain the base U instead of T

Answer: A

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Easy

Important Words/Concepts: nucleotide, PCR

77. Sequential cycles of heating and DNA extension of primer-specific DNA regions is known as .

*Answer:* PCR, polymerase chain reaction

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA profiling, forensics, PCR

78. Explain why a heating step is needed during PCR.

*Answer:* Heating helps to “melt” or denature the DNA. This separates the DNA into two strands that can be copied. It’s also needed for the primers to be able to bind to the DNA.

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Hard

Important Words/Concepts: PCR, DNA base pairing, DNA replication

79. From a forensic sample, you have 15 copies of a short length of DNA. You need at least 450,000 copies to start your DNA analysis, and it takes 3 minutes per cycle with your PCR equipment. How many cycles are needed? How long will it be before you can start analyzing your DNA?

*Answer:* To make 450,000 copies from 15 copies, it will take 15 cycles. At 3 minutes per cycle, that will total 45 minutes*.*

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA analysis, DNA

80. How does PCR aid in detecting genetic differences from a small starting sample, say a strand of hair?

*Answer:* PCR increases the number of copies of DNA in any given sample. Typically, PCR is used to amplify a specific sequence, thereby increasing the total amount of DNA from the target region that you would like to compare. Thus, many copies of a target sequence can be made from a very small starting sample.

DQ: How is DNA copied in living cells, and how can DNA be amplified for forensics?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA profiling, forensics, PCR

81. STRs are

A. single tandem repeats.

B. sequence tandem reactants.

C. single technique runs.

D. short tandem repeats.

E. several tandem repeats.

Answer: D

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: STRs

82. STRs are

A. found only on chromosome 7.

B. in the coding regions only of all chromosomes.

C. the same on every chromosome.

D. in the non-coding regions of all chromosomes.

E. in the non-coding regions of some chromosomes.

Answer: D

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Hard

Important Words/Concepts: STR/location

83. STRs are

A. pieces of DNA of the same length scattered throughout the genome.

B. repeated different numbers of times in different individuals.

C. DNA sequences inherited from only one parent.

D. identical on both members of a chromosome pair.

E. always identical in fraternal twins.

Answer: B

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: STR

84. DNA profiling is used to identify

A. genes.

B. a person.

C. chromosome mutations.

D. protein mutations.

E. time of a crime.

Answer: B

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Easy

Important Words/Concepts: STR

85. What are short tandem repeats (STRs)?

A. Blocks of repeated RNA sequences (AGCT) found at points along our chromosomes

B. Blocks of repeated DNA sequences (AGCT) that are highly similar from person to person

C. Blocks of repeated DNA sequences (AGCT) that vary in length from person to person

D. Sequences of non-repeated DNA that are consistent from person to person

E. Sequences of non-repeated DNA that are highly variable from person to person

Answer: C

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: STR

86. What is the significance of STRs in DNA profiling?

A. STRs vary among different tissues within an individual, so they can be used to determine which organ was the source of the DNA.

B. STRs are inherited from only maternal DNA and can track parentage.

C. STRs are inherited from only paternal DNA and can track parentage.

D. STRs vary in length from person to person, which helps to identify specific individuals.

E. STRs code for proteins, therefore they are highly variable among individuals and can help to identify specific individuals.

Answer: D

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA profiling, forensics, STR

87. The “coding” region of DNA is the DNA sequence that

A. encodes a specific protein sequence.

B. is unique among individuals.

C. provides a genetic “fingerprint,” because of individual variation.

D. encodes a specific carbohydrate sequence.

E. encodes the double-helix shape.

Answer: A

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA, coding region

88. DNA regions that do not code for protein

A. make up a limited portion of chromosomal DNA.

B. have no function.

C. are nearly identical from person to person.

D. are segregated on a few large chromosomes.

E. can control how and when coding regions are used.

Answer: E

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA profiling, forensics, STR

89. Short tandem repeats are important because they are

A. only found within the coding regions of the DNA.

B. DNA sequences that can identify individuals.

C. similar even in most unrelated individuals.

D. found on only 7 of the 23 chromosome pairs.

E. large proteins that can be amplified via gel electrophoresis.

Answer: B

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: forensics, STR

90. STR DNA analysis can be used for all of the following applications EXCEPT

A. determining time of death.

B. identifying a missing person.

C. paternity testing.

D. crime scene suspect identification.

E. ruling out a potential suspect.

Answer: A

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA profiling, forensics, STR

91. Which of the following is an STR?

A. AGATAGATAGAT

B. AGATTAGAAGAT

C. AGATCAGATAGA

D. AGAUAGAUAGAU

E. Serine-lysine-serine-lysine

Answer: A

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: allele, STR

92. Which of the following statements is FALSE?

A. You may have different numbers of copies of an STR on each member of a pair of chromosomes.

B. The greater the number of STRs analyzed, the smaller the field of individuals with identical numbers of STRs.

C. Females inherit STRs on their X chromosomes only from their mothers.

D. Males inherit STRs on the Y chromosome only from their fathers.

E. STR analysis can be used to determine paternity using DNA samples.

Answer: C

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Hard

Important Words/Concepts: Inheritance, paternity

93. Forensic scientists create DNA profiles using non-coding DNA sequences known as \_\_\_\_\_\_\_\_\_.

*Answer:* STRs OR short tandem repeats

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: allele, STR

94. Explain the difference between coding and non-coding regions of DNA.

*Answer:* Coding regions of DNA contain genes that encode specific proteins. Coding regions contain regions of DNA that are nearly identical between individuals. Non-coding regions do not code for proteins and thus are not genes, but they do contain STRs, which vary in length and can be used to identify individuals.

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA profiling, forensics, STR

95. For a certain STR, a mother has 7 repeats on one chromosome and 3 repeats on the other chromosome. Her child has 4 repeats on one chromosome and 3 repeats on the other chromosome. How many repeats must the child’s father have on at least one chromosome?

*Answer:* 4

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Easy

Important Words/Concepts: STR, paternity

96. What is “junk DNA”? What important use do scientists have for “junk DNA”?

*Answer:* “Junk DNA” refers to non-coding DNA. This DNA contains short tandem repeats. These STRs can be used for identification and comparison among individuals, including forensic DNA analysis, paternity testing, and ancestry determination.

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA profiling, forensics, STR

97. A DNA profile of an individual is usually made by comparing banding patterns from

A. 15 STRs.

B. 15 PCRs.

C. chromosome 7 STRs.

D. 15 STRs on chromosome 7.

E. 15 PCRs of chromosome 7.

Answer: A

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Easy

Important Words/Concepts: STR/DNA profile

98. What is a DNA profile?

A. The sequence of the coding region within a DNA sample

B. A unique banding pattern seen on gel electrophoresis corresponding to the non-coding regions of an individual’s DNA

C. A unique banding pattern seen on gel electrophoresis corresponding to the coding regions of an individual’s DNA

D. A banding pattern seen on gel electrophoresis, which is usually identical between parent and child

E. A technique used by forensic scientists that compares protein sequences among individuals in order to identify suspects

Answer: B

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA profile, forensics, gel electrophoresis

99. The exact \_\_\_\_ of each STR region varies from person to person.

*Answer:* length

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Easy

Important Words/Concepts: STR

100. What is the correct sequence in creating a DNA profile?

A. Collect sample->extract DNA->PCR to amplify STRs->gel electrophoresis->analyze gel

B. Collect sample->extract DNA-> gel electrophoresis->PCR to amplify STRs-> analyze gel

C. Collect sample->gel electrophoresis->extract DNA->PCR to amplify STRs->gel electrophoresis again->analyze gel

D. Collect sample->PCR to amplify sample->gel electrophoresis->extract DNA->gel electrophoresis again->analyze gel

E. PCR to amplify sample->extract DNA->gel electrophoresis->analyze gel

Answer: A

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA profile, forensics, gel electrophoresis, PCR, STR

101. What is gel electrophoresis?

A. A laboratory technique used to amplify DNA based on the size of the DNA fragment

B. A laboratory technique used to separate DNA into coding and non-coding regions

C. A laboratory technique used to analyze DNA samples that separates DNA according to the size of the DNA fragment

D. A laboratory technique used to analyze DNA samples that separates DNA into chromosomes

E. A laboratory technique that stains regions of a chromosome different colors so that an individual may be identified

Answer: C

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA profiling, forensics, gel electrophoresis

102. Which is NOT true of gel electrophoresis?

A. Smaller DNA fragments remain together and cannot be separated.

B. PCR fragments can be separated using an electric current.

C. For any one STR region, a person may have either one or two bands.

D. PCR fragments of the same length travel through the gel at the same rate.

E. Large fragments stay closer to the loading wells.

Answer: A

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA profiling. Forensics, gel electrophoresis, STR

103. When performing gel electrophoresis, the STRs are separated by \_\_\_\_\_, with the \_\_\_\_\_\_ones moving the farthest.

A. size; largest

B. charge; negative

C. charge; positive

D. size; smallest

E. number of adenines; most adenine-dense

Answer: D

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Easy

Important Words/Concepts: STE, gel electrophoresis

104. A DNA profile using 15 STRs may show as many as \_\_\_\_ bands on a gel.

A. 60

B. 30

C. 15

D. 32

E. None of the above

Answer: B

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Easy

Important Words/Concepts: STR/DNA profile

105. PCR of a single STR can produce \_\_\_\_\_ on a gel.

A. one thick band

B. one thin band

C. two thin bands

D. two thick bands

E. one thick or two thin bands

Answer: E

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Easy

Important Words/Concepts: STR/DNA profile

106. When creating a DNA profile, why are STRs used?

*Answer:* STRs are highly variable, and although individuals may share the same number of repeats at any particular STR, the combined pattern of STR repeats at multiple sites is unique to every person.

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA profiling forensics, STR

107. You collect cells from a patient’s kidney and liver and isolate DNA from each sample separately. You use that DNA to obtain a genetic fingerprint for liver versus kidney. What do you expect to see?

1. STR profiles will be completely different because liver and kidney have completely different functions, and thus completely different genes.
2. STR profiles will be related, but not identical, because different cell types have different numbers of STR’s.
3. STR profiles will be identical because all cells belonging to an individual have the same DNA and the same genes.
4. STR profiles may be identical or completely different because half of a person’s DNA comes from Mom and the other half comes from Dad.
5. Any of the above may be true.

Answer: C

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Hard

Important Words/Concepts: gene regulation, all cells in an individual contain the full genome, STR, DNA fingerprinting

108. Identical chromosomal DNA sequences would most likely be found between an individual and his/her

A. mother.

B. sibling.

C. step-brother.

D. identical twin.

E. fraternal twin.

Answer: D

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA inheritance

109. Whose DNA will be most similar to Bob’s? Arrange them in order, from most similar to least similar: mother, sibling, grandfather, identical twin.

1. identical twin, mother, sibling, grandfather
2. grandfather, sibling, mother, identical twin
3. mother, sibling, identical twin, grandfather
4. identical twin, sibling, grandfather, mother
5. none of the above

Answer: A

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Hard

Important Words/Concepts: heredity, DNA and uniqueness

110. Whose DNA would be least similar to yours?

1. mother
2. father
3. mother’s brother
4. identical Twin
5. elder sibling

Answer: C

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA similarity, inheritance

111. One commonly used STR is called “TH01,” found on chromosome 11. Let’s say we have STR information on TH01 from DNA profiles of both of Marcus’s parents. Which is the most likely description of TH01 differences between Marcus’s parents?

A. Mom has three copies of TH01 and Dad has five copies.

B. Mom has TH01 and Dad does not.

C. Dad has TH01 and Mom does not.

D. Mom’s TH01 has a different sequence than Dad’s TH01.

E. Any of these are likely possibilities.

Answer: A

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Hard

Important Words/Concepts: STR, chromosomes, inheritance, DNA profiling, STR sites

112. Here are non-coding sequences from Mary and Bob. Both sequences come from the same region of chromosome 12:

Mary: TTCGTTCCCAGCTAGCTAGCTAGCTAGCTTAACCGGC

Bob: TTCGTTCCCAGCTAGCTTAACCGGC

Which of the following accurately compares Mary and Bob’s DNA?

A. Mary and Bob are most likely fraternal twins.

B. Mary has five STRs at this site; Bob has two.

C. Mary has one STR at this site; Bob has none.

D. The DNA shown must be from the 23rd chromosome, not the 12th.

E. None of the above

Answer: B

DQ: How does DNA profiling make use of genetic variation in DNA sequences?

Type: Use It

Difficulty: Easy

Important Words/Concepts: STR, DNA non-coding sequences

113. DNA can be found in/on

A. a fresh blood sample.

1. a hair follicle.
2. a sperm cell.
3. your pencil.
4. All of the above

Answer: E

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA, location

114. Where is DNA found?

1. chromosomes
2. blood
3. saliva
4. hair root
5. All of the above.

Answer: E

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Easy

Important Words/Concepts: chromosomes, DNA location

115. You are a juror at a trial and you have been told that the suspect’s DNA was found at the crime scene. The DNA came from a sweat-stained shirt and saliva on a cigarette butt. Several other jurors are quite skeptical of this information, adamant in their belief that sweat and saliva are body fluids and therefore should not contain DNA. How do you explain the scientific basis of this evidence to them during deliberations in the jury chamber?

*Answer:* The other jurors are correct that sweat and saliva are body fluids and in knowing that DNA is found in cells. However, body fluids often contain cells. Saliva contains cells from the inner surface of the cheeks, and sweat often contains skin cells.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: cells, DNA

116. You are a juror at a trial and you have been told that the suspect’s DNA was found at the crime scene. The DNA came from a sweat-stained shirt and saliva on a cigarette butt. Several other jurors are quite skeptical of this information, adamant in their belief that sweat and saliva are body fluids (not cells) and therefore should not contain DNA. How do you explain the scientific basis of this evidence to them during deliberations in the jury chamber?

1. The jurors are correct; body fluids do not contain cells.
2. The jurors are mostly correct; body fluids contain cells but not DNA.
3. Body fluids contain a few cells, and thus some DNA.
4. Sweat contains DNA, but saliva does not.
5. Saliva contains DNA, but sweat does not.

Answer: C

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: cells, DNA

117. The use of DNA in forensic science is

A. widely accepted.

B. junk science.

C. still being validated.

D seldom used.

E only used when other evidence is doubtful.

Answer: A

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA analysis

118. DNA analysis is used in

A. paternity suits.

B. placing suspects at the scene of a crime.

C. analysis of mummies.

D. identifying corpses.

E. All of the above.

Answer: E

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA analysis

119. Some problems with use of DNA analysis for forensic evidence may occur because of

A. identical twins.

B. not enough of a sample.

C. contaminated samples.

D. degraded samples.

E. All of the above.

Answer: E

DQ: How does DNA evidence fit into forensic investigations?

Type: Use it

Difficulty: Easy

Important Words/Concepts: DNA analysis

120. A blood stain collected at a crime scene is believed to belong to a suspect. What would NOT be a problem in using DNA from that sample to conclusively identify the suspect?

1. The suspect is one of three identical triplets.
2. The sample is contaminated with DNA from other unknown people.
3. The DNA is in good condition, but the amount is small.
4. The suspect is missing and no DNA from him/her is available.
5. All of the above would prevent identification using DNA.

Answer: C

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA fingerprinting, DNA profiling, PCR

121. Which of the following statements is least likely to be true?

A. A father and son share some identical sequences of DNA.

B. A mother and daughter share some identical sequences of DNA

C. A father and daughter share some identical sequences of DNA

D. The DNA that codes for human hair is more likely to be similar between genetic siblings than between unrelated individuals.

E. A mother and father share more identical sequences with each other than they do with their children.

Answer: E

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Easy

Important Words/Concepts: inheritance, DNA similarity

122. The only person(s) with DNA that exactly matches your DNA would be \_\_\_\_\_\_\_.

*Answer:* a sibling that resulted from the same egg as you (an identical twin, triplet, etc.)

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Easy

Important Words/Concepts: inheritance, DNA similarity

123. Some highly degraded DNA was collected from a crime scene. Upon analysis, forensic scientists were only able to accurately sequence one 450-nucleotide-long segment of DNA from a Y chromosome. There are five suspects in the case, but they have fled the state. However, they all have large extended families in the area. How can the police narrow the search to just one suspect?

*Answer:* Analyze the DNA of male siblings, fathers, or paternal grandfathers, because the Y chromosome is passed from father to son.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: Y chromosome, inheritance

124. Some highly degraded DNA was collected from a crime scene. Upon analysis, forensic scientists were only able to accurately sequence one 450-nucleotide-long segment of DNA from a Y chromosome. There are five suspects in the case, but they have fled the state. However, they all have large extended families in the area. How can the police narrow the search to just one suspect?

A. Collect DNA from male siblings, fathers, or paternal grandfathers.

B. Collect DNA from sisters, mothers, and maternal grandmothers.

C. Collect DNA from any male relatives on the mother’s or father’s side.

D. Collect DNA from any female relatives on the mother’s or father’s side.

E. Collect DNA from any available blood relatives of any gender.

Answer: A

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA profiling, sex chromosome inheritance

125. Explain how DNA samples are isolated from a crime scene.

*Answer:* Investigators must carefully identify potential sources of DNA and collect samples, being sure not to contaminate those samples with their own DNA (from their skin cells, hair, etc.). Then DNA must be isolated from the source materials (clothing, carpeting, etc.). This often involves the use of chemicals and a centrifuge to separate the DNA from the source; the type of chemical depends on the source material.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: forensics, DNA isolation

126. The gel at right shows the DNA profiles for several individuals. If A is the mother and B is the father, which one of the others could be their child?

A. C

B. D

C. E

D. C, D, and E

E. None of the above

Answer: A

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Easy

Important Words/Concepts: STR, paternity testing, DNA profiling, inheritance

127. You have been asked to verify that you are not the father of a child, and you have gone in for a paternity test. As part of that testing, you were provided the following information regarding your STRs. What does this chart mean?

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| STR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| You | 2,7 | 3,8 | 3,19 | 2,3 | 7,9 | 9,10 | 2,8 | 3,4 | 4,4 | 5,9 | 12,12 | 9,20 | 8,19 | 10,20 | 5,9 |

*Answer:* The paternity testing center has examined the 15 standard STRs used in forensic science. You have two numbers for each of these STRs because you have two copies of every chromosome, one copy you inherited from your mother and one copy you inherited from your father. The numbers indicate the number of STR repeats you have on each chromosome.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Easy

Important Words/Concepts: STR analysis, forensic science, paternity

128. Based on the data below showing a limited number of STRs, discuss the parentage of this child.

|  |  |  |  |
| --- | --- | --- | --- |
| STR# | Child’s STRs | Mother’s STRs | Father’s STRs |
| #1 | 3,8 | 3, 8 | 4,8 |
| #2 | 6,9 | 2,9 | 6,9 |
| #3 | 4,4 | 4,8 | 7,4 |
| #4 | 5,12 | 16, 12 | 15, 2 |
| #5 | 6, 16 | 6, 1 | 9,12 |

*Answer:* For STRs 1, 2, and 3, each of the listed parents has at least one matching STR. However, for STRs 4 and 5, the father has no matching STRs, eliminating him as the biological father. The mother is still potentially the mother; however, five STRs is not enough to fully validate that.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: STR

129. What is now commonly used by forensic scientists as evidence in criminal cases to free people wrongly convicted of crimes?

A. RNA profile

B. DNA profile

C. protein profile

D. carbohydrate profile

E. expert witnesses

Answer: B

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA profiling, forensics, STR

130. How is DNA analyzed for the purposes of forensic evidence?

A. DNA is analyzed for the presence of nucleotide bases.

B. Fragments of DNA are run on a gel to separate them by size and form a pattern.

C. DNA is analyzed quickly, within a certain time frame, because it degrades over time.

D. A technique called STR is used to amplify small fragments of DNA.

E. Regions of DNA from the suspect are amplified and compared to crime scene DNA.

Answer: E

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA profiling, forensics, gel electrophoresis, PCR

131. Why can DNA extraction be a very painstaking process for forensic scientists?

A. It can be difficult to obtain enough cells in a sample to yield enough DNA.

B. Samples can become contaminated with foreign DNA from improper handling.

C. Samples stored improperly can degrade too much to be used.

D. Samples from the crime scene may contain DNA from multiple individuals.

E. All of the above

Answer: E

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA profiling, forensics

132. Explain how DNA PCR analysis has changed modern crime-scene analysis.

*Answer:* Many traditional sources of evidence can have multiple reasons for their presence at a crime scene. Thus, linking that evidence to a particular suspect beyond a reasonable doubt can be difficult. Because PCR provides a DNA fingerprint unique to every individual, there is no doubt about the source of the DNA at a crime scene.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA profiling, forensics, PCR, STR

133. Which type of crime scene evidence is most reliable?

A. blood-spatter analysis

B. eyewitness accounts

C. STR analysis

D. dental-bite impressions

E. enzyme analysis

Answer: C

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: easy

Important Words/Concepts: forensics, STR

134. Since 1992, the Innocence Project has overturned the convictions and freed more than

A. 3 people.

B. 30 people.

C. 300 people.

D. 3,000 people.

E. 30,000 people.

Answer: C

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Hard

Important Words/Concepts: CODIS, forensics

135. CODIS is a database that has

A. helped to convict over 1 million criminals.

B. been used to free 45,000 persons who were wrongfully arrested.

C. only rarely been useful for identifying potential suspects.

D. records for over 4.5 million criminal DNA profiles.

E. helped to convict over 4.5 million criminals.

Answer: D

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Easy

Important Words/Concepts: CODIS, forensics

136. What is the significance of CODIS?

A. CODIS aids in setting free wrongfully accused people.

B. CODIS contains more than 4.5 million profiles from criminals in 50 states.

C. Each DNA profile in CODIS contains 15 specific STRs.

D. CODIS can help identify suspects when other methods cannot.

E. All of the above.

Answer: E

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Easy

Important Words/Concepts: CODIS, DNA profiling, STR

137. What is the major drawback of STR profile comparisons, especially with respect to use in forensics?

*Answer:* In order to make any conclusions, you must have a sample to compare your unknown sample against. The STR profile of an unknown sample of DNA must have a sample to be compared to in order to draw any conclusions. This is why the CODIS database is so useful—it gives scientists a number of DNA STR profiles to search for possible matches.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA profiling, forensics, STR

138. Imagine a crime scene in which traditional sources of evidence have not yielded a suspect. A DNA profile is generated and run through the CODIS database. There is no perfect match; however, one person has at least one band in common with the crime-scene DNA at every STR site. This person, however, is in jail and could not have committed the crime. Is this information still useful for identifying a potential suspect?

*Answer:* Yes. Because STRs are inherited from your parents, someone who has a high number of matches to the unknown sample could be a relative. In the case above, having one band in common at every STR site suggests a parent child relationship.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA profiling, forensics, STR

139. You have DNA samples isolated from three separate locations at a crime scene. You have amplified the DNA and run it through CODIS and have no matches. What are your next steps?

*Answer:* DNA comparisons are a very useful tool, but they do not eliminate the need for basic investigative police work to identify potential suspects. The next step is to pursue normal investigative channels to identify suspects and collect samples of DNA for comparison.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Easy

Important Words/Concepts: forensic analysis, CODIS

138. You are running gel electrophoresis on several samples of DNA collected from a crime scene. When you look at the gel, you notice that suspect number 2 has three bands for one STR. Is this a problem? Why or why not?

*Answer:* Yes, this is a problem. Every person inherits two alleles for each STR—one from their mother and one from their father. These alleles can either be the same length or different lengths. If they are the same length, then they will show up as one band on the gel. If the alleles are of two different lengths, they will show up as two bands on the gel. Having three bands for one STR in one individual is impossible. Therefore, this sample has been contaminated with DNA from another individual.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA profiling, forensics, STRs

139. Currently, forensic scientists use \_\_\_\_ STRs found on \_\_\_ different chromosomes.

*Answer:* 15; 14

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Easy

Important Words/Concepts: STR

140. You have the following dataset and you are trying determine paternity between two potential fathers. How do these data reflect the need for multiple STRs for proper analysis?

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| STR# | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Mother | 3,4 | 5,9 | 4,8 | 3,8 | 4,4 | 4,10 | 2,4 | 3,3 | 3,8 | 2,2 | 4,4 | 2,2 | 4,7 | 7,7 | 6,7 |
| Child | 3,4 | 5,8 | 4,4 | 3,8 | 4,4 | 4,10 | 2,4 | 3,3 | 3,4 | 2,2 | 4,5 | 2,2 | 4,7 | 7,7 | 6,7 |
| Male 1 | 3,4 | 5,9 | 4,8 | 3,8 | 4,4 | 4,10 | 2,4 | 3,3 | 3,4 | 2,2 | 5,5 | 2,4 | 4,6 | 7,9 | 6,9 |
| Male 2 | 3,4 | 5,9 | 4,4 | 3,8 | 4,4 | 4,4 | 2,4 | 3,5 | 3,4 | 2,4 | 5,6 | 2,4 | 7,7 | 7,9 | 8,9 |

*Answer:* Much of the data are inconclusive, eliminating neither man. STRs 1, 4, 5, and 7 reflect the fact that many people share the same number for any given STR. In this case, the child, mother, and both potential fathers had the same number of STRs on each chromosome. In looking at STRs 2, 3, 6, and 8 through 14, either man could have been a match, depending on which STR represented the one the child inherited from the mother. Only on the 15th STR do you see a case where male 2 could not have been the DNA contributor.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA profiling, STR, paternity testing, need for multiple STR sites

141. You examine a gel containing the DNA profile of a mother and her biological child. Only 10 STRs were used to obtain the profile. How many bands on the gel should be identical in size between mother and child?

A. 20

B. 10

C. 5

D. 1

E. 8

Answer: B

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: STR/DNA profile

142. Typically, the pattern for any one STR site is shared by \_\_\_\_ of people.

A. 5% to 20%

B. 2% to 5%

C. 10% to 15%

D. 15% to 20%

E. greater than 25%

Answer: A

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA profiling, forensics

143. How many STR patterns are generally analyzed to create a profile?

A. 9

B. 11

C. 12

D. 15

E. 17

Answer: D

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Easy

Important Words/Concepts: DNA profiling, forensics, STR

144. DNA sequence data on criminals is stored in a database called

A. DNA registry.

B. CODIS.

C. the Innocence Project.

D. Biobank.

E. STRbase.

Answer: B

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Easy

Important Words/Concepts: CODIS, DNA profiling, forensics

145. Do you think STRs could be used to prove paternity? How?

*Answer:* Yes! In the same way that you can use STRs to determine if a person’s DNA matches the DNA found at crime scene, one can use STRs inherited from one’s parents to determine paternity.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA profiling, STR

146. A parent gives half their DNA to their child. This means that when 10 STRs are studied, at least \_\_\_\_\_ bands will be identical on a gel comparing one parent and child.

A. 5

B. 10

C. 20

D. more than 20

E. 5 but no more than 10

Answer: B

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: STR, inheritance, paternity testing, DNA profiling

147. Currently, 15 STR sites are used to create a DNA profile. What are the implications for crime scene analysis if only four sites were used? What are the implications if 25 sites are used?

*Answer:* If only four sites are used, positive identification of a suspect becomes more difficult because as the number of sites decreases, the chances for multiple people matching at those sites increase. Conversely, the more sites are examined, the less likely two people are to match and the more confidence you would have that you correctly identified the source of the DNA.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Hard

Important Words/Concepts: DNA profiling, forensics, STR

148. Which of the following would give the greatest chance of identifying a person using a DNA profile?

A. 5 STR sites

B. 15 STR sites

C. 25 STR sites

D. There’s no difference; anything over 5 is enough.

E. There’s no difference; anything under 25 is enough.

Answer: C

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Easy

Important Words/Concepts: STRs, DNA profiling

149. If you share the same banding pattern at an individual STR site with up to 20% of all other people, how is it that STRs can positively identify one individual among millions?

*Answer:* While someone may share the same banding pattern at any one STR site with up to 20% of all other people, the variation in STR alleles is so high that the combined banding patterns across 15 STR sites is highly unlikely to match any other person in the world.

DQ: How does DNA evidence fit into forensic investigations?

Type: Know It

Difficulty: Hard

Important Words/Concepts: DNA profiling, forensics, STR

150. You are analyzing DNA from a crime scene, but you have a very limited budget. Instead of looking at the 15 STR sites generally used to create a DNA profile, you decide to only look at eight STR sites. There are only two possible suspects in the crime, and they are brothers. Do you think the eight STR sites you examine will be adequate to make a positive identification to determine which brother committed the crime? Why or why not?

*Answer:* Because the suspects are brothers, they have a high likelihood of sharing the same pattern at any one STR site. Therefore, an examination of only eight STR sites has only a low probability of identifying the brother who committed the crime.

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA profiling, forensics, STR

151. You are analyzing DNA from a crime scene, but you have a very limited budget. Instead of looking at the 15 STR sites generally used to create a DNA profile, you decide to only look at eight STR sites. There are only two possible suspects in the crime, and they are brothers. Do you think the eight STR sites you examine will be adequate to make a positive identification to determine which brother committed the crime?

A. Yes, because five or more sites are enough to identify most individuals.

B. Yes, because siblings only share seven or eight sites, so eight STRs will be enough.

C. No, because siblings have more similar DNA profiles than unrelated people.

D. No, because siblings will have identical DNA profiles, even with 15 STRs.

E. STRs cannot be used to distinguish between siblings.

Answer: C

DQ: How does DNA evidence fit into forensic investigations?

Type: Use It

Difficulty: Easy

Important Words/Concepts: DNA profiling, forensics, STR