1. Translation requires:
   A. mRNA, tRNA, DNA and rRNA
   B. mRNA, DNA, rRNA
   C. mRNA, tRNA, DNA, rRNA and amino acid
   D. mRNA, tRNA and DNA
   E. mRNA, tRNA, rRNA

2. Okazaki fragments are joined together by:
   A. Primase
   B. DNA polymerase I
   C. DNA polymerase III
   D. DNA ligase
   E. DNA polymerase II

3. Post- translational modifications of proteins may include the --------:
   A. Addition of carbohydrate to form a glycoprotein
   B. Addition of a poly-A tail
   C. Intron shuffling
   D. Addition to 5’ cap
   E. Removal of introns

4. In the process of transcription, ----------:
   A. Protein modification is completed
   B. Proteins are synthesized
   C. RNA is synthesized
   D. mRNA attaches to ribosomes
   E. DNA is replicated

5. The oxygen produced in the light reaction of photosynthesis comes from:
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   B. ATP
   C. Glucose
   D. CO_2
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6. The 5’ end of each Okazaki fragment begins with:
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   B. Terminator
   C. Origin of replication
   D. RNA primer

7. Transcription in eukaryotes requires which of the following in addition to RNA polymerase:
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   B. Ribosomes and tRNA
   C. Transcription factors
   D. The protein product of promoter
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   B. Topoisomerase
   C. Single strand binding proteins
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    A. Each new strand is complementary not identical to its template
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    C. Adenine
    D. Guanine
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16. True OR false: Both DNA and RNA have the same pentose

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B. The lagging strand
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28. Which of the following is mis-matched?
A. (G = C) and (A = T) Chargaff rules
B. TATA box: DNA polymerase binding
C. DNA: Double helix
D. Splicing: Eukaryotic pre-mRNA
E. Lagging strand: Okazaki fragment

29. Which of the following statement about nucleosome is incorrect?
A. The nucleosome core contains an octet of 8 histone proteins
B. There are two copies of each histone protein in the nucleosome core
C. Four copies of histone H1 is present in the nucleosome core
D. Are the unit of DNA packing
E. The nucleosome core is wrapped by the DNA double helix

30. Which is incorrect for RNA polymerase:
A. Several RNA polymerases can transcribe a gene simultaneously
B. It needs a primer
C. It can unwind the two strands of DNA to initiate transcription
D. It is binding to the DNA template strand is mediated by transcription factor
E. All of the options are incorrect

31. The point mutation that doesn't produce a change in the amino acid sequence of a protein is known as:
A. Non-sense mutation
B. Missense mutation
C. Chromosomal mutation
D. Frame-shift mutation
E. Silent mutation

32. In a nucleosome, the DNA is wrapped around :
A. Polymerase molecules
B. Ribosomes
C. Histones
D. A thymine dimer
E. Satellite DNA

33. Which of the following represents the order of increasingly higher levels of organization of chromatin?

A. Nucleosome, 30-nm chromatin fiber, looped domain
B. Looped domain, 30-nm chromatin fiber, nucleosome
C. Looped domain, nucleosome, 30-nm chromatin fiber
D. Nucleosome, looped domain, 30-nm chromatin fiber
E. 30-nm chromatin fiber, nucleosome, looped domain

34. Why do histones bind tightly to DNA?

A. Histones are positively charged, and DNA is negatively charged.
B. Histones are negatively charged, and DNA is positively charged.
C. Both histones and DNA are strongly hydrophobic.
D. Histones are covalently linked to the DNA.
E. Histones are highly hydrophobic, and DNA is hydrophilic

35. Which of the following statements describes the eukaryotic chromosome?

A. It is composed of DNA alone.
B. The nucleosome is its most basic functional subunit.
C. The number of genes on each chromosome is different in different cell types of an organism.
D. It consists of a single linear molecule of double-stranded DNA.
E. Active transcription occurs on heterochromatin.

36. Which of the following sets of materials are required by both eukaryotes and prokaryotes for replication?

A. Double-stranded DNA, 4 kinds of dNTPs, primers, origins
B. Topoisomerases, telomerase, polymerases
C. G-C rich regions, polymerases, chromosome nicks
D. nucleosome loosening, 4 dNTPs, 4 rNTPs
E. ligase, primers, nucleases

37. Individuals with the disorder xeroderma pigmentosum are hypersensitive to sunlight. This occurs because their cells have which impaired ability?

A. They cannot replicate DNA.
B. They cannot undergo mitosis.
C. They cannot exchange DNA with other cells.
D. They cannot repair thymine dimers.
E. They do not recombine homologous chromosomes during meiosis.

38. Which of the following help to hold the DNA strands apart while they are being replicated?

A. Primase
B. Ligase
C. DNA polymerase
D. Single-strand binding proteins
E. Exonuclease

39. What is the role of DNA ligase in the elongation of the lagging strand during DNA replication?

A. Synthesize RNA nucleotides to make a primer
B. Catalyze the lengthening of telomeres
C. Join Okazaki fragments together
D. Unwind the parental double helix
E. Stabilize the unwound parental DNA

40. What is the function of topoisomerase?

A. Relieving strain in the DNA ahead of the replication fork
B. Elongation of new DNA at a replication fork by addition of nucleotides to the existing chain
C. The addition of methyl groups to bases of DNA
D. Unwinding of the double helix
E. Stabilizing single-stranded DNA at the replication fork

41. The leading and the lagging strands differ in that

A. The leading strand is synthesized in the same direction as the movement of the replication fork, and the lagging strand is synthesized in the opposite direction.
B. The leading strand is synthesized by adding nucleotides to the 3' end of the growing strand, and the lagging strand is synthesized by adding nucleotides to the 5' end.
C. The lagging strand is synthesized continuously, whereas the leading strand is synthesized in short fragments that are ultimately stitched together.
D. The leading strand is synthesized at twice the rate of the lagging strand.

42. Which of the following best describes the addition of nucleotides to a growing DNA chain?

A. A nucleoside triphosphate is added to the 5' end of the DNA, releasing a molecule of pyrophosphate.
B. A nucleoside triphosphate is added to the 3' end of the DNA, releasing a molecule of pyrophosphate.
C. A nucleoside diphosphate is added to the 5' end of the DNA, releasing a molecule of phosphate.
D. A nucleoside diphosphate is added to the 3' end of the DNA, releasing a molecule of phosphate.
E. A nucleoside monophosphate is added to the 5' end of the DNA.

43. Which of the following synthesizes short segments of RNA?

A. Helicase
B. DNA polymerase III
C. Ligase
D. DNA polymerase I
E. Primase

44. The difference between ATP and the nucleoside triphosphates used during DNA synthesis is that

A. The nucleoside triphosphates have the sugar deoxyribose; ATP has the sugar ribose.
B. The nucleoside triphosphates have two phosphate groups; ATP has three phosphate groups.
C. ATP contains three high-energy bonds; the nucleoside triphosphates have two.
D. ATP is found only in human cells; the nucleoside triphosphates are found in all animal and plant cells.
E. Triphosphate monomers are active in the nucleoside triphosphates, but not in ATP.

45. Which of the following removes the RNA nucleotides from the primer and adds equivalent DNA nucleotides to the 3' end of Okazaki fragments?

A. Helicase
B. DNA polymerase III
C. Ligase
D. DNA polymerase I
E. Primase

46. Which of the following separates the DNA strands during replication?
A. Helicase
B. DNA polymerase III
C. ligase
D. DNA polymerase I
E. Primase

47. Which of the following covalently connects segments of DNA?
A. Helicase
B. DNA polymerase III
C. ligase
D. DNA polymerase I
E. Primase

48. To repair a thymine dimmer by nucleotide excision repair, in which order do the necessary enzymes act?
A. Exonuclease, DNA polymerase III, RNA primase
B. Helicase, DNA polymerase I, DNA ligase
C. DNA ligase, nuclease, helicase
D. DNA polymerase I, DNA polymerase III, DNA ligase
E. Endonuclease, DNA polymerase I, DNA ligase

49. What is the function of DNA polymerase III?
A. To unwind the DNA helix during replication
B. To seal together the broken ends of DNA strands
C. To add nucleotides to the end of a growing DNA strand
D. To degrade damaged DNA molecules
E. To rejoin the two DNA strands (one new and one old) after replication

50. What determines the nucleotide sequence of the newly synthesized strand during DNA replication?
A. The particular DNA polymerase catalyzing the reaction
B. The relative amounts of the four nucleoside triphosphates in the cell
C. The nucleotide sequence of the template strand
D. The primase used in the reaction
E. The arrangement of histones in the sugar phosphate backbone

51. An Okazaki fragment has which of the following arrangements?
A. Primase, polymerase, ligase
B. 3' RNA nucleotides, DNA nucleotides 5'
C. 5' RNA nucleotides, DNA nucleotides 3'
D. DNA polymerase I, DNA polymerase III
E. 5' DNA to 3'

52. Replication in prokaryotes differs from replication in eukaryotes for which of these reasons?
A. The prokaryotic chromosome has histones, whereas eukaryotic chromosomes do not.
B. Prokaryotic chromosomes have a single origin of replication, whereas eukaryotic chromosomes have many.
C. The rate of elongation during DNA replication is slower in prokaryotes than in eukaryotes.
D. Prokaryotes produce Okazaki fragments during DNA replication, but eukaryotes do not.
E. Prokaryotes have telomeres, and eukaryotes do not.

53. What is meant by the description "antiparallel" regarding the strands that make up DNA?
A. The twisting nature of DNA creates nonparallel strands.
B. The 5' to 3' direction of one strand runs counter to the 5' to 3' direction of the other strand.
C. Base pairings create unequal spacing between the two DNA strands.
D. One strand is positively charged and the other is negatively charged.
E. One strand contains only purines and the other contains only pyrimidines

54. In an analysis of the nucleotide composition of DNA, which of the following will be found?
A. A = C
B. A = G and C = T
C. A + C = G + T
D. G + C = T + A

55. Why does the DNA double helix have a uniform diameter?

A. Purines pair with pyrimidines.
B. C nucleotides pair with A nucleotides.
C. Deoxyribose sugars bind with ribose sugars.
D. Nucleotides bind with nucleosides.
E. Nucleotides bind with nucleoside triphosphates.

56. What kind of chemical bond is found between paired bases of the DNA double helix?

A. Hydrogen
B. Ionic
C. Covalent
D. Sulfhydryl
E. Phosphate

57. Which of the following is not true of RNA processing?

A. Exons are cut out before mRNA leaves the nucleus.
B. Nucleotides may be added at both ends of the RNA.
C. Ribozymes may function in RNA splicing.
D. RNA splicing can be catalyzed by spliceosomes.
E. A primary transcript is often much longer than the final RNA molecule that leaves the nucleus.

58. The anticodon of a particular tRNA molecule is

A. Complementary to the corresponding mRNA codon.
B. Complementary to the corresponding triplet in rRNA.
C. The part of tRNA that bonds to a specific amino acid.
D. Changeable, depending on the amino acid that attaches to the tRNA.
E. Catalytic, making the tRNA a ribozyme

59. A frameshift mutation could result from

A. A base insertion only.
B. A base deletion only.
C. A base substitution only.
D. Deletion of three consecutive bases.
E. Either an insertion or a deletion of a base.

60. Sickle-cell disease is probably the result of which kind of mutation?
A. Point
B. Frameshift
C. nonsense
D. nondisjunction
E. both B and D

61. When does translation begin in prokaryotic cells?
A. After a transcription initiation complex has been formed
B. as soon as transcription has begun
C. after the 5' caps are converted to mRNA
D. once the pre-mRNA has been converted to mRNA
E. as soon as the DNA introns are removed from the template

62. What is the effect of a nonsense mutation in a gene?
A. It changes an amino acid in the encoded protein.
B. It has no effect on the amino acid sequence of the encoded protein.
C. It introduces a premature stop codon into the mRNA.
D. It alters the reading frame of the mRNA.
E. It prevents introns from being excised.

63. Which of the following is a function of a signal peptide?
A. To direct an mRNA molecule into the cisternal space of the ER
B. to bind RNA polymerase to DNA and initiate transcription
C. to terminate translation of the messenger RNA
D. to translocate polypeptides across the ER membrane
E. to signal the initiation of transcription

64. What are polyribosomes?
A. Groups of ribosomes reading a single mRNA simultaneously
B. Ribosomes containing more than two subunits
C. Multiple copies of ribosomes associated with giant chromosomes
D. Aggregations of vesicles containing ribosomal RNA
E. Ribosomes associated with more than one tRNA

65. During splicing, which molecular component of the spliceosome catalyzes the excision reaction?

A. Protein
B. DNA
C. RNA
D. lipid
E. sugar

66. Alternative RNA splicing

A. Is a mechanism for increasing the rate of transcription.
B. Can allow the production of proteins of different sizes from a single mRNA.
C. Can allow the production of similar proteins from different RNAs.
D. Increases the rate of transcription.
E. Is due to the presence or absence of particular snRNPs.

67. What is the most abundant type of RNA?

A. mRNA
B. tRNA
C. rRNA
D. pre-mRNA
E. hnRNA

68. There are 61 mRNA codons that specify an amino acid, but only 45 tRNAs. This is best explained by the fact that

A. Some tRNAs have anticodons that recognize four or more different codons.
B. The rules for base pairing between the third base of a codon and tRNA are flexible.
C. Many codons are never used, so the tRNAs that recognize them are dispensable.
D. The DNA codes for all 61 tRNAs but some are then destroyed.
E. Competitive exclusion forces some tRNAs to be destroyed by nucleases.

69. What type of bonding is responsible for maintaining the shape of the tRNA molecule?

A. covalent bonding between sulfur atoms
B. ionic bonding between phosphates
C. hydrogen bonding between base pairs
D. van der Waals interactions between hydrogen atoms
E. Peptide bonding between amino acids

70. Accuracy in the translation of mRNA into the primary structure of a polypeptide depends on specificity in the
A. binding of ribosomes to mRNA.
B. shape of the A and P sites of ribosomes.
C. bonding of the anticodon to the codon.
D. attachment of amino acids to tRNAs.
E. both C and D

71. A particular triplet of bases in the coding sequence of DNA is AAA. The anticodon on the tRNA that binds the mRNA codon is
A. TTT
B. UUA
C. UUU
D. AAA.
E. either UAA or TAA, depending on first base wobble.

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73. A mutation in which of the following parts of a gene is likely to be most damaging to a cell?
A. intron
B. exon
C. 5' UTR
D. 3' UTR
E. All would be equally damaging

74. Once transcribed, eukaryotic mRNA typically undergoes substantial alteration that includes
A. union with ribosomes.
B. fusion into circular forms known as plasmids.
C. linkage to histone molecules.
D. excision of introns.
E. fusion with other newly transcribed mRNA

75. In eukaryotes there are several different types of RNA polymerase. Which type is involved in transcription of mRNA for a globin protein?

A. ligase
B. RNA polymerase I
C. RNA polymerase II
D. RNA polymerase III

76. RNA polymerase moves in which direction along the DNA?

A. 3' → 5' along the template strand
B. 3' → 5' along the coding (sense) strand
C. 5' → 3' along the template strand
D. 3' → 5' along the coding strand
E. 5' → 3' along the double-stranded DNA

77. A particular triplet of bases in the template strand of DNA is 5' AGT 3'. The corresponding codon for the mRNA transcribed is

A. 3' UCA 5'
B. 3' UGA 5'
C. 5' TCA 3'
D. 3'ACU 5'
E. either UCA or TCA, depending on wobble in the first base.

78. If proteins were composed of only 12 different kinds of amino acids, what would be the smallest possible codon size in a genetic system with four different nucleotides?

A. 1
B. 2
C. 3
D. 4
E. 12

79. The oxygen released by photosynthesis is produced by which of the following processes?

A. splitting water molecules
B. chemiosmosis
C. the electron transfer system of photosystem I
D. the electron transfer system of photosystem II

80. Which molecule is the final electron acceptor for electrons from photosystem I?
A. oxygen
B. chlorophyll in photosystem II
C. carbon dioxide
D. NADP+

81. What are the products of linear electron flow during the light reactions of photosynthesis?
A. heat and fluorescence
B. ATP and P700
C. ATP and NADPH
D. ADP and NADP+

82. What are the products of cyclic electron flow during the light reactions of photosynthesis?
A. heat and fluorescence
B. ATP
C. ATP and NADPH
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83. Where are ATP synthase complexes located in plant cells?
A. thylakoid membrane only
B. inner mitochondrial membrane only
C. thylakoid membrane and inner mitochondrial membrane
D. thylakoid membrane and plasma membrane

84. In a plant, which of the following reactions produce molecular oxygen (O2)?
A. the light reactions alone
B. the Calvin cycle alone
C. the light reactions and the Calvin cycle
D. neither the light reactions nor the Calvin cycle

85. The mechanism of photophosphorylation is most similar to which of the following processes?
A. substrate-level phosphorylation in glycolysis
B. oxidative phosphorylation in cellular respiration
C. the Calvin cycles
D. reduction of NADP+

86. Which of the following processes is most directly driven by light energy?
A. creation of a pH gradient by pumping protons across the thylakoid membrane
B. carbon fixation in the stroma
C. reduction of NADP+ molecules
D. removal of electrons from chlorophyll molecules

87. Which of the following sequences correctly represents the flow of electrons during photosynthesis?
A. NADPH → O2 → CO2
B. H2O → NADPH → Calvin cycle
C. NADPH → chlorophyll → Calvin cycle
D. NADPH → electron transport chain → O2

88. Which of the following processes occurs during the Calvin cycle?
A. reduction of NADPH
B. release of oxygen
C. regeneration of the CO2 acceptor
D. production of ATP

89. What is the function of the pigment molecules in a light-harvesting complex in the thylakoid membranes?
A. They split water and release oxygen from the reaction-center chlorophyll.
B. They absorb and transfer light energy to the reaction-center chlorophyll.
C. They synthesize ATP from ADP and Pi
D. They transfer electrons to NADP+

90. Which of the following statements is the most current description of a gene?
A. a unit of heredity that causes formation of a phenotypic characteristic
B. a DNA subunit that codes for a single complete protein
C. a DNA sequence that is expressed to form a functional product: either RNA or polypeptide
D. a discrete unit of hereditary information that consists of a sequence of amino acids

91. Which of the following processes occurs when termination of translation takes place?
A. The end of the mRNA molecule is reached.
B. A stop codon is reached.
C. The 5′ cap is reached.
D. The poly-A tail is reached.

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B. ATP
C. H_2O
D. Glucose
E. NADP+

21. Which is not required by the Calvin cycle?

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B. ATP
C. NADPH
D. CO_2
E. All of the above are correct

22. A gene promoter

A. Is a nucleotide sequence that signals the start of translation
B. Is the binding site of RNA polymerase
C. Is the nucleotide sequence that signals the end of transcription
D. Contains the polyadenylation signal
E. None of the options is correct

23. During protein biosynthesis, targeting polypeptides to endoplasmic reticulum does not involve:

A. Translocation complex
B. Signal recognition particle
C. SRP receptor
D. RNA polymerase
E. Signal peptide

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B. The lagging strand
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D. Okazaki fragment
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NOTE: although each segment of nascent DNA is synthesized in the 5' to 3' direction, the overall direction of lagging strand synthesis is **3' to 5'**,

28. Which of the following is mis-matched?
A. (G = C) and (A = T) Chargaff rules
B. TATA box: DNA polymerase binding
C. DNA: Double helix
D. Splicing: Eukaryotic pre-mRNA
E. Lagging strand: Okazaki fragment

29. Which of the following statement about nucleosome is incorrect?
A. The nucleosome core contains an octet of 8 histone proteins
B. There are two copies of each histone protein in the nucleosome core
C. Four copies of histone H1 is present in the nucleosome core
D. Are the unit of DNA packing
E. The nucleosome core is wrapped by the DNA double helix

30. Which is incorrect for RNA polymerase:
A. Several RNA polymerases can transcribe a gene simultaneously
B. It needs a primer
C. It can unwind the two strands of DNA to initiate transcription
D. It is binding to the DNA template strand is mediated by transcription factor
E. All of the options are incorrect

31. The point mutation that doesn't produce a change in the amino acid sequence of a protein is known as:
A. Non-sense mutation
B. Missense mutation
C. Chromosomal mutation
D. Frame-shift mutation
E. Silent mutation

32. In a nucleosome, the DNA is wrapped around:
A. Polymerase molecules
B. Ribosomes
C. Histones
D. A thymine dimer
E. Satellite DNA

33. Which of the following represents the order of increasingly higher levels of organization of chromatin?

A. Nucleosome, 30-nm chromatin fiber, looped domain
B. Looped domain, 30-nm chromatin fiber, nucleosome
C. Looped domain, nucleosome, 30-nm chromatin fiber
D. Nucleosome, looped domain, 30-nm chromatin fiber
E. 30-nm chromatin fiber, nucleosome, looped domain

34. Why do histones bind tightly to DNA?

A. Histones are positively charged, and DNA is negatively charged.
B. Histones are negatively charged, and DNA is positively charged.
C. Both histones and DNA are strongly hydrophobic.
D. Histones are covalently linked to the DNA.
E. Histones are highly hydrophobic, and DNA is hydrophilic

35. Which of the following statements describes the eukaryotic chromosome?

A. It is composed of DNA alone.
B. The nucleosome is its most basic functional subunit.
C. The number of genes on each chromosome is different in different cell types of an organism.
D. It consists of a single linear molecule of double-stranded DNA.
E. Active transcription occurs on heterochromatin.

36. Which of the following sets of materials are required by both eukaryotes and prokaryotes for replication?

A. Double-stranded DNA, 4 kinds of dNTPs, primers, origins
B. Topoisomerases, telomerase, polymerases
C. G-C rich regions, polymerases, chromosome nicks
D. nucleosome loosening, 4 dNTPs, 4 rNTPs
E. ligase, primers, nucleases

37. Individuals with the disorder xeroderma pigmentosum are hypersensitive to sunlight. This occurs because their cells have which impaired ability?

A. They cannot replicate DNA.
B. They cannot undergo mitosis.
C. They cannot exchange DNA with other cells.
D. They cannot repair thymine dimers.
E. They do not recombine homologous chromosomes during meiosis.

38. Which of the following help to hold the DNA strands apart while they are being replicated?

A. Primase
B. Ligase
C. DNA polymerase
D. Single-strand binding proteins
E. Exonuclease

39. What is the role of DNA ligase in the elongation of the lagging strand during DNA replication?

A. Synthesize RNA nucleotides to make a primer
B. Catalyze the lengthening of telomeres
C. Join Okazaki fragments together
D. Unwind the parental double helix
E. Stabilize the unwound parental DNA

40. What is the function of topoisomerase?

A. Relieving strain in the DNA ahead of the replication fork
B. Elongation of new DNA at a replication fork by addition of nucleotides to the existing chain
C. The addition of methyl groups to bases of DNA
D. Unwinding of the double helix
E. Stabilizing single-stranded DNA at the replication fork

41. The leading and the lagging strands differ in that

A. The leading strand is synthesized in the same direction as the movement of the replication fork, and the lagging strand is synthesized in the opposite direction.
B. The leading strand is synthesized by adding nucleotides to the 3' end of the growing strand, and the lagging strand is synthesized by adding nucleotides to the 5' end.
C. The lagging strand is synthesized continuously, whereas the leading strand is synthesized in short fragments that are ultimately stitched together.
D. The leading strand is synthesized at twice the rate of the lagging strand.

42. Which of the following best describes the addition of nucleotides to a growing DNA chain?

A. A nucleoside triphosphate is added to the 5' end of the DNA, releasing a molecule of pyrophosphate.
B. A nucleoside triphosphate is added to the 3' end of the DNA, releasing a molecule of pyrophosphate.
C. A nucleoside diphosphate is added to the 5' end of the DNA, releasing a molecule of phosphate.
D. A nucleoside diphosphate is added to the 3' end of the DNA, releasing a molecule of phosphate.
E. A nucleoside monophosphate is added to the 5' end of the DNA.

43. Which of the following synthesizes short segments of RNA?

A. Helicase
B. DNA polymerase III
C. Ligase
D. DNA polymerase I
E. Primase

44. The difference between ATP and the nucleoside triphosphates used during DNA synthesis is that

A. The nucleoside triphosphates have the sugar deoxyribose; ATP has the sugar ribose.
B. The nucleoside triphosphates have two phosphate groups; ATP has three phosphate groups.
C. ATP contains three high-energy bonds; the nucleoside triphosphates have two.
D. ATP is found only in human cells; the nucleoside triphosphates are found in all animal and plant cells.
E. Triphosphate monomers are active in the nucleoside triphosphates, but not in ATP.

45. Which of the following removes the RNA nucleotides from the primer and adds equivalent DNA nucleotides to the 3' end of Okazaki fragments?

A. Helicase
B. DNA polymerase III
C. Ligase
D. DNA polymerase I
E. Primase

46. Which of the following separates the DNA strands during replication?

A. Helicase
B. DNA polymerase III
C. ligase
D. DNA polymerase I
E. Primase

47. Which of the following covalently connects segments of DNA?

A. Helicase
B. DNA polymerase III
C. ligase
D. DNA polymerase I
E. Primase

48. To repair a thymine dimmer by nucleotide excision repair, in which order do the necessary enzymes act?

A. Exonuclease, DNA polymerase III, RNA primase
B. Helicase, DNA polymerase I, DNA ligase
C. DNA ligase, nuclease, DNA polymerase
D. DNA polymerase I, DNA polymerase III, DNA ligase
E. Endonuclease, DNA polymerase I, DNA ligase

49. What is the function of DNA polymerase III?

A. To unwind the DNA helix during replication
B. To seal together the broken ends of DNA strands
C. To add nucleotides to the end of a growing DNA strand
D. To degrade damaged DNA molecules
E. To rejoin the two DNA strands (one new and one old) after replication

50. What determines the nucleotide sequence of the newly synthesized strand during DNA replication?

A. The particular DNA polymerase catalyzing the reaction
B. The relative amounts of the four nucleoside triphosphates in the cell
C. The nucleotide sequence of the template strand
D. The primase used in the reaction
E. The arrangement of histones in the sugar phosphate backbone

51. An Okazaki fragment has which of the following arrangements?

A. Primase, polymerase, ligase
B. 3' RNA nucleotides, DNA nucleotides 5'
C. 5' RNA nucleotides, DNA nucleotides 3'
D. DNA polymerase I, DNA polymerase III
E. 5' DNA to 3'

52. Replication in prokaryotes differs from replication in eukaryotes for which of these reasons?

A. The prokaryotic chromosome has histones, whereas eukaryotic chromosomes do not.
B. Prokaryotic chromosomes have a single origin of replication, whereas eukaryotic chromosomes have many.
C. The rate of elongation during DNA replication is slower in prokaryotes than in eukaryotes.
D. Prokaryotes produce Okazaki fragments during DNA replication, but eukaryotes do not.
E. Prokaryotes have telomeres, and eukaryotes do not.

53. What is meant by the description "antiparallel" regarding the strands that make up DNA?

A. The twisting nature of DNA creates nonparallel strands.
B. The 5' to 3' direction of one strand runs counter to the 5' to 3' direction of the other strand.
C. Base pairings create unequal spacing between the two DNA strands.
D. One strand is positively charged and the other is negatively charged.
E. One strand contains only purines and the other contains only pyrimidines

54. In an analysis of the nucleotide composition of DNA, which of the following will be found?

A. A = C
B. A = G and C = T
C. A + C = G + T
D. G + C = T + A

55. Why does the DNA double helix have a uniform diameter?

A. Purines pair with pyrimidines.
B. C nucleotides pair with A nucleotides.
C. Deoxyribose sugars bind with ribose sugars.
D. Nucleotides bind with nucleosides.
E. Nucleotides bind with nucleoside triphosphates.

56. What kind of chemical bond is found between paired bases of the DNA double helix?

A. Hydrogen
B. Ionic
C. Covalent
D. Sulfhydryl
E. Phosphate

57. Which of the following is not true of RNA processing?

A. Exons are cut out before mRNA leaves the nucleus.
B. Nucleotides may be added at both ends of the RNA.
C. Ribozymes may function in RNA splicing.
D. RNA splicing can be catalyzed by spliceosomes.
E. A primary transcript is often much longer than the final RNA molecule that leaves the nucleus.

58. The anticodon of a particular tRNA molecule is

A. Complementary to the corresponding mRNA codon.
B. Complementary to the corresponding triplet in rRNA.
C. The part of tRNA that bonds to a specific amino acid.
D. Changeable, depending on the amino acid that attaches to the tRNA.
E. Catalytic, making the tRNA a ribozyme

59. A frameshift mutation could result from

A. A base insertion only.
B. A base deletion only.
C. A base substitution only.
D. Deletion of three consecutive bases.
E. Either an insertion or a deletion of a base.

60. Sickle-cell disease is probably the result of which kind of mutation?

A. Point
B. Frameshift
C. nonsense
D. nondisjunction
E. both B and D

61. When does translation begin in prokaryotic cells?

A. After a transcription initiation complex has been formed
B. as soon as transcription has begun
C. after the 5' caps are converted to mRNA
D. once the pre-mRNA has been converted to mRNA
E. as soon as the DNA introns are removed from the template

62. What is the effect of a nonsense mutation in a gene?

A. It changes an amino acid in the encoded protein.
B. It has no effect on the amino acid sequence of the encoded protein.
C. It introduces a premature stop codon into the mRNA.
D. It alters the reading frame of the mRNA.
E. It prevents introns from being excised.

63. Which of the following is a function of a signal peptide?

A. To direct an mRNA molecule into the cisternal space of the ER
B. to bind RNA polymerase to DNA and initiate transcription
C. to terminate translation of the messenger RNA
D. to translocate polypeptides across the ER membrane
E. to signal the initiation of transcription

64. What are polyribosomes?

A. Groups of ribosomes reading a single mRNA simultaneously
B. Ribosomes containing more than two subunits
C. Multiple copies of ribosomes associated with giant chromosomes
D. Aggregations of vesicles containing ribosomal RNA
E. Ribosomes associated with more than one tRNA

65. During splicing, which molecular component of the spliceosome catalyzes the excision reaction?

A. Protein
B. DNA
C. RNA
D. lipid
E. sugar

66. Alternative RNA splicing

A. Is a mechanism for increasing the rate of transcription.
B. Can allow the production of proteins of different sizes from a single mRNA.
C. Can allow the production of similar proteins from different RNAs.
D. Increases the rate of transcription.
E. Is due to the presence or absence of particular snRNPs.

67. What is the most abundant type of RNA?

A. mRNA
B. tRNA
C. rRNA
D. pre-mRNA
E. hnRNA

68. There are 61 mRNA codons that specify an amino acid, but only 45 tRNAs. This is best explained by the fact that

A. Some tRNAs have anticodons that recognize four or more different codons.
B. The rules for base pairing between the third base of a codon and tRNA are flexible.
C. Many codons are never used, so the tRNAs that recognize them are dispensable.
D. The DNA codes for all 61 tRNAs but some are then destroyed.
E. Competitive exclusion forces some tRNAs to be destroyed by nucleases.

69. What type of bonding is responsible for maintaining the shape of the tRNA molecule?

A. covalent bonding between sulfur atoms
B. ionic bonding between phosphates
C. hydrogen bonding between base pairs
D. van der Waals interactions between hydrogen atoms
E. Peptide bonding between amino acids

70. Accuracy in the translation of mRNA into the primary structure of a polypeptide depends on specificity in the

A. binding of ribosomes to mRNA.
B. shape of the A and P sites of ribosomes.
C. bonding of the anticodon to the codon.
D. attachment of amino acids to tRNAs.
E. both C and D

71. A particular triplet of bases in the coding sequence of DNA is AAA. The anticodon on the tRNA that binds the mRNA codon is

A. TTT
B. UUA
C. UUU
D. AAA.
E. either UAA or TAA, depending on first base wobble.

72. During splicing, which molecular component of the spliceosome catalyzes the excision reaction?

A. protein
B. DNA
C. RNA
D. lipid
E. sugar

73. A mutation in which of the following parts of a gene is likely to be most damaging to a cell?

A. intron
B. exon
C. 5' UTR
D. 3' UTR
E. All would be equally damaging

74. Once transcribed, eukaryotic mRNA typically undergoes substantial alteration that includes

A. union with ribosomes.
B. fusion into circular forms known as plasmids.
C. linkage to histone molecules.
D. excision of introns.
E. fusion with other newly transcribed mRNA

75. In eukaryotes there are several different types of RNA polymerase. Which type is involved in transcription of mRNA for a globin protein?

A. ligase
B. RNA polymerase I
C. RNA polymerase II
D. RNA polymerase III

76. RNA polymerase moves in which direction along the DNA?

A. 3' → 5' along the template strand
B. 3' → 5' along the coding (sense) strand
C. 5' → 3' along the template strand
D. 3' → 5' along the coding strand
E. 5' → 3' along the double-stranded DNA

77. A particular triplet of bases in the template strand of DNA is 5' AGT 3'. The corresponding codon for the mRNA transcribed is

A. 3' UCA 5'
B. 3' UGA 5'
C. 5' TCA 3'
D. 3'ACU 5'
E. either UCA or TCA, depending on wobble in the first base.

78. If proteins were composed of only 12 different kinds of amino acids, what would be the smallest possible codon size in a genetic system with four different nucleotides?

A. 1
B. 2
C. 3
D. 4
E. 12

79. The oxygen released by photosynthesis is produced by which of the following processes?

A. splitting water molecules
B. chemiosmosis
C. the electron transfer system of photosystem I
D. the electron transfer system of photosystem II

80. Which molecule is the final electron acceptor for electrons from photosystem I?
A. oxygen
B. chlorophyll in photosystem II
C. carbon dioxide
D. NADP+

81. What are the products of linear electron flow during the light reactions of photosynthesis?
A. heat and fluorescence
B. ATP and P700
C. ATP and NADPH
D. ADP and NADP+

82. What are the products of cyclic electron flow during the light reactions of photosynthesis?
A. heat and fluorescence
B. ATP
C. ATP and NADPH
D. ADP and NADP+

83. Where are ATP synthase complexes located in plant cells?
A. thylakoid membrane only
B. inner mitochondrial membrane only
C. thylakoid membrane and inner mitochondrial membrane
D. thylakoid membrane and plasma membrane

84. In a plant, which of the following reactions produce molecular oxygen (O2)?
A. the light reactions alone
B. the Calvin cycle alone
C. the light reactions and the Calvin cycle
D. neither the light reactions nor the Calvin cycle

85. The mechanism of photophosphorylation is most similar to which of the following processes?
A. substrate-level phosphorylation in glycolysis
B. oxidative phosphorylation in cellular respiration
C. the Calvin cycles
D. reduction of NADP+

86. Which of the following processes is most directly driven by light energy?
A. creation of a pH gradient by pumping protons across the thylakoid membrane
B. carbon fixation in the stroma
C. reduction of NADP+ molecules
D. removal of electrons from chlorophyll molecules

87. Which of the following sequences correctly represents the flow of electrons during photosynthesis?
A. NADPH → O2 → CO2
B. H2O → NADPH → Calvin cycle
C. NADPH → chlorophyll → Calvin cycle
D. NADPH → electron transport chain → O2

88. Which of the following processes occurs during the Calvin cycle?
A. reduction of NADPH
B. release of oxygen
C. regeneration of the CO2 acceptor
D. production of ATP

89. What is the function of the pigment molecules in a light-harvesting complex in the thylakoid membranes?
A. They split water and release oxygen from the reaction-center chlorophyll.
B. They absorb and transfer light energy to the reaction-center chlorophyll.
C. They synthesize ATP from ADP and Pi
D. They transfer electrons to NADP+

90. Which of the following statements is the most current description of a gene?
A. a unit of heredity that causes formation of a phenotypic characteristic
B. a DNA subunit that codes for a single complete protein
C. a DNA sequence that is expressed to form a functional product: either RNA or polypeptide
D. a discrete unit of hereditary information that consists of a sequence of amino acids

91. Which of the following processes occurs when termination of translation takes place?

A. The end of the mRNA molecule is reached.
B. A stop codon is reached.
C. The 5′ cap is reached.
D. The poly-A tail is reached.