1. Of the three metabolic pathways that contribute to cellular respiration, which produces the most ATP molecules per glucose?
   a. glycolysis
   b. Krebs cycle
   c. electron transport

2. Cells can harvest the most chemical energy from which of the following?
   a. an NADH molecule
   b. a glucose molecule
   c. six CO₂ molecules
   d. two pyruvic acid molecules

3. Which of the following metabolic pathways is common to both fermentation and cellular respiration?
   a. glycolysis
   b. Krebs cycle
   c. electron transport

4. Sports physiologists at an Olympic training center wanted to monitor athletes to determine at what point their muscles were functioning anaerobically. They could do this by checking for a buildup of:
   a. ADP.
   b. lactic acid.
   c. CO₂
   d. oxygen.

5. During electron transport, the energy form electrons pumps what ion across an inner mitochondrial membrane?
   a. H
   b. O
   c. N
   d. C

6. ATP is formed during electron transport because a concentration gradient of a specific ion activates the enzyme that adds a phosphorus atom to ADP. What is the ion?
   a. C
   b. Fe
   c. Ca
   d. H
For questions 7-21, use the following for answers:

a. oxygen  
ab. H₂O  
abd. FADH
b. two  
ac. Three  
abc. Glucose
c. acetyl-CoA  
ad. 38  
ae. Fatty acids
d. CO₂  
abc. Photosynthesis
e. pyruvic acid

7-9. The overall equation for cellular respiration is:

\[ \text{C}_6\text{H}_{12}\text{O}_6 + (7) \rightarrow (8) + (9) + \text{energy} \]

10. Glycolysis breaks glucose into two molecules of what?

11. How many net molecules of ATP are formed during glycolysis?

12. The transition molecule from pyruvic acid into the Krebs cycle is what?

13. During electron transport, NADH produces how many ATP molecules?

14. During electron transport, FADH produces how many ATP molecules?

15. How many ATP molecules are produced by cellular respiration of one molecule of glucose?

16. What gas is produced during lactic acid and alcoholic fermentation?

17. When we use fat for energy, it enters cellular respiration as either glycerol or what?

18. The process that synthesizes glucose from CO₂ and water is called what?

19. The electron acceptors in cellular respiration are NADH and ________.

20-21. The overall equation for photosynthesis is:

\[ 6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow (20) + (21) \]

22. Which of the following colors of light are most effective in driving photosynthesis?

a. green  
b. red  
c. blue  
d. a & b only  
e. b & c only
23. The combustion of fossil fuels may be contributing to global warming by raising atmospheric concentrations of:
   a. \( \text{H}_2\text{O} \)
   b. \( \text{O}_2 \)
   c. \( \text{CO}_2 \)
   d. NADH.

24. Of the following metabolic processes which one is common to photosynthesis and cellular respiration?
   a. reactions that convert light energy to chemical energy
   b. reactions that split \( \text{H}_2\text{O} \) molecules and release \( \text{O}_2 \)
   c. reactions that store energy by pumping Hydrogen ions across membranes

25. Which of the following are produced by the light reactions of photosynthesis?
   a. glucose and \( \text{O}_2 \)
   b. \( \text{CO}_2 \) and \( \text{H}_2\text{O} \)
   c. NADP and ADP
   d. ATP and NADPH

26. Green light is very ineffective in driving photosynthesis. Why?
   a. it is absorbed by leaves
   b. it is destroyed by the chloroplasts
   c. it is reflected by chloroplasts

27. You find a plant on a bright summer day in the desert with its' stomata closed. Yet, it is still producing ATP. This plant must be carrying out:
   a. photorespiration.
   b. the \( \text{C}_3 \) cycle.
   c. the \( \text{C}_4 \) pathway.
   d. CAM metabolism.
   e. \( \text{CO}_2 \) uptake.

28. Plants carry out cellular respiration as well as photosynthesis.
   a. True
   b. False

29. Without photosynthesis occurring anywhere on Earth, which of the following would be able to survive?
   a. plants
   b. animals
   c. fungi
   d. bacteria
   e. none of the above

30. In which organelle does photosynthesis occur?
   a. mitochondria
   b. endoplasmic reticulum
   c. Golgi complex
   d. chloroplast
31. Which of the following occur during the Calvin cycle?  
   a. O₂ is released  
   b. CO₂ is released  
   c. ATP is produced  
   d. CO₂ fixation

32. When a plant produces sugar molecules during photosynthesis, it can be used for all of the following except:  
   a. cellular respiration.  
   b. glycogen synthesis.  
   c. cellulose synthesis.  
   d. production of starch.

33. When during the cell cycle does a cell replicate its DNA?  
   a. during G₁  
   b. during G₂  
   c. during the S phase  
   d. during mitosis

34. The two parts of a replicated chromosome are called:  
   a. homologous chromosomes  
   b. centromores  
   c. alleles  
   d. sister chromatids

35. The two daughter cells that are the result of mitosis are:  
   a. genetically identical to each other.  
   b. genetically identical to their parent cell.  
   c. diploid.  
   d. all of the above  
   e. a & b only

36. Which of the following is not a function of mitosis in humans?  
   a. repair of wounds  
   b. growth  
   c. replacement of lost or damaged cells  
   d. production of gametes from diploid cells

37. If an intestinal cell in a dog contains 78 chromosomes, a dog sperm cell would contain _______ chromosomes.
List the phases of mitosis, in order, beginning with prophase. (38-48)
For questions 38-48, use the following choices for your answers:

a. interphase  
b. cytokinesis  
c. metaphase  
d. prophase  
e. anaphase  
ab. telophase

38. ____________________________
39. ____________________________
40. ____________________________
41. ____________________________
42. ____________________________

43. Sister chromatids are aligned across the center of the cell.
44. The chromosomes are in the form of long thin strands and individual chromosomes cannot be seen.
45. The nuclear membrane disintegrates.
46. Sister chromatids move toward opposite poles of the cell.
47. The nuclear membrane begins to reform and spindle fibers have disappeared.
48. The cleavage furrow forms, separating the cytoplasm into two daughter cells.

49. The equivalent of the cleavage furrow in plant cells undergoing mitosis is the:
   a. metaphase plate  
   b. cell plate  
   c. nuclear membrane

50. A picture of an individual’s chromosomes is called a:
   a. crossover  
   b. karyotype  
   c. centromere  
   d. life cycle

For questions 51-56, use the following answers:

a. haploid  
b. homologous chromosomes  
c. diploid  
d. sister chromatids  
e. prophase of meiosis I  
ab. anaphase of meiosis II

51. The chromosome content of daughter cells after mitosis is said to be _________________. 
52. The chromosome content of gametes is said to be __________________________.
53. __________________________ separate during anaphase of mitosis.
54. Tetrad formation and crossing over occurs during what phase of meiosis? ________________.
55. During anaphase of meiosis I, what structures separate? __________________________.
56. Sister chromatids separate during which phase of meiosis? __________________________.

For questions 57-64 use the following for answers:

a. Klinefelter  
   b. chromosome X  
   c. chromosome 21  
   d. crossing over  
   e. Down syndrome  
   ab. nondisjunction  
   ac. Xy  
   ad. XX

57. This chromosomal disorder occurs more often in older pregnant women than in younger ones. __________________________.
58. Down syndrome is characterized by having 3 copies of which chromosome? ________________.
59. Down syndrome is caused by what during meiosis? __________________________.
60. A man with an extra X chromosome has what chromosomal disorder? __________________.
61. A woman with Turner syndrome is missing a copy of which chromosome? ________________.
62. Name an event during meiosis that contributes to genetic variation. ______________________.
63. The normal male sex chromosome makeup is what? __________________________.
64. The normal female sex chromosome makeup is what? __________________________.

For questions 65-75, use the following terms to match the descriptions:

a. allele  
   b. dominant  
   c. phenotype  
   d. homologous chromosomes  
   e. locus  
   ab. homozygous  
   ac. recessive  
   ad. sex-linked trait  
   ae. gene  
   abc. genotype  
   abd. heterozygous

65. A trait that is controlled by a gene located within the sex chromosome and is linked or associated with sex. __________________________
66. Members of a pair of chromosomes which are identical in size, shape, structure and function.

67. The basic unit of inheritance.

68. An alternative form of the same gene.

69. Position of a gene within a chromosome.

70. Adjective describing one member of a contrasting pair of genes which, when present in the heterozygous state, suppresses the phenotypic manifestation of the other.

71. Genetic constitution of the organism.

72. Adjective describing one member of a contrasting pair of genes, which must be present in the homozygous state in order to manifest its phenotypic expression of the character.

73. Visible constitution of the organism with respect to the trait in question; determined by the genotype and influenced by the environment.

74. When both members of a specific gene pair possessed by an organism are alike.

75. When both members of a specific gene pair possessed by an individual are different.

76. All the offspring of a white hen and a black rooster are gray. The explanation for this pattern of inheritance is:
   a. pleiotrophy.
   b. sex linkage.
   c. co-dominance.
   d. incomplete dominance.

77. A true-breeding brown mouse (BB) is mated with a true-breeding white mouse (bb) and all their offspring are brown. What are their genotypes?
   a. BB
   b. Bb
   c. bb
   d. none of the above

78. Continuing from #77, if two of these brown offspring are mated, what fraction of the F2 mice will be brown?
   a. 25%
   b. 100%
   c. 75%
   d. 50%
79. Again, from #77 and #78, what would be the genotypic ratio of the F2 generation?
   a. 1 BB: 1 Bb
   b. 1BB: 2Bb: 1bb
   c. ½ BB: ½ bb

80. Tim and Jan both have freckles, a dominant trait, but their son does not. What is the most likely genotype for Tim and Jan? Use F as the symbol denoting freckles.
   a. FF
   b. ff
   c. Ff

For questions 81-87, use the following as answers:
   a. all W
   b. all M
   c. all m
   d. ½ M: ½ m
   e. ½ MW: ½ mW
   ae. \( x^H y \)
   ab. all MmWW
   ac. ¼ MW: ½ mW: ¼ Mw
   ad. ½ Mw: ½ mw

81-83. A couple are both phenotypically normal, but their son suffers from hemophilia, a sex-linked disorder. Fill in the genotypes for the pedigree below based on what you know of the parents (use \( H = \) normal, \( h = \) affected).

What kinds of gametes will be produced by individuals of the following genotypes?

84. WW
85. Mm
86. MmWW
87. Mmww
For questions 88-91, use the following as answers:

a. RR
d. 3 rollers : 1 non-roller
b. Rr
e. all rollers
c. rr
ab. 1 RR : 2 Rr : 1 rr

88-91. A man, homozygous for tongue rolling, marries a woman who cannot roll her tongue. Use R=tongue rolling.

88. What will be the genotype of any F₁ offspring? ____________________________________________

89. What will be the phenotype of any F₁ offspring? __________________________________________

90. What will be the expected phenotypic ratio of F₂ offspring? ________________________________

91. What will be the expected genotypic ratio of F₂ offspring? ________________________________

For questions 92-100, use the following terms:

a. pleiotropy
b. heart disease
c. incomplete dominance
d. Xcy
e. Huntington's disease
ab. hemophilia
ac. cystic fibrosis
ad. Cy
ae. epistasis
abc xc xc

92. What is the condition called when neither of a pair of contrasting alleles are dominant to each other? ____________________________________________

93. When one gene affects many traits, it is called what? ______________________________________

94. When multiple genes affect only one trait, it is called what? ______________________________

95. An example of a recessive trait. ______________________________________________________

96. An example of a dominant disorder. __________________________________________________

97. An example of a polygenic disorder. __________________________________________________

98. An example of a sex-linked disease. __________________________________________________

99. If a couple has a color-blind son, what is his genotype? ________________________________

100. The father of a color-blind daughter has what genotype? ________________________________