Important note: This mock final exam was written by your Biology 120 Peer Mentors. It is designed to help you test yourself on topics and concepts covered in class; it is not a preview of the final exam.

You are required to remain in your seat for 30 minutes. No talking and no use of any electronic devices.

This exam consists of 110 questions. Carefully read the questions and all possible answers and choose the best answer. Only select one answer per question.

We encourage you to take note of your start and finish time, or to keep track of how many questions you were able to complete. This may help you to better judge your time for the final exam.

Start Time: ________________
End Time: ________________
Questions completed: ___________

You are invited to return to HLTH 1150 at ~3:00pm for a Question and Answer period.

Post-mock final session notes:

- The answers will be posted on the SSS webpage http://library.usask.ca/sss
- Question 76, answer b has been slightly changed to read ‘of replication’ not ‘or replication’.
- Question 96 is beyond the scope of this course, so please omit it.
- There have been corrections to two of the answers in the answer key. Please see the answer key for details.
1. What does a negative free energy change mean?
   a. The reaction will need some energy to proceed.
   b. The reaction will happen spontaneously.
   c. The reaction will need to be coupled with ATP.
   d. a) and c)

2. To form a sister chromatid, which of the following would have occurred to the DNA?
   a. Hydrolysis
   b. Phosphorylation
   c. Replication
   d. Translation
   e. b) and c)

3. A virus is NOT considered to be a living organism because …
   a. it is not able to reproduce on its own.
   b. it does not have a nucleus.
   c. it is not multi-cellular.
   d. it is not able to move on its own.

4. Biologically important molecules …
   a. can only be made by autotrophs.
   b. can only be found within cells.
   c. cannot be created nor destroyed, only transformed.
   d. can be synthesized outside of living cells.

5. After a rather rowdy party, Sam is stuck cleaning up her house the following morning. Which of the
   following statements is true about this scenario? The entropy of her room is ___________ and hence
   the entropy of the universe around her is ______________.
   a. negative; negative
   b. negative; positive
   c. positive; negative
   d. positive; positive

6. Which of the following statements are FALSE?
   a. Surface area to volume ratio increases as cells increase in size
   b. Volume increases faster than surface area does as a cell increases in size
   c. Bigger cells have more metabolic reactions and require more materials from their environment
   d. both a) and b) are false

7. Which of the following is true regarding interkinesis?
   a. DNA is synthesized.
   b. Afterward, meiosis I begins.
   c. Sister chromatids are separated before this phase.
   d. None of the above are true.

8. Fur colour in wombats is determined by one gene with 4 different alleles. In a heterozygous
   individual, how many alleles will be in one of their gametes?
   a. 1
   b. 2
   c. 3
   d. 4

9. Which of the following is NOT a factor that contributes to the fluidity of the membrane of a yeast
   cell?
   a. The amount of cholesterol present in the membrane.
   b. Temperature.
   c. The number of desaturases produced in a cell.
   d. The intracellular concentration of water.
   e. None of the above.
10. You see a cell that is being “pinched” apart by a ring-like structure. The ring-like structure is composed of which of the following?
   a. Cytoskeleton
   b. Microfilaments
   c. Microtubules
   d. Intermediate filaments

11. The driving force behind diffusion is __________.
   a. entropy
   b. ionic charges
   c. weak fusion forces
   d. membrane proteins
   e. mitochondria: the powerhouse of the cell

12. Which of the following does not fit?
   a. Carbohydrate – monosaccharide
   b. Protein – Polypeptide
   c. Nucleic acid – Nucleotide
   d. Lipid – Fatty acid
   e. All of the above fit

13. The difference between a DNA nucleotide and an RNA nucleotide lies in the …
   a. phosphate group
   b. the fact that DNA has nucleotides while RNA has nucleosides
   c. the fact that DNA has pyrimidines whereas RNA has purines
   d. ribose
   e. b) and d)

14. According to the Reducing Atmosphere Hypothesis, the atmosphere 4 billion years ago was almost completely void of:
   a. Gases
   b. Heat
   c. Water vapor
   d. Sunlight
   e. Molecular oxygen

15. Flipase …
   a. flips proteins in the membrane.
   b. flips phospholipids across the membrane.
   c. flips ribose sugars between its deoxyribose and ribose forms.
   d. has “flippers” which it uses to walk on the microfilament component of the cytoskeleton.
   e. doesn’t exist.

16. Which of the following would be unable to passively diffuse through the cell membrane?
   a. A positively-charged sodium ion
   b. Glucose
   c. Small, uncharged polar molecules
   d. a) and b)
   e. All of the above

17. A substrate and an enzyme meet in a test tube, in vitro. Which of the following is the correct term for the location where the substrate attaches to the enzyme?
   a. Allosteric site
   b. Lock site
   c. Reaction site
   d. None of the above

18. Catabolic processes …
   a. metabolize complex molecules to simpler molecular building blocks.
   b. are always endothermic reactions.
   c. are always exothermic reactions.
   d. both a) and c)
19. The liver, the organ responsible for detoxifying drugs, contains a lot of (relative to other cells) …
   a. spliceosomes.
   b. Golgi Apparatus.
   c. smooth ER.
   d. transcription factors.

20. Protein αBetalose is destined for secretion. Which path would this protein take?
   a. ER cis Golgi medial Golgi trans Golgi plasma membrane
   b. ER trans Golgi medial Golgi cis Golgi plasma membrane
   c. cis-Golgi trans Golgi medial Golgi lysosome plasma membrane
   d. ER medial Golgi trans Golgi cis Golgi plasma membrane

21. How many of the following structures are part of the endomembrane system?
   Nucleus
   Vesicles
   Ribosomes
   Golgi apparatus
   Endoplasmic reticulum
   Mitochondria
   Plasma membrane
   Vacuoles
   Lysosomes
   a. 6
   b. 7
   c. 8
   d. 9

22. Cholesterol …
   a. is hydrophilic.
   b. is hydrophobic.
   c. has an –OH head.
   d. is an integral protein.
   e. is anchored to the plasma membrane by an integral protein.

23. Which of the following is true regarding facilitated diffusion?
   a. It is specific for certain substances.
   b. It requires ATP.
   c. It results in the movement of molecules against their concentration gradient.
   d. It requires a peripheral membrane protein.

24. Which of the following structure/function pairs are incorrectly matched?
   a. Microtubules/cytokinesis
   b. Intermediate filaments/structural support
   c. Microfilaments/cytoplasmic streaming
   d. All of these are correctly matched.

25. Which of the following is not a function of membrane proteins?
   a. Signal transduction
   b. Transport
   c. Enzymatic activity
   d. Attachment/recognition
   e. All of the above are functions of membrane proteins.

26. Dr. Wales’s research extensively covers the *streptococcus bacterium*. One day, he is able to share some of his knowledge about his research. Which of the following statements would he most likely say about his organism of interest?
   a. The nucleus stores most of the cell’s genetic material in the form of circular DNA.
   b. The nucleus allows for transport of material in and out of its nuclear envelope through many small pores.
   c. The nucleus may contain a structure called a nucleolus.
   d. None of the above

27. Enzymes catalyze reactions by …
   a. lowering the activation energy.
   b. increasing substrate concentration.
   c. lowering substrate concentration.
   d. contributing needed energy to help a non-spontaneous reaction to occur.
28. One day, Jimmy decided he wanted some ice cream. He went to the grocery store and grabbed his favorite ice cream, and went home to eat it. However, Jimmy lost his appetite when he started thinking about the microbes that could be living in his ice cream. He took a scoop of it to a biology lab for some testing; the lab staff found a new species of bacteria in the sample, which they named *Bacillus icecreamius*. When the biologists examined this cell under a microscope, what do you think they would have seen in regards to the composition of the cell membrane?
   a. A high concentration of unsaturated fatty acids in the cell membrane
   b. A high concentration of cholesterol embedded in the cell membrane
   c. A high concentration of saturated fatty acids in the cell membrane
   d. None of the above seem like plausible observations.

29. Na⁺/K⁺ ATPase is a membrane transport protein that will maintain the correct intracellular/extracellular concentration of sodium and potassium in order for certain cellular processes (such as nerve cell conduction) to function efficiently. This protein would be considered a(n) ____________ .
   a. integral membrane protein
   b. lipid anchored protein
   c. peripheral membrane protein
   d. ion channel

30. You are examining a cell under a microscope. The cell is in the process of dividing in two. Which of the following can help you determine if the cell is in mitosis or meiosis?
   a. If the cell is a eukaryote it will be in meiosis, and if it is a prokaryote it will be in mitosis.
   b. If the cell is diploid it will be in meiosis, and if it is haploid it will be in mitosis.
   c. In multicellular organisms, where the cell is located in the body can indicate whether it goes through meiosis or mitosis.
   d. b) and c)

31. What is the end result of meiosis?
   a. Four genetically identical daughter cells.
   b. Two genetically identical daughter cells.
   c. Four genetically variable daughter cells.
   d. Two genetically variable daughter cells.
   e. None of the above are possible end results of meiosis.

32. Ribosomes are only present in eukaryotic cells.
   a. True.
   b. False.
   c. True, but with one exception- some viruses have ribosomes.
   d. False, but with one exception- some bacteria lack ribosomes.

33. Which of the following does NOT correctly describe microtubules?
   a. Microtubules are made of actin dimers.
   b. Microtubules associate with the motor proteins dynein and kinesin.
   c. Microtubules form the centrioles in animal cells.
   d. A microtubule is the largest of the eukaryotic cytoskeletal components.

34. Which of the following best describes osmosis?
   a. The passive diffusion of molecules into an area of greater water concentration.
   b. The passive diffusion of water from an area of higher solute concentration to an area of lower solute concentration through a semi-permeable.
   c. The passive diffusion of water from an area of lower solute concentration to an area of higher solute concentration through a semi-permeable membrane.
   d. The beginning of the formation of a cleavage furrow.
   e. None of the above describe osmosis.

35. Why do humans require enzymes?
   a. Enzymes provide energy for reactions.
   b. Enzymes slow down reactions to allow for control.
   c. Enzymes speed up reactions that occur too slowly.
   d. Enzymes provide structure and support.
36. Which of the following is true regarding passive diffusion?
   a. Solute molecules utilize a transport protein; solute molecules move from an area of high concentration to an area of low concentration.
   b. Solute molecules pass through a membrane unassisted; solute molecules move from an area of high concentration to an area of low concentration.
   c. Solute molecules pass through a membrane unassisted; solute molecules move freely, independent of concentration gradient.
   d. Below 0 degrees Celsius, due to the watery nature of a cell membrane, no diffusion can take place.

37. The gametes produced by a diploid animal are ____________ .
   a. diploid
   b. haploid
   c. produced by mitosis
   d. going to grow into a gametophyte
   e. None of the above.

38. In which stage of meiosis are homologous chromosomes separated?
   a. Telophase
   b. Telophase I
   c. Anaphase I
   d. Anaphase II

39. Which of the following is false regarding homologous chromosomes?
   a. Alleles on homologous chromosomes are identical.
   b. Homologous chromosomes are the same size.
   c. Genes located on homologous chromosomes are the same.
   d. Homologous chromosomes are separated during meiosis.
   e. None of the above are false.

40. What stage of mitosis is illustrated below?
   a. Anaphase
   b. Anaphase II
   c. Telophase
   d. Metaphase
   e. Anaphase I

41. The Miller-Urey Experiment …
   a. showed that DNA replication is a semi-conservative process.
   b. confirmed DNA as the genetic material.
   c. showed that several organic compounds could be formed spontaneously in Earth's early atmosphere.
   d. showed that spontaneous generation of living microorganisms doesn’t happen.
   e. showed that mitochondria and plastids come from prokaryote ancestors.

42. The Meselson and Stahl experiment …
   a. showed that DNA replication is a semi-conservative process.
   b. confirmed DNA as the genetic material.
   c. showed that several organic compounds could be formed spontaneously in Earth's early atmosphere.
   d. showed that spontaneous generation of living microorganisms doesn’t happen.
   e. showed that mitochondria and plastids come from prokaryote ancestors.
43. In guinea pigs, brown fur (B) is dominant to white fur (b), and straight fur (S) is dominant to curly fur (s). If you buy a brown guinea pig with straight fur, what kind of cross could you perform to determine its genotype?
   a. A dihybrid cross with a homozygous brown and straight furred guinea pig
   b. A test cross with a curly haired, white guinea pig
   c. A test cross with another unknown guinea pig
   d. A monohybrid cross with a white furred guinea pig

44. Once a new tRNA (and its associated amino acid) arrive in the E-site during elongation, what are the next likely steps?
   a. Peptidyltransferase (on the large ribosomal subunit) will catalyze the formation of a peptide bond between the amino acid attached to the tRNA currently in the P-site, and the new amino acid, and the tRNA in the P-site will release its amino acid, which results in our growing polypeptide being held by the tRNA in the E-site.
   b. Peptidyltransferase will catalyze the formation of a hydrogen bond between the amino acid attached to the tRNA currently in the P-site, and the new amino acid, and the tRNA in the P-site will release its amino acid, which results in our growing polypeptide being held by the tRNA in the E-site.
   c. The small ribosomal subunit will catalyze the formation of an amino-acyl bond between the amino acid attached to the tRNA currently in the P-site, and the new amino acid, and the tRNA in the P-site will release its amino acid, which results in our growing polypeptide being held by the tRNA in the E-site.
   d. None of the above are correct, because the situation described in the question does not happen.

45. Which of the following is an example of Post-Translational Modification?
   a. The addition of a poly-A tail to the end of an mRNA molecule.
   b. A polypeptide chain folding into its tertiary structure.
   c. The formation of the transcription-initiation complex.
   d. None of the above are examples of Post-Translational Modification.

46. In *Drosophila*, two genes, one for body colour and one for eye colour, are located on the same chromosome. The wild type grey body colour (G) is dominant to black (g), and wild-type red eyes (R) are dominant to purple (r). You cross a fly with a grey body and red eyes with a black bodied, purple eyed fly. 49% of the offspring have grey bodies and red eyes, 48% have black bodies and purple eyes, and 3% have either black bodies and red eyes or grey bodies and purple eyes. Which of the following is NOT true?
   a. Gr & gR are linked in the first parent and gr in the second.
   b. The recombinant phenotypes are not grey bodies with red eyes and black bodies with purple eyes.
   c. GR & gr are linked in the first parent and gr in the second.
   d. The recombinant phenotypes are black bodies and red eyes or grey bodies and purple eyes.
   e. All of the above are true.

47. Which of the following crosses is an example of a test cross?
   a. Rr x Rr
   b. R_ x rr
   c. R_ x RR
   d. RR x rr
   e. Impossible to determine

48. During cellular respiration in eukaryotes, the Electron Transport Chain builds a proton gradient across ___________.
   a. the plasma membrane
   b. the outer mitochondrial membrane
   c. the thylakoid membrane
   d. none of the above

49. In prokaryotes, transcription occurs in the ___________.
   a. nucleus
   b. nucleolus
   c. Golgi Apparatus
   d. none of the above
50. An unknown nucleic acid was found to contain 12% A, 24% U, 24% G, and 40% C. This suggests that it is …
   a. a double stranded DNA molecule
   b. a double stranded RNA molecule
   c. a plasmid
   d. a single stranded DNA molecule
   e. a single stranded RNA molecule

51. To better study cellular respiration, you shrink yourself so that you can explore the cell. Once inside, you notice that glycolysis occurs in the ________, pyruvate oxidation occurs in the ________, and the citric acid cycle occurs in the ____________.
   a. Mitochondrial intermembrane space; mitochondrial outer membrane; cytosol
   b. Cytosol; mitochondrial matrix; mitochondrial matrix
   c. Mitochondrial matrix; mitochondrial matrix; cytosol
   d. Cytosol; cytosol; mitochondrial matrix

52. LacZ is a gene found in the bacteria *Escherichia coli* that, in the absence of glucose, will be expressed and lead to the synthesis of an enzyme known as β-Galactosidase, which metabolizes lactose. Which of the following is true?
   a. The complementary mRNA strand will not have a Poly-A tail added to it.
   b. The complementary mRNA strand will be synthesized in the nucleus.
   c. The complementary DNA strand will use the nucleotide ‘Uracil’ instead of ‘Thymine’.
   d. None of the above are true.

53. What is an intron?
   a. The portion of a gene that is included in the RNA transcript
   b. The portion of a gene that is removed from the RNA transcript
   c. The portion of a gene that is used as a template for DNA replication
   d. The product of reverse transcriptase creating a complementary DNA strand to a template mRNA
   e. None of the above

54. What would be the correct complementary RNA sequence for the following DNA sequence?
   5’ ATTCAAGATCC 3’
   a. 5’ ATTCAAGATCC 3’
   b. 5’ UAAGUUCUAGG 3’
   c. 5’ GGATCTTGAAT 3’
   d. 5’ GGAUCUUGAAU 3’
   e. None of the above are the correct sequence.

55. What is the central dogma of molecular biology?
   a. DNA → RNA → Protein
   b. Amino acids → Polypeptide → Protein
   c. Protein → RNA → DNA
   d. DNA → Phosphate group → Hydroxyl group → Nucleotide
   e. Every living thing arises from previously existing cells.

56. Sickle cell anemia is an example of which of the following?
   a. Polygenetic
   b. Pleiotropy
   c. Epistasis
   d. Codominance

57. Multiple ribosomes can translate the same mRNA at the same time.
   a. True
   b. False
   c. Only in prokaryotes
   d. Only in eukaryotes
58. What causes the ribosomal subunits to dissociate once they reach the stop codon on the mRNA?
   a. A release factor binds to the stop codon which causes the ribosomal subunits and the polypeptide chain to release.
   b. A tRNA brings the ‘STOP’ anticodon to match the stop codon, which causes the ribosomal subunits and polypeptide chain to release.
   c. Once they reach the stop codon, the polypeptide chain is too long, and the increase in entropy caused by all of the peptide bonds causes the polypeptide chain to dissociate from the mRNA, followed by the ribosomal subunits.
   d. The stop codon is part of the poly-A tail, which carries no gene sequence that can be expressed, and so the ribosomal subunits and polypeptide chain dissociate.
   e. I am going to be honest with myself and select this choice, because I don’t actually know the answer.

59. Which of the following occur in both the chloroplast and mitochondria?
   i. DNA replication
   ii. meiosis
   iii. transcription
   iv. translation
   a. i, iii, and iv only
   b. ii only
   c. i, ii, iii, and iv
   d. iii and iv only

60. Which of the following correctly outlines the order of events during cellular respiration?
   a. Glycolysis, electron transport chain, oxidative phosphorylation, citric acid cycle
   b. Glycolysis, citric acid cycle, electron transport chain, substrate level phosphorylation
   c. Glycolysis, citric acid cycle, oxidative phosphorylation, electron transport chain
   d. none of the above

61. You are given a pedigree for a family with a history of hemophilia. The pedigree starts with an apparently normal male and an affected female. They have two affected sons and one apparently normal daughter. One of the sons has two apparently normal daughters with an apparently normal female. What type of pedigree is this?
   a. Autosomal recessive
   b. Autosomal dominant
   c. Sex-linked
   d. Impossible to determine

62. The purpose of the reaction that takes place on the thylakoid membrane is to produce________.
   a. ATP
   b. NADPH
   c. Glucose
   d. NADP
   e. a) and b)

63. A scientist quantifies the amount of guanine in an E.coli genome. Which of the following can he expect to find?
   a. DNA has uniform diameter along its length
   b. An unknown amount of thymine
   c. A similar amount of cytosine
   d. b) and c)

64. Hawaii is an isolated volcanic archipelago in the Central Pacific Ocean. Hawaii’s climate is typical for the tropics, with summer days reaching a temperature of 31 °C and the nights reaching 24 °C. With this information, what can be said about the DNA structure and DNA replication process of yellow hibiscus, Hawaii’s state plant?
   a. It replicates its DNA faster than a plant in Saskatchewan.
   b. The Hawaiian plant will have a higher proportion of saturated fatty acids in its DNA.
   c. It will probably have more DNA coding for temperature-regulating proteins than in an SK plant.
   d. All of the above
   e. None of the above
65. A sample of DNA is found to have 29% adenine. How much guanine would you expect to be present in the same sample?
   a. 21%
   b. 29%
   c. 42%
   d. 58%
   e. It depends on whether the sample came from prokaryotic cells or from eukaryotic cells.

66. In DNA replication, nucleotides are always added …
   a. at the 5' end, which has a free –H group.
   b. at the phosphate group, by removing the phosphate –H group.
   c. at the 3' end, which has a free –OH group.
   d. at the 5' end, which has a free –OH group.
   e. at the 3' end, which has a free –H group.

67. The mutation responsible for sickle-cell anemia involves a mutation in the gene for one of the hemoglobin polypeptides altering a codon enough to specify a different amino acid, thus resulting in an encoded polypeptide that differs by one amino acid than what is in the normal polypeptide. This kind of mutation is a ________ mutation.
   a. silent
   b. frameshift
   c. nonsense
   d. missense

68. The alleles for flower colour and stem length segregate together. An unknown cross results in 43% of the offspring having red flowers and a long stem, 43% white flowers and a short stem, 7% red flowers and a short stem, and 7% white flowers and a long stem. Which phenotypes are the recombinant phenotypes?
   a. Red flowers and long stem, and white flowers and short stem
   b. Red flowers and long stem, and white flowers and long stem
   c. White flowers and short stem, and white flowers and long stem
   d. None of the above

69. From the above question, how far apart are the genes on the chromosome?
   a. 43 map units
   b. 14 map units
   c. 86 map units
   d. 7 map units
   e. 50 map units

70. An enzyme tethers DNA polymerase III to the DNA template. This enzyme is …
   a. topoisomerase.
   b. amerase.
   c. not an enzyme, but a lipid-oligosaccharide structure.
   d. a sliding clamp.

71. In humans, the SRY protein is responsible for:
   a. the production of female sexual characteristics
   b. the production of male sexual characteristics
   c. regulation of the SRY gene
   d. is found in Canadians and gives them an overwhelming urge to constantly apologize
   e. Both b) and c)

72. The semi-conservative mechanism in DNA replication …
   a. produces DNA strands in which segments of the new DNA are interspaced with the parental DNA
   b. produces DNA molecules with one parental strand and one newly made strand
   c. was confirmed by the Hershey-Chase Experiments to be the mechanism of DNA replication
   d. produces one double helix with both parental strands, and the other with two new daughter strands.
   e. b) and c)
73. You breed a female ostrich that is homozygous for black feathers (F) and a long neck (n) with a male ostrich that is homozygous for white feathers (f) and a short neck (N). What percentage of their offspring will have white feathers and a long neck?
   a. 0%
   b. 25%
   c. 50%
   d. 100%

74. The complement of the lagging strand in DNA replication is synthesized …
   a. in the 3’ → 5’ direction.
   b. in the 5’ → 3’ direction.
   c. away from the replication fork.
   d. towards the replication fork.
   e. b) and c)

75. Okazaki fragments are synthesized …
   a. in the 3’ → 5’ direction
   b. as complements of the leading strand
   c. as complements of the lagging strand
   d. of ribonucleotide monomers

76. Replication forks …
   a. are catalyzed by primase and maintained by sliding clamp proteins.
   b. run away from the origin of replication.
   c. are catalyzed by helicase and maintained by single-stranded binding proteins.
   d. a) and b)
   e. b) and c)
   f. are used to eat DNA spaghetti.

77. Topoisomerase …
   a. stabilizes the DNA as the strands unwind.
   b. avoids the twisting of the DNA ahead of the replication fork.
   c. seals nicks left between adjacent bases after RNA primers are replaced with DNA.
   d. assembles RNA primers in the 5’ → 3’ direction to initiate a new DNA strand.

78. Your friend, an aspiring geneticist, tells you that he wants to start an experiment on gene linkage. He says he wants to use giant pandas as his test subjects. Why is this not a very good idea?
   a. Giant pandas are difficult to breed.
   b. Giant pandas have long generation times.
   c. Giant pandas do not experience gene linkage.
   d. Both a) and b)
   e. All of the above

79. Cellular respiration has been demonstrated to occur in which of the following?
   a. Dracaena fragrans massangeana (corn)
   b. Saccharomyces cerevisiae (yeast)
   c. Escherichia coli (a bacterium)
   d. All of the above

80. In comparison to prokaryotes, eukaryotes increase their speed of DNA replication by …
   a. increasing the enzyme concentration of DNA polymerase.
   b. increasing their temperature to make DNA more accessible.
   c. having more origins of replication.
   d. having linear DNA.

81. Facultative and strict anaerobes differ in that …
   a. facultative anaerobes require a steady oxygen supply, while strict anaerobes require an oxygen-free environment.
   b. facultative anaerobes have a greater number of energy producing organelles.
   c. facultative anaerobes can function with or without oxygen, while strict anaerobes can only function in the absence of oxygen.
   d. facultative anaerobes can live with or without conducting the electron transport chain whereas strict anaerobes can’t live without it.
82. In order to study CO₂ release in cellular respiration, Michael has conducted a series of experiments that have isolated parts of cellular respiration. The experiments can be broken down to:
   i. Glycolysis
   ii. Pyruvate oxidation
   iii. Oxidative phosphorylation
   iv. Citric acid cycle
In which experiments would Michael find CO₂ release?
   a. i and ii only
   b. ii and iii only
   c. iii and iv only
   d. none of the above

83. You breed a heterozygous, brown furred (B), black-eyed rat (E) named Tim with a white furred, red-eyed rat named Brenda. Tim’s dad was a brown furred red-eyed rat. What are the recombinant gametes from Tim?
   a. Be and bE
   b. Be and be
   c. BÈ and be
   d. BÈ and bE

84. C. botulinum is a bacterium that produces a toxin that causes botulism in humans. Most cases of botulism occur when food is improperly canned, providing these bacteria with an oxygen-free environment and a moist food source. C. botulinum is best classified as a(n) ___________.
   a. facultative anaerobe
   b. obligate aerobe
   c. strict anaerobe
   d. photosynthetic aerobe

85. Deoxyribonucleic acid and ribonucleic acid are both polymers of nucleotides that hold genetic information. Which of the following statements is true concerning the difference between them?
   a. DNA contains uracil and RNA contains thymine.
   b. RNA has a free hydroxyl group on the 2’ carbon and DNA has a hydrogen.
   c. DNA is usually single-stranded and RNA is usually double-stranded.
   d. RNA is found in the cytoplasm and never in the nucleus.
   e. Deoxyribonucleic acid does not contain any oxygen.

86. The creation of ATP in the glycolysis pathway is known as ________ because ________.
   a. Substrate level phosphorylation; oxygen is required to accept the final electrons to allow the creation of a proton (H+) gradient that drives the synthesis of ATP by ATP Synthase
   b. Substrate level phosphorylation; ATP synthesis occurs when a reaction releases enough energy to enzymatically transfer a phosphate to an ADP molecule
   c. Oxidative phosphorylation; ATP synthesis occurs when a reaction releases enough energy to physically transfer a phosphate to an ADP molecule
   d. Oxidative phosphorylation; oxygen is required to accept the final electrons to allow the creation of a proton (H+) gradient that drives the synthesis of ATP by ATP Synthase

87. Guanine and adenine are ____________.
   a. complementary bases
   b. both purines
   c. both pyrimidines
   d. in both DNA and RNA
   e. b) and d)

88. The double helix of DNA is stabilized by ____________.
   a. hydrophobic interactions
   b. hydrogen bonds between nitrogen bases
   c. peptide bonds
   d. phosphodiester bonds between nucleosides
   e. b) and d)
89. A recently replicated DNA daughter helix has a 5’ to 3’ strand with many fragments ending in disconnected but adjacent sugar and phosphate groups. This cell likely has a problem with which enzyme?
   a. DNA polymerase
   b. Primase
   c. Phosphate group connectase
   d. Ligase
   e. Helicase

90. The citric acid cycle yields ________.
   a. NAD+ , FAD, ADP
   b. CO2 , NADH, FADH2 , ADP
   c. CO2 , NADH, acetyl-CoA
   d. none of the above

91. How would the absence of single-stranded binding proteins affect DNA replication?
   a. The DNA molecule would wound up too tight.
   b. The strands would bind together again after they’re separated.
   c. There would be no way of separating the strands.
   d. The lagging strand would not be replicated.
   e. There would be no effect as single stranded binding proteins are factors of translation and not replication.
   f. Double stranded binding protein would come out from years of hiding and make the most of this opportunity to finally shine.

92. A scientist studies genetic replication and observes the doubling of DNA material in the cytosol. Which of the following organisms must she be studying?
   a. A gamete
   b. A virus
   c. An extremophile
   d. An autosome
   e. A bacterium

93. DNA polymerase adds a …
   a. nucleotide diphosphate to the 3’ end of a DNA primer.
   b. nucleotide triphosphate to the 5’ end of a DNA primer.
   c. nucleotide triphosphate to the 3’ end of an RNA primer.
   d. nucleotide triphosphate to the 5’ end of an RNA primer.

94. When crossing two organisms, you notice the first generation offspring expresses a trait absent from both parents, and this trait, coded for by one gene, is a blend of the parental traits. This is an example of ________.
   a. codominance
   b. incomplete dominance
   c. pleiotropy
   d. polygenic inheritance
   e. The blending theory was disproven in the 18th century.

95. Hair color is coded for by one gene in a certain type of cattle. When breeding a red and blue cattle, you ended up with purple offspring. Upon closer inspection, you notice that some hairs are actually blue and some red, giving the illusion of purple hair. This is an example of __________.
   a. codominance
   b. incomplete dominance
   c. pleiotropy
   d. polygenic inheritance
   e. I’m pretty sure this is impossible

96. Which of the following help form RNA’s tertiary structure?
   a. Lots of caffeine
   b. Succinyl-CoA dehydrogenase
   c. CRISPR
   d. Hydrogen bonds
   e. Tertiary structure refers to proteins, not RNA
97. Glycolysis occurs in _________.
   a. Animalia
   b. Eukaryota
   c. Bacteria
   d. All of the above

98. The mitochondrial Electron Transport Chain synthesizes ATP by ________________.
   a. substrate-level phosphorylation
   b. fermentation
   c. photophosphorylation
   d. oxidative phosphorylation

99. A nonsense mutation results in ________________.
   a. multiple amino acid alterations
   b. a single amino acid alteration
   c. the end of the polypeptide chain
   d. no change in the amino acid sequence

100. Jim has a recessive X-linked genetic disease. Neither his father nor his mother have the genetic
disease. What does Jim know about his disease?
   a. He must have gotten the allele for this disease from his father.
   b. He must have gotten the allele for this disease from his mother.
   c. Both his parents must be carriers for the disease.
   d. Jim must have been adopted.

101. When two genes are linked …
   a. both Mendel’s first and second laws still apply.
   b. Mendel’s first law applies but his second law does not.
   c. Mendel’s second law applies but his first law does not.
   d. Neither the first nor the second law apply.

102. Which of the following molecules are not involved in protein synthesis?
   a. rRNA.
   b. tRNA.
   c. mRNA.
   d. cRNA
   e. None of the above.

103. RuBisCo is regenerated during the ______ phase of the ______ cycle.
   a. reduction; Calvin
   b. reduction; citric acid
   c. regeneration; Calvin
   d. regeneration; citric acid

104. The purpose of the reaction that takes place in the stroma is to produce__________.
   a. ATP
   b. NADPH
   c. glucose and other organic molecules
   d. a) and c)
   e. a) and b)

105. Chlorophyll appears green because it …
   a. can only absorb energy in the green spectrum, which allows it to emit green light.
   b. is unable to absorb green wavelengths, and thus green light is reflected.
   c. is a member of Rider nation.
   d. can only absorb energy in the form of blue and yellow photons, which combined give off a
green colour.
106. ATP is produced in the chloroplast by accumulating protons in the lumen of the …
   a. inner membrane of the chloroplast, then the protons move down their concentration gradient through ATP synthase to produce ATP.
   b. thylakoid, then the protons move down their concentration gradient through ATP synthase to produce ATP.
   c. inner membrane of the chloroplast, then the protons move up their concentration gradient through ATP synthase to produce ATP.
   d. thylakoid, then the protons move up their concentration gradient through ATP synthase to produce ATP.

107. Electrons from photosystem I are donated to …
   a. NADP+ reductase on the lumen face of the thylakoid membrane, where NADP+ is reduced to NADPH
   b. NADP+ reductase on the lumen face of the thylakoid membrane, where NADPH is reduced to NADP+
   c. NADP+ reductase on the stroma face of the thylakoid membrane, where NADP+ is reduced to NADPH
   d. NADP+ oxidase on the stroma face of the thylakoid membrane, where NADPH is oxidized to NADP+

108. The Calvin cycle is called light independent, but it will come to a halt if a plant is deprived of light for a substantial amount of time. This is because …
   a. the Calvin cycle converts light energy to chemical energy using an electron transport chain.
   b. the enzyme Rubisco requires light to function.
   c. the plant is unable to find CO$_2$ when it is dark.
   d. the Calvin cycle requires a constant supply of ATP and NADPH generated by light dependent reactions.
   e. the Calvin cycle requires a constant supply of ATP and NADP+ generated by light dependent reactions.

109. The light-dependent reactions are called such because light …
   a. is the source of electrons.
   b. splits the water molecule directly.
   c. energizes electrons.
   d. is required to activate the enzyme plastoquinone.

110. Which of the following are INCORRECTLY matched?
   a. Cellular respiration produces H$_2$O and CO$_2$
   b. Photosynthesis produces O$_2$ and sugars
   c. Cellular respiration produces glucose and ATP
   d. Photosynthesis requires H$_2$O and CO$_2$. 

*End of the Biology 120 Mock Final Examination*