

Part I – Multiple choice – 1 pt. each.

1. Two dogs find a piece of meat on the ground. Dog1 chases dog 2 away and eats the meat. Dog 1 is showing a social behavior called: A) cooperation
B) altruism C) spite D) selfish E) none of the above
2. Bees pollinate flowers on plants and the flowers in turn provide the bees with a nectar food supply. This sort of interaction is called: _____ (Use the choices in question 1)
3. An individual guards its nest against predators. In doing so, it endangers itself but helps it's offspring. This interaction is _____ (use the choices in question 1)
4. On a strict genetic basis behavior such as that in question 3 would be more likely shown by an individual toward it's: A) siblings B) grandchildren
C) aunts and uncles D) 1st cousins E) more than one of the above equally
5. The hypothesis you used to determine your answer to question 4 is termed _____ . (Fill in)
6. Cell fossils similar to those found in modern bacteria 1st appear in the fossil record about _____ billion years ago. A) 4 B) 2.5 C) 2 D) 1.7 E) 1
7. A population: A) is more than one species B) shares a common gene pool
C) consists of all the organisms in a certain habitat D) both B and C
E) all of the above
8. You are raising fruit flies, and in each generation you let only the flies with the smallest wings reproduce the next generation. This continues for 35 generations. At the end of the experiment, you would expect: A) all flies to be born without wings B) no change in the size of the flies' wings C) flies to have larger wings D) flies to have smaller wings E) none of the above
9. The flies in question 8 were subjected to: A) kin selection B) disruptive selection C) stabilizing selection D) sexual selection E) directional selection
10. _____ is a force of evolution that necessarily leads to adaptation. A) natural selection B) gene flow C) mutation D) genetic drift E) meiotic drive
11. The most difficult polymers to produce in early Earth simulation experiments (e.g. Miller's) are: A) proteins B) lipids C) carbohydrates D) nucleic acids E) polysaccharides

12. At a particular gene locus, all of the individuals in a population are homozygous for the same allele. 10% of these individuals emigrate from the population. Such movement is a potential force of evolution called: A) natural selection B) genetic drift C) mutation D) meiotic drive E) gene flow
13. As a result of the emigration in question 12, there was evolutionary change at the gene in question. A) true B) false C) there is insufficient information to answer the question

In questions 14 through 19 use the following information: 100 people in a lifeboat from the HMS Titanic drift onto a small uninhabited uncharted island and live there unknown and isolated from the rest of the world. 81 of them are homozygous for blue eyes, a recessive trait. The other 19 have brown eyes, the dominant trait. There are no other eye color alleles in the population except brown and blue. Assume the population is in Hardy/Weinberg equilibrium unless otherwise told.

14. What is the frequency of heterozygotes (H) in the lifeboat population? A) 0 B) 0.01 C) 0.1 D) 0.18 E) 0.9 F) 1.0
15. What is the frequency of the blue-eye allele (q) in the lifeboat population? _____ (Use the choices in question 14)
16. If none of the blue-eyed people reproduce at all, what will be the frequency of the blue-eye allele in the next generation? A) 0 B) >0, but <1 C) 1
17. If all the brown-eyed people leave the island and try to return to civilization, what would be the frequency of the blue-eyed allele in the people left on the island? _____ (Use the choices in question 16)
18. Such a change in allele frequency as seen in question 16 would be due to a force of evolution called A) genetic drift B) gene flow C) natural selection D) mutation E) meiotic drive
19. All 100 stay on the island and reproduce, and eventually the island population size reaches 10,000. Among those 10,000 we find one person with unpigmented (pink) eyes. This person's trait must have been caused by: A) natural selection B) genetic recombination C) gene flow D) mutation E) genetic drift
20. Of the many ways in which polymerization of monomers might have occurred in the origin of life, _____ is considered to be the most likely one. A) evaporation B) heating the primordial soup C) freezing the soup D) concentration in layered minerals E) none of the above
21. Which of the following was probably not a component of the early Earth's atmosphere? A) oxygen B) water C) methane D) ammonia E) hydrogen

22. After a storm, it was discovered that average sized sparrows survived better than sparrows of other sizes. Thus, in the storm the sparrows were subjected to _____ selection. A) sexual B) stabilizing C) directional D) disruptive
23. If storms such as in question 22 were important in sparrow evolution, we would expect the average size of the sparrows to be _____ in the next generation. A) larger B) smaller C) the same D) there is no predictable outcome
24. In the zoo, chimpanzees and bonobos (pygmy chimpanzees) have mated and produced fertile offspring. In areas of Africa where both species coexist, such mixed offspring are also born, but they never live long enough to be able to reproduce themselves. This is most likely an example of: A) behavioral isolation B) hybrid inviability C) hybrid sterility D) gamete mortality
25. Energy for all living things is 1st incorporated into organic material through the process of: A) fermentation B) photorespiration C) respiration D) translation E) photosynthesis
26. The process in question 25 takes place in organelles (or structures) called: A) nuclei B) lysosomes C) mitochondria D) ribosomes E) chloroplasts
27. The primary useful end product of the process in question 25 is: A) ATP B) protein C) carbon dioxide D) glucose E) oxygen
28. Linked genes: A) do not follow the law of independent assortment B) are on the same chromosome C) carry codes for similar traits D) more than one of the above E) all of the above
29. If solution 1 is hypotonic to solution 2, then water will flow: A) toward solution 1 B) toward solution 2 C) in both directions equally D) in both directions, but mainly toward solution 1 E) in both directions, but mainly toward solution 2
30. A tentative answer to a scientific question is a(n): A) theory B) prediction C) deduction D) hypothesis E) test result
31. Segregation of chromatids or chromosomes always occurs during: A) metaphase B) prophase C) anaphase D) interphase E) telophase
32. If cytokinesis occurs, it takes place primarily in _____. (use the choices in question 31.)
33. A(n) _____ is an integrated collection of tissues. A) cell B) system C) organ D) organism E) Kleenex box

34. If a human female shows a sex-linked recessive trait and her husband does not, then _____ percent of her sons will show the trait. A) 0 B) 25 C) 33.3 D) 50 E) 100
35. A messenger RNA has the base sequence UGCCAAUAG. The DNA from which it was formed had the sequence: A) ACGGUUAUC B) TCGGTTATC C) ACGGTTATC D) TGCCAATAG E) UGCCAAUAG
36. _____ is/are the major barrier component(s) of a cell membrane. A) cellulose B) proteins C) nucleotides D) lignin E) phospholipids
37. Using the choices in question 36, which component of the membrane largely determines its' permeability? _____
38. In taxonomy, a group of similar genuses is called a(n): A) order B) family C) species D) division E) class
39. The ultimate 3-dimensional shape of a single chain of amino acids is called the _____ structure of the chain. A) primary B) secondary C) tertiary D) quaternary E) pentary
40. The packaging of cell secretions into functional vacuoles is largely the function of a organelle called a(n): A) nucleus B) endoplasmic reticulum C) plastid D) Golgi body(apparatus) E) microbody
41. A major functional organelle produced by the structure in question 40 is a(n): A) ribosome B) lysosome C) chloroplast D) cell wall E) mitochondrion
42. A ratio of 1:1 is characteristic result of a test cross in which the unknown parent was: A) homozygous dominant B) heterozygous C) homozygous recessive
43. Light reactions take place in/on the: A) stroma B) thylakoid membranes C) christae membranes D) matrix E) outer plastid membranes
44. Two chromatids are joined by a structure called a(n): A) centriole B) spindle C) synapse D) cytoskeleton E) centromere
45. The two attached chromatids in question 44 represent: A) homologous chromosomes B) linked chromosomes C) replicated chromosomes D) polytene chromosomes E) sex chromosomes
46. In an operon the actual protein codes are found in the: A) inducer B) operator C) promoter D) structural gene E) corepressor
47. A single codon carries information for a single: A) protein B) amino acid C) nucleotide D) gene E) messenger RNA

48. Which element is found in nucleic acids but not in proteins? A) nitrogen
B) phosphorus C) oxygen D) sulfur E) carbon
49. Organisms that are sessile (not moving), heterotrophic, and multicellular would most likely be classed in the kingdom: A) monera B) fungi C) plantae
D) animalia E) protista
50. Single celled, heterotrophic, eucaryotic organisms would be in the kingdom _____ (Use the choices in question 49)

Part II – True-false – 1 pt. each.

1. One effect of natural selection is to increase the adaptiveness of traits in a population.
2. Female lions necessarily have a higher fitness than males because, having reached maturity, they live longer.
3. Genetic drift has its greatest effect on large populations.
4. Stabilizing selection does not lead to any evolutionary changes in a population.
5. For speciation to occur, one needs disruptive selection and barriers between the selected groups.
6. If there were no natural selection, there would be no evolution.
7. The Mesozoic era begins with the Tertiary period.
8. Hard-bodied organisms fossilize more readily than soft-bodied ones.
9. A carrier protein and ATP are necessary for facilitated diffusion.
10. In usual DNA base pairing, it is one purine pairing with one pyrimidine.
11. A single amino acid may be specified by more than one codon.
12. Water is a polar substance, thus it will generally mix easily with other polar substances.
13. Excluding mutations, the offspring cells of mitosis are genetically identical to each other.
14. Most ATP is produced in electron transport chains.

15. It is possible for 40% of the bases in a DNA molecule to be uracil.
16. Mendel mathematically described the process of meiosis in his law of segregation.
17. Reduced NAD contains more energy than oxidized NAD.

Part III – Fill-in - 1 pt. each blank.

1. Evolution is defined as a(n) _____ in the _____ of a population.
2. In _____ selection, it is typically the female that exercises mate choice. In cardinals, if only the extreme reddest males are chosen as mates, then those males are also being subjected to _____ selection.
3. Eucaryotic cells are thought to have originated through _____, when one _____ cell moved inside the body of another. The driving force for this movement may have been the increasing concentration of poisonous _____ in the environment at that time.
4. If 2 species are mechanically isolated from each other, they do not successfully interbreed because _____.
5. An experiment's results are considered valid only if they can be _____.
6. A(n) _____ is a heritable change in a gene. One type of such changes is a(n) _____, caused by the addition or deletion of a nucleotide during replication.
7. _____ bonds between nonadjacent amino acids in a protein are responsible for the regular folding pattern in the protein, also called the _____ structure of the protein.
8. _____ and _____ are parts of the _____. The general function of this structure is _____.

Part IV – Short answer – pts as indicated

1. Define: (3 pts each)

A. speciation

B. gene flow

C. ribozyme

D. microsphere

E. heterotroph

F. homeostasis

G. endocytosis

H. osmosis

I. allele

J. transcription

K. sex-linked gene

L. organelle

2. List in order the periods associated with the Paleozoic Era in the fossil record and give one biological event associated with each. (14 pts)

3. Define a Hardy/Weinberg equilibrium. What 5 characteristics must a population have in order to maintain such an equilibrium? In the simplest case, how many generations would it take for a non-equilibrium population to reach such an equilibrium? (15 pts)

4. Outline the scientific method. Distinguish between theory and hypothesis as they relate to the method. (12 pts)

5. Distinguish between repressors, corepressors, and inducers. (9 pts)
6. Distinguish between dominant, recessive, codominant, and incompletely dominant. (12 pts)
7. Give one **specific** function for each of the following: (2 pts each)
- A. cellulose
 - B. mitochondrion
 - C. triglyceride
 - D. tRNA
 - E. permease
 - F. spindle
 - G. enzyme
 - H. dark reactions
 - I. promoter