BIO 213—Principles of Evolution—Summer 2001, Midterm

1. Read these directions before you begin.
2. Write your name on your Scantron sheet (tests without names will not be graded).
3. Check this test to make sure it has all pages, 1–4.
4. Mark all answers on the Scantron sheet. There is only one correct answer to each question.
5. When you are finished, turn in the Scantron on the front table. Please keep this sheet.

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1. _____ is an example of a postzygotic breeding barrier
   a. Allopatry
   b. Behavioral incompatibility
   c. Hybrid inviability
   d. Mechanical incompatibility
   e. Sperm death
2. _____ is an example of a prezygotic breeding barrier
   a. Developmental abnormalities in the embryo
   b. Ecological failure of F_2s and backcrosses
   c. F_1 sterility
   d. Sperm death
   e. Zygote death
3. _____, one of Darwin's supporters, debated evolution with Bishop Samuel Wilberforce.
   a. Alfred Russell Wallace
   b. Carl Linnaeus
   c. Ernst Haeckel
   d. Thomas Huxley
   e. Thomas Malthus
4. A "living fossil" is
   a. a computer-animated extinct creature, such as the dinosaurs in Jurassic Park.
   b. a fossil that still contains recoverable DNA and traces of metabolic activity
   c. a missing link
   d. a modern organism little changed from its ancient fossil ancestors
   e. any fossil of a species still alive today
5. A change in chromosome number *other than* by duplication of the entire genome (creating a multiple of the basic number) is called
   a. aneuploidy
   b. diploidy
   c. disploidy
   d. haploidy
   e. polyploidy
6. A frame-shift mutation
   a. can be caused by a base deletion
   b. can be caused by a base insertion
   c. usually results in a polypeptide with very different amino acids
   d. all of the above
   e. none of the above
7. A likely homology shared by all living organisms is
   a. 46 chromosomes
   b. a common genetic code
   c. hair
   d. membrane-bound nuclei
   e. oxidative respiration
8. A non-reduced gamete (of the sort that can lead to allopolyploidy)
   a. has half the number of chromosomes as the somatic (body) cells of the organisms that produced it
   b. has only one haploid chromosome set
   c. has the same number of chromosomes as the somatic (body) cells of the organism that produced it
   d. has twice as many chromosomes as the somatic (body) cells of the organism that produced it
   e. is the product of ordinary meiosis
9. A population has genotype frequencies AA = 0.40, Aa = 0.40, and aa = 0.20 for a specific gene. Is the population in Hardy-Weinberg equilibrium for this gene? What are p and q?
   a. No; $p = 0.60$, $q = 0.40$
   b. No; p and q cannot be determined
   c. Yes; $p = 0.40$, $q = 0.20$
   d. Yes; $p = 0.40$, $q = 0.60$
   e. Yes; $p = 0.60$, $q = 0.40$
10. A population has genotype frequencies AA = 0.49, Aa = 0.42, and aa = 0.09 for a specific gene. Is the population in Hardy-Weinberg equilibrium for this gene? What are p and q?
    a. No; $p = 0.70$, $q = 0.30$
    b. No; p and q cannot be determined
    c. Yes; $p = 0.30$, $q = 0.70$
    d. Yes; $p = 0.49$, $q = 0.09$
    e. Yes; $p = 0.70$, $q = 0.30$

11. A population is in Hardy-Weinberg equilibrium for a specific gene. The gene has two alleles; the frequency of *p* is 0.2. The genotypic frequencies are: homozygous dominant = ____, heterozygous = ____, and homozygous recessive = ____.
    a. 0.04 … 0.32 … 0.64
    b. 0.04 … 0.40 … 0.56
    c. 0.20 … 0.00 … 0.80
    d. 0.64 … 0.32 … 0.04
    e. cannot be determined from the data given
12. A synonymous mutation (synonymous substitution)
    a. causes a different protein to be formed
    b. changes a codon from an amino acid to a terminator
    c. changes a codon into another that codes for the same amino acid
    d. is always the result of a frame shift
    e. usually occurs in the first base of a codon
13. A vestigial organ
    a. becomes vestigial because it is not needed, organisms stop using it, and they pass down that disuse to their offspring
    b. has no function in an existing species, but is functional in related species, suggesting that its function was lost in the species in which it is vestigial
    c. is as functional as the non-vestigial organs in related species, it's just smaller
    d. is completely lost; there is no trace of it ever having existed.
    e. never had a function
14. According to Malthus in his essay on population,
    a. population size increases geometrically (for example, doubling)
    b. resources increase arithmetically (a given amount is added in each time period)
    c. population will eventually surpass available resources, resulting in famine, disease, etc.
    d. all of the above
    e. none of the above
15. According to the "biological species concept", a species consists of populations of "actually or potentially interbreeding organisms." Which of these is *not* a criticism of the biological species concept?
    a. Hybridization is common in many groups of easily-distinguished species.
    b. Interbreeding doesn't always contribute to gene flow.
    c. Organisms that interbreed are usually similar in their morphology and ecology, as well.
    d. "Potential interbreeding" has no effect on evolution until it happens.
    e. There are many different evolutionary reasons for breeding barriers.
16. According to the essentialist (typological) species definition,
    a. accidental variation (variation within a species) and essential variation (variation between species) are indistinguishable
    b. if all organisms that ever existed could be viewed at the same time, the differences between species would disappear
    c. individual species have defining features
    d. species are a human invention
    e. species are related by kinship
17. According to the evolutionary species definition,
    a. accidental variation and essential variation are biologically different
    b. species are real entities in nature, the result of evolutionary processes
    c. species are a human invention
    d. if all organisms that ever existed could be viewed at the same time, the differences between species would disappear
    e. species do not play an important role in evolution
18. According to the principle of natural selection,
    a. accumulated mutations always make organisms more successful
    b. animals always fight with each other, and the strongest always win
    c. farmers select those crops that give the best yield and plant them the next season
    d. only the fittest organisms will strive for perfection and pass their acquired traits on to their offspring
    e. organisms that have traits that are favorable to their survival will leave more offspring in the next generation, and so pass on those traits
19. Darwin's major work on evolution, published in 1859, was entitled
    a. *Essays on Population*
    b. *Jean Baptiste Pierre Antoine de Monet, Chevalier de Lamarck*
    c. *On the Origin of Species by Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*
    d. *Principles of Population Genetics*
    e. *Variations of Plants Under Cultivation*

20. During his voyage on the Beagle, Darwin saw ecologically specialized finches on the Galápagos Islands that were similar to ecological generalist finches on mainland South America. From this, he later deduced that
    a. God created similar finches geographically close together, even when they lived in different habitats
    b. the finches had been separately created for their different ecological roles
    c. the finches had evolved from a common ancestor
    d. the finches on the islands were striving harder for perfection
    e. there was no point in studying biology
21. Genetic drift
    a. always results in an equilibrium in gene frequencies
    b. has a greater effect in larger populations than in smaller populations
    c. helps to keep gene frequencies constant from one generation to the next
    d. is the source of the "founder effect"
    e. never occurs in the presence of selection or mutation
22. In peripatric speciation (peripheral isolation),
    a. a geographic barrier arises and splits the range of a species
    b. new species ordinarily form on the periphery of established ones
    c. the ancestral species ceases to exist, being transformed into the two new species
    d. the new species evolve slowly, since they consist of so many individuals
    e. the resulting species have roughly equal numbers of individuals
23. In the genetic code, a sequence of _____ nucleotides is called a(n) _____, and is translated into a(n) _____.
    a. four...amino acid...codon
    b. three...amino acid...polypeptide
    c. three...codon...amino acid
    d. three...ribosome...transfer RNA
    e. two...codon...amino acid
24. In vicariance (geographic) speciation,
    a. new species always form on the periphery of established ones
    b. small numbers of organisms disperse across a pre-existing geographic barrier
    c. the ancestral species remains unchanged
    d. the new species evolves rapidly in a small population
    e. the two resulting species have roughly equal numbers of individuals
25. Intense selection against the phenotype of a recessive allele
    a. will increase its frequency
    b. will increase the frequency of heterozygous individuals
    c. will not change its frequency
    d. will quickly eliminate it from the population
    e. will reduce its frequency, but not eliminate it
26. Mendel's principle of _____ only applies to genes on different nonhomologous chromosomes; genes on the same chromosome are said to exhibit _____.
    a. disequilibrium … translocation
    b. independent assortment … dominance
    c. independent assortment … linkage
    d. segregation … dominance
    e. segregation … linkage
27. Similarity between species that is the result of common descent is termed
    a. analogy
    b. convergence
    c. hierarchy
    d. homology
    e. homoplasy
28. Stabilizing selection happens when _____ and favors _____.
    a. a population is in Hardy-Weinberg equilibrium...panmixia
    b. heterozygous individuals have a phenotype different from that of either homozygote...the phenotype of the heterozygote
    c. homozygous dominant and homozygous recessive individuals look alike...the dominant allele
    d. mutation rates are high...organisms without mutations
    e. the Moon is in the Seventh House…the Age of Aquarius
29. Studies of allozymes (enzymes coded for by different alleles of the same gene) show that most are in Hardy-Weinberg equilibrium. The view that these genes are not actively affected by selection is called the _____ hypothesis.
    a. competitionist
    b. migrationist
    c. mutationist
    d. neutralist
    e. selectionist

30. The "Modern (Neo-Darwinian) Synthesis" refers to
    a. the synthesis of benzene, first accomplished in 1873
    b. the synthesis of developmental biology and natural theology that happened in the 1830s
    c. the synthesis of evolution and ecology that happened in the 1970s
    d. the synthesis of evolution and population genetics that happened in the 1930s
    e. the synthesis of gold from lead, first accomplished in a cyclotron in 1965
31. The biologist who co-published the original account of natural selection with Charles Darwin was
    a. Alfred Russell Wallace
    b. Ernst Haeckel
    c. Pierre Teilhard de Chardin
    d. Thomas Huxley
    e. Thomas Malthus
32. The Galápagos Islands are located
    a. in the eastern Pacific Ocean on the Equator
    b. in the central Atlantic Ocean west of Africa
    c. between Hawai'i and Alaska
    d. between Australia and New Zealand
    e. off the coast of India
33. The most general term for false homology is
    a. analogy
    b. convergence
    c. homoplasy
    d. mimicry
    e. parallelism
34. The *ultimate* source of all new genetic variation is
    a. genetic drift
    b. migration
    c. mutation
    d. recombination
    e. selection
35. Two factors are ordinarily necessary for speciation to occur:
    a. a changing environment and animals struggling for existence
    b. a high mutation rate and a barrier to gene flow
    c. rubber bands and scissors
    d. selection for divergence and a barrier to gene flow
    e. stabilizing selection and change in chromosome number
36. What is "founder effect"?
    a. Founders Day is a time to bring big donors to campus.
    b. In a newly established population, genetic drift doesn't take place.
    c. Migration is only important in small populations.
    d. When a small number of individuals found a new population, the allele frequencies of the new population are representative of the founders, not of the population they came from.
    e. When a small number of individuals found a new population, the allele frequencies of the new population are representative of the population they came from, not of the founders.
37. When we consider the geographic range of a typical species, we can say that
    a. genetic diversity is high at the periphery
    b. genetic diversity is high in the center of distribution
    c. intraspecific competition is low in the center of distribution
    d. population density is high at the periphery
    e. the periphery represents environments just as favorable to the species as the center of distribution
38. Which of the following does *not* cause a population to deviate from the Hardy-Weinberg equilibrium?
    a. genetic drift
    b. migration
    c. mutation
    d. panmixia
    e. selection
39. Which of the following statements about gel electrophoresis is false?
    a. It can be used to separate proteins or nucleic acids
    b. It is a useful tool for molecular biology
    c. It is a useful tool to understand genetic variation
    d. It relies on differences in the size and electrical charge of macromolecules
    e. It separates isozymes, but not allozymes
40. Which philosophical viewpoint is an important part of modern science?
    a. Teleology
    b. Causality
    c. Essentialism
    d. Vitalism
    e. Scala Naturae (ladder of nature)