

NAME: _____ KEY _____ SCORE: _____/100

Notes:

1. Make sure you have your name on the test.
2. Make sure you have the correct number of pages — check now!
3. Be sure to show ALL your work on problems — credit is given for correct steps in solving the problem. The correct answer without a clear showing of the derivation of the answer will receive little or no credit.
4. Maintain silence throughout the test.
5. For multiple choice questions, put the letter of the correct answer in the blank to the left of the question number.
6. DO NOT GET UP — if you have a question, raise your hand and the instructor will come to you.
7. Read the questions carefully — misreading is a primary cause of point loss. Also be sure to answer the question that was asked.
8. If you run out of room to answer a question, please continue on the back of the same page.
9. Papers are due on the instructor's desk at 2:50 PM. **NO LATE PAPERS WILL BE ACCEPTED!!** Class for today is over after you turn in your test.

1. (16) List, in order, ***starting with the most ancient***, the periods and the eras to which they belong Give the approximate dates for the start and end of each **era**. (Just do this for the three most recent eras)

FOR EACH ERA, list a typical life form that existed in that era. "Typical" means either a common form that lived in no other era, or a common form that may have lived in another era(s), but which was not a dominant life form except in the era in which you list it.

<i>Paleozoic era</i>	<i>~600-~225Ma</i>	<i>Trilobites</i>
<i>Cambrian</i>		
<i>Ordovician</i>		
<i>Silurian</i>		
<i>Devonian</i>		
<i>Carboniferous</i>		
<i>Permian</i>		

<i>Mesozoic Era</i>	<i>~225-65Ma</i>	<i>Dinosaurs</i>
<i>Triassic</i>		
<i>Jurassic</i>		
<i>Cretaceous</i>		

<i>Cenozoic Era</i>	<i>65Ma - present</i>	<i>large mammals & large birds</i>
<i>Tertiary</i>		
<i>Quaternary</i>		

2. (15) Having read Chapter 3 in your book carefully, explain what you think is the single best line of evidence for organic change through time (i.e., evolution in lineages of living organisms) — **EXCLUDING THE FOSSIL RECORD**. Tell what the evidence is, and why you think it is the best evidence. Stay within the bounds of science in your explanation. Try to design your explanation like a scientific paper; in other words, do a thought experiment on paper. Set up an empirical test of the following sort: If lineages evolve through time, the following must happen; if they didn't change through time, we would find this alternative instead. Then tell what has actually been found.

(one possibility follows) Other than the fossil record, I think the evidence from homology provides the strongest evidence for organic evolution. Any two living species will show some similarities: are these due to functional constraint (analogy) or descent from a common ancestor (homology)? Flying organisms must have airfoils (usually wings). Large, fast-swimming organisms must have streamlined bodies and a propulsion system; to move on land requires still different body parts.

Hypothesis: if living organisms are descended from a common ancestor, their bodies will show modification of a basic plan, no matter what the current function; however, if living organisms are designed for function, they will show morphologies best suited to the function, and these forms will not be related any more than, say a jet plane and a submarine are related.

When we look at mammals, say, we find that no matter what the function (swimming, walking/running, or flying), the limb is constructed on the same basic plan (pentadactyl). (Contrast propeller, jet engine, and wheels) We also find that for all vertebrates, the "recurrent" laryngeal nerve follows the same path, even though this makes sense in fish, and requires a many meter detour in giraffes. (A wire needing to go from one side of the cockpit to the other would be called a "mistake" if it detoured by the tail of the airplane) We also find that all eukaryotes, for instance, use the same genetic code, and have similar chemistries - no matter what they do for a living (chemists use teflon for some things, steel for other things, and far different processes to make them).

Thus, form is only superficially suited to function; at its most basic, form is dictated by genes which are passed on from generation to generation: it is this fact which is responsible for the homologies we see, and which is evidence that evolution, not some other process, is responsible for the homologies we see in nature.

3. (10) If one atom out of every 2 billion atoms of ^{132}Qs decays to ^{130}Rz in a year, and you find a rock in which has 67% of the total atoms of ($^{132}\text{Qs} + ^{130}\text{Rz}$) are ^{132}Qs , how old is the rock? (Assume all the ^{130}Rz present is decay product of ^{132}Qs that was originally present)

$$t = \frac{1}{r} \ln \frac{N_0}{N_t} \qquad r = \frac{1}{2,000,000,000}$$

$$t = 2,000,000,000 \ln \frac{1}{.67} = 2,000,000,000(.4004776) = 800,955,133$$

or about 801 million years

4. (15) List, in order, 5 human ancestors, giving approximate dates when they lived, and for each, tell whether it made stone tools, used fire, and approximately what size its brain was compared to modern humans. Use the following table to record your answers.

Name of Ancestor	Approximate Dates	Made stone tools? (Y/N)	Used fire? (Y/N)	Small, medium or large brain?
<i>Australopithecus afarensis</i>	~3.8-2.8 Ma	N	N	small
<i>Australopithecus africanus</i>	~3-2 Ma	N	N	small
<i>Homo habilis</i>	~2.2-1.6 Ma	Y(crude)	N	medium
<i>Homo erectus</i>	~1.6 - 0.4 Ma	Y(good)	Y	large
<i>Homo sapiens</i>	~0.4 Ma - present	Y(excellent)	Y	large

5. (6) List the three processes by which genetic variation is recombined:

- a. crossing over
- b. independent assortment
- c. gametic fusion

Multiple choice questions: worth 2 points each

- c 6. [lecture] A theory, as the term is used in science, is: a. just a guess about how something happened b. an initial, well thought-out explanation of an observation, but without much, if any, supporting evidence c. an explanation which has been tested and supported to a reasonable degree d. an explanation which has been thoroughly tested and disproved e. refers specifically to the cell theory, best expressed in the Latin phrase "*omnis cellula e cellula*"
- c 7. [lecture] The one thing that sets science most apart from other ways of knowing, and is referred to as the criterion of demarcation, is: a. having a progression from hypothesis to theory to law b. the building of new science on previous knowledge c. empirical falsifiability d. science being internally consistent e. scientific hypotheses having explanatory value
- d 8. [Ch. 1.2] A living thing which appears well-fitted to its environment in terms of form, physiology and behavior is said to possess: a. divergences b. equilibria c. advantages d. adaptations e. parthenogenesis
- b 9. [Ch. 1.5] Darwin's contemporaries mainly accepted the evidence that evolution had occurred, but not Darwin's ideas on: a. coral reefs b. natural selection c. pigeons d. South American mammals e. orchids
- a 10. [Ch. 1.6] When Mendel's ideas were rediscovered in 1900, they were initially taken as evidence that: a. natural selection couldn't occur in the way stated by Darwin b. Darwin was correct in his descriptions of artificial selection c. Darwin was correct in his theory of natural selection d. genetics and biometrics were incompatible e. genes were not on chromosomes
- d 11. [Ch. 1.7] Fisher, Haldane, and Wright are largely remembered for: a. proving Darwin wrong about natural selection b. taking the side of the Mendelians in the battle over how evolution occurs c. taking the side of the Biometricians in the battle over how evolution occurs d. unifying the mendelian and biometrics viewpoints e. rediscovering the Mendelian principles in 1900
- b 12. [Ch. 2.5] For a simple Mendelian trait, if a homozygote mates to a heterozygote, and half of their offspring look like each parent, the homozygote was: a. a dominant homozygote b. a recessive homozygote c. a codominant homozygote d. a pleiotropic plesiomorphic homozygote e. can't tell from information given
- e 13. [Ch. 2.2] The genetic code is deciphered in two stages or processes, called: a. transformation and conjugation b. meiosis and mitosis c. transcription and crossing-over d. translation and transformation e. transcription and translation
- b 14. [Ch. 2.3] Each human has how many copies of each gene? a. 1 b. 2 c. 3 d. 4 e. 5

- __b__ 15. [Ch. 2.6] Blending inheritance would make natural selection: a. more powerful than particulate inheritance b. less powerful than particulate inheritance c. impossible d. much more dependent on the mutation rate e. able to work on dominant alleles, but not on recessive alleles
- __a__ 16. [Ch. 3.3] Ring species are important because they show that: a. variation within a species can be extensive enough to produce a new species b. different species cannot interbreed c. species rarely form rings d. introgression may occur e. species hybridize in nature
- __c__ 17. [Ch. 3] Which of the following is **NOT** a line of evidence for organic evolution: a. direct observation of microevolutionary changes b. the order of groups in the fossil record c. the fact that genes are on chromosomes in higher organisms d. homologous similarities among species e. imperfect adaptations
- __d__ 18. [Ch. 3.5] Which of the following is an analogy, not a homology: a. bird wing and bat wing b. whale front flipper and human hand c. bee wing and wasp wing d. bat wing and bee wing e. 7 vertebrae in the neck of a giraffe and 7 vertebrae in the neck of a mouse
- __e__ 19. [Ch. 3.4] Which of the following is ***NOT*** evidence for a common ancestor of all living tetrapod vertebrates? a. the morphology of the eukaryotic cell b. the genetic code c. the pentadactyl limb d. the recurrent laryngeal nerve e. the different environments in which they live
- __e__ 20. [Ch. 3.2] New reproductively isolated species are easily formed both artificially and naturally by chromosome doubling in one major group of eukaryotes, which is the: a. fish b. euglenoids c. Basidiomycete fungi d. salamanders & newts e. flowering plants
- __d__ 21. [Ch. 19.1] Fossils are found in what type of rock? a. igneous b. metamorphic c. clademorphic d. sedimentary e. none of the preceding
- __b__ 22. [Ch. 19.2] Most fossils are found in rock dating from: a. the Archaic era b. the past 600 million years c. 3.8 - 0.6 Million years ago d. the pre-Cambrian e. the era of the stromatolites
- __b__ 23 [Ch. 19.4] Eukaryotic cells originated about how long ago? a. 3.8 billion years b. 1.8 billion years c. 0.8 billion years d. 600 million years e. 250 million years
- __c__ 24 [Ch. 19.5] The completeness of the fossil record is defined by: a. the observed thickness divided by the timespan of the rock b. the observed thickness divided by the short-term rate of deposition c. the observed thickness divided by the product of the short-term rate of deposition and the timespan of the rock d. the timespan of the rock divided by the product of the short-term rate of deposition and the observed thickness e. none of the preceding