

NAME: _____ 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 **BY THE END OF THE SCHEDULED CLASS PERIOD.**
NO LATE PAPERS WILL BE ACCEPTED!! Class for today is over after you turn in your test.

1. (12) 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.

Paleozoic era

~600--~225Ma

Trilobites

Cambrian

Ordovician

Silurian

Devonian

Carboniferous

Permian

Mesozoic Era

~225-65Ma

Dinosaurs

Triassic

Jurassic

Cretaceous

Cenozoic Era

65Ma - present

large mammals & large birds

Tertiary

Quarternary

2. (12) Two fossils will be presented, identified as "Fossil A" and "Fossil B". For each, identify the fossil, and give the ERA in which it (or the organism producing it) lived. Use the table below to record your answers.

	Name of Organism	Era in which it lived
FOSSIL A:	<i>Ammonite</i>	<i>Mesozoic (Paleozoic also OK)</i>
FOSSIL B:	<i>Sand Dollar</i>	<i>Paleozoic</i>

3. (15) Having read Chapter 3 in your book carefully (and perhaps the old tests on the web), explain what you think is the single best line of evidence for organic change through time (i.e., evolution in lineages of living organisms). 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. Continue on the back of THE PRECEEDING PAGE if you need more room to write.

One possible answer:

Fossil forms are, I believe, the single best line of evidence for evolution. If lineages have evolved through time, and if occasionally organisms are buried in current sediments and fossilized, we would expect the following: the more different the fossil from modern forms, the more ancient the rock should be in which it is buried. If all forms were created at once and have survived from then on, there should not be such things as fossils of organisms different from modern forms. Clearly, however, there are. Furthermore, radiodating of the rocks shows exactly what we would expect if lineages evolved: the more different the fossil from modern forms, the more ancient the rock should be in which it is buried. For the most part, the deeper the rock under the surface, also the more different the fossil from modern forms; however, occasionally rocks are folded so their order is not with the oldest on the bottom. The above argument presupposes that fossils are the remains or the casts of remains of once-living organisms; there can be no reasonable doubt about this, since fossils in all stages of formation are readily found, even fossils of modern organisms.

4. (12) If one atom of out of every 300 million atoms of ^{22}Zy decays to ^{19}Qr in a year, and you find a rock in which one thousandth of the total atoms of ($^{22}\text{Zy} + ^{19}\text{Qr}$) are ^{19}Qr , how old is the rock ? (Assume all the ^{19}Qr present is decay product of ^{22}Zy that was originally present)

$$t = \frac{1}{r} \ln \frac{N_0}{N_t}$$

$$r = \frac{1}{300,000,000}$$

$$t = 300,000,000 \ln \frac{1}{.999} = 300,000,000(0.0010005) = 300,150$$

or, approximately 300,000 years old.

5. (12) List, in order, from most ancient to most recent, 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>	<i>~0.4 Ma - present</i>	<i>Y-excellent</i>	<i>Y</i>	<i>large</i>
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6. (11) Calculate the allele frequencies for a population of 600 A_1A_1 , 400 A_1A_2 , and 200 A_2A_2 individuals.

$$f(A_1) = \frac{600 + \frac{400}{2}}{600 + 400 + 200} = \frac{800}{1200} = 0.67$$

$$f(A_2) = 1 - f(A_1) = 0.33$$

Here are 13 Multiple choice questions: worth 2 points each

- a 7. Which of the following is a logical prediction based on the hypothesis that early humans were scavengers? **a. human marks on bones should be on top of those of predatory carnivores**
b. human marks on bones should be under those of predatory carnivores c. one should find sharp, meat-cutting tools with the animal bones d. one should find small, neat little piles of carefully arranged, broken animal bones e. most of the broken bones with evidence of being smashed with human tools should be the flat bones which do not contain any marrow
- a 8. [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
- a 9. [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
- b 10. [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

- __c__ 11. [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__ 12. [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
- __c__ 13. A heavy jaw, large, flat rear teeth (molars), and small eye teeth (canines) are indicative of which of the following ways of life? a. eating meat (carnivory) b. fighting with the teeth **c. eating plants (herbivory)** d. eating both plants and animals (omnivory) e. scavenging
- __d__ 14. [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
- __d__ 15. [Ch. 3.5] Which of the following is an analogy, not a homology, at the level indicated: a. bird wing and bat wing at the level of basic bone structure b. whale front flipper and human hand at the level of basic bone structure c. bee wing and wasp wing at the level of wing **d. bat wing and bee wing at the level of wing** e. 7 vertebrae in the neck of a giraffe and 7 vertebrae in the neck of a mouse at the level of number of vertebrae
- __e__ 16. [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__ 17. [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**
- __e__ 18. [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**
- __e__ 19. The skeleton of "Lucy" was important in that it showed that: a. large brains were present before upright walking b. scavenging was better than just plant-eating c. Australopithecines had the running speed and size to be active hunters d. arthritis is an ancient disease **e. upright walking was present before large brains**

