Summer Fun Fest Assignment #2
Answer Sheet

Name _____ email address:_____
Due Date: _____ Date received _____

Directions: Answer the questions from the first SF2 assignment and write your answers the answer spaces below.

Darwin's View Of Life

1.a.
b.
c.
d.
e.
f.
g.
h.
i

2.
3.
4.
5.
6.
7.
8.
9.
10.

Evolution of Populations

11.
12.
13.
14.
15.
16.a

b. Show set-up

c. See below, right

d. See below, right

17a.
b.
c.

18a
b.
c.

19.
20.
21.
22.
23.
24.
25.
26 a
b.
c.
27.
28.
29.
30.
31.

16.c

Genotypes	*Phenotypes*
___ *BB*	
___ *Bb*	___ % black
___ *bb*	___ % gray

16.d

Parents (F_1)	*B sperm*	*b sperm*
___ *BB*	___	___
___ *Bb*	___	___
___ *bb*	___	___
Totals =	___	___

Speciation	Phylogeny	Origin of Life
32.	54.a.	67.
33.		68.
34.	b.	69.
35.	c.	70.
36.	d.	71.
37.		72.
38.	e.	73.
39.	f.	74.
40.		75.
41.	55.	76.
42.	56.	77.
43.	57.	78.
44.	58.	79.
45.	59.	80.
46.	60.	81.
47.	61.	
48.	62.	
49.	63.	
50.	64.	
51.	65.	
52.		
53.	66.NO Question	

Summer Fun Fest Assignment #2

A Darwinian View of Life

This chapter deals with an introduction to evolution – descent from a common ancestor; natural selection as the mechanism to modify species which leads to evolution of species adapted to their environment.

1. Several key players and events in the life of Charles Darwin led him to his conclusions about natural selection and evolution. Summarize these influences by completing the table below.

Event/Person	*Importance to Synthesis of Evolutionary Theory*
a.	Botanist at Cambridge University who perceived Darwin's real interests and arranged for Darwin to become a ship's naturalist
b.	Where Darwin earned a degree in theology but also developed his love for natural history
c.	British ship that carried Darwin (as a naturalist) on a five-year voyage around the world
d.	Wrote *Principles of Geology;* advanced the theory of uniformity; suggested that Earth was much older than 6,000 years
e.	Wrote an influential essay (read by Darwin) on human populations asserting that people tend to produce children faster than food supplies, living space, and other resources can be sustained
f.	Volcanic islands 900 kilometers from the South American coast where Darwin correlated differences in various species of finches with their environmental challenges
g.	The key point in Darwin's theory of evolution; involves reproductive capacity, heritable variations, and adaptive traits
h.	English naturalist contemporary with Darwin; independently developed Darwin's theory of evolution before Darwin published
i.	Unearthed in 1861; the first transitional fossil (between reptiles and birds); provided evidence for Darwin's theory

Sequence

Read Ideas A–G through first, then put them in an order that logically develops the Darwin-Wallace theory of evolution in correct sequence. Number 2 is the first, most fundamental idea. Idea number 15 set the stage for and underlies the remaining ideas.

2 The first idea in the series
3 The second idea in the series
4 The third idea in the series
5 The fourth idea in the series
6 The fifth idea in the series
7 The sixth idea in the series
8 The concluding idea in the series

A. Nature "selects" those individuals with traits that allow them to obtain the resources they need. They live longer and produce more offspring than others in the population that cannot get the resources they need to live and reproduce.
B. As population size increases, available resources dwindle.
C. A population is evolving when the forms of its heritable traits are changing over successive generations.
D. Animal populations tend to reproduce faster than food supplies, living space and other resources can sustain the populations.
E. The struggle for existence intensifies.
F. There is genetic variation in all sexually-reproducing populations; variations in traits might affect individuals' abilities to get resources, and therefore to survive and reproduce in particular environments.
G. Over time the more successful phenotypes will dominate the population that exists in that particular environment.

9. Evolution occurs at the level of
   a. the individual genotype.
   b. the individual phenotype.
   c. environmentally based phenotypic variation.
   d. the population.

10. What does natural selection act upon?
   a. The gene pool of the species
   b. The genotype
   c. The phenotype
   d. Multiple gene inheritance systems

The Evolution of Populations

Individuals do NOT evolve. Populations are subjected to natural selection. A population of organisms contains variations in phenotypes. As a result, some organisms within a population have greater reproductive success than others. Microevolution – the accumulation of changes in the gene pool is the focus of this chapter.

For questions 11-13 choose from these answers:

a. gene pool
b. genetic variation
c. gene flow
d. allele frequency

11. Differences in the combinations of alleles carried by the individuals of a population would be its _____.

12. For sexually reproducing species, the _____ is a source of potentially enormous variation in traits.

13. The relative abundance of each type of allele in a population is the _____.

14. p plus q = 1 expresses the _____ of a population; p^2 plus $2pq$ plus q^2 expresses the _____ of a population.

a. genotype frequency; allele frequency
b. genotype frequency; genotype frequency
c. allele frequency; genotype frequency
d. allele frequency; allele frequency

15. The unit used in studying evolution is the _____.

a. population
b. individual
c. fossil
d. missing link

16a. List the conditions (in any order) that must be met before genetic equilibrium (or nonevolution) will occur.

For the following situation, assume that the conditions listed in question do exist; therefore, there should be no change in gene frequency, generation after generation. Consider a population of hamsters in which dominant gene *B* produces black coat color and recessive gene *b* produces gray coat color (two alleles are responsible for color). The dominant gene has a frequency of 80 percent (or .80). It would follow that the frequency of the recessive gene is 20 percent (or .20). From this, the assumption is made that 80 percent of all sperm and eggs have gene B. Also, 20 percent of all sperm and eggs carry gene *b*.

16b. Calculate the probabilities of all possible matings in the Punnett square.

16c. Summarize the genotype and phenotype frequencies of the F_1 generation.

Genotypes	*Phenotypes*
___ *BB*	
___ *Bb*	___ % black
___ *bb*	___ % gray

		Sperm 0.80 *B*	Sperm 0.20 *b*
Eggs	0.80 *B*	*BB*	*Bb*
	0.20 *b*	*Bb*	*bb*

16d. Further assume that the individuals of the F_1 generation produce another generation and the assumptions of the Hardy–Weinberg rule still hold. What are the frequencies of the sperm produced?

Parents (F_1)	*B sperm*	*b sperm*
___ *BB*	___	___
___ *Bb*	___	___
___ *bb*	___	___
Totals =	___	___

The egg frequencies may be similarly calculated. Note that the gamete frequencies of the F_2 are the same as the gamete frequencies of the last generation. Phenotype percentage also remains the same. Thus, the gene frequencies did not change between the F_1 and the F_2 generation. Again, given the assumptions of the Hardy-Weinberg equilibrium, gene frequencies do not change generation after generation.

17. In a population, 81 percent of the organisms are homozygous dominant, and 1 percent are homozygous recessive. Find the following
    a. the percentage of heterozygotes
    b. the frequency of the dominant allele
    c. the frequency of the recessive allele

18. In a population of 200 individuals, determine the following for a particular locus if $p = 0.80$.
    a. the number of homozygous dominant individuals
    b. the number of homozygous recessive individuals
    c. the number of heterozygous individuals

19. If the percentage of gene *D* is 70 percent in a gene pool, find the percentage of gene *d*.

20. If the frequency of gene *R* in a population is 0.60, what percentage of the individuals are heterozygous *Rr*?

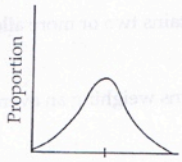
21. In comparing several populations of the same species, the population with the greatest genetic variation would have the
    a. greatest number of genes.
    b. greatest number of alleles per gene.
    c. greatest number of population members.
    d. largest gene pool.

22. The ability to taste the chemical PTC (phenylthiocarbamide) is determined in humans by a dominant allele *T*, with tasters having the genotypes *Tt* or *TT* and nontasters having *tt*. If you discover that 36 percent of the members of a population cannot taste PTC, then according to the Hardy–Weinberg rule, the frequency of the *T* allele should be
    a. 0.4.
    b. 0.6.
    c. 0.64.
    d. 0.8.

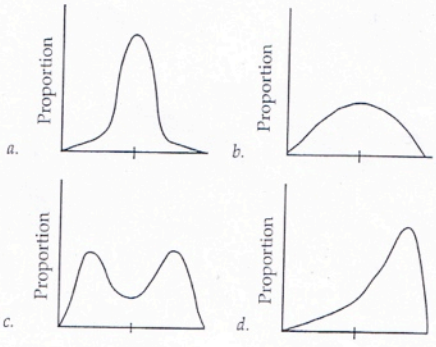
23. A gene in humans has two alleles, *M* and *N*, that code for different surface proteins on red blood cells. If you know that the frequency of allele *M* is 0.2, according to the Hardy–Weinberg rule, the frequency of the genotype *MN* in the population should be
    a. 0.16.
    b. 0.32.
    c. 0.64.
    d. 0.8.

24. A small, isolated population would most likely be subject over time to
    a. assortative mating.
    b. a founder effect.
    c. genetic drift.
    d. gene flow.

25. The following graph shows the range of variation among population members for a trait determined by multiple genes.

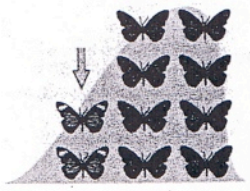


If this population is subject to *stabilizing selection* for several generations, which of the distributions (*a–d*) is most likely to result?

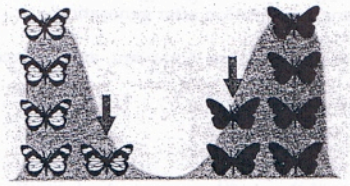


Labeling

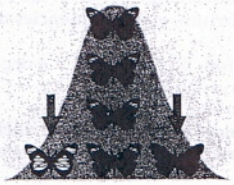
26. Identify the three curves below as stabilizing selection, directional selection, or disruptive selection.



a. _____



b. _____



c. _____

Choice

For questions 27-31, choose from the following categories of natural selection; in some cases, two letters may be correct.

a. directional selection b. stabilizing selection c. disruptive selection
d. balanced polymorphism e. sexual selection

27 The most frequent wing color of peppered moths shifted from a light form to a dark form as tree trunks became soot-darkened due to coal used for fuel during the industrial revolution

28 Females of a species choosing mates and directly affecting reproductive success

29 Phenotypic forms at both ends of the variation range are favored and intermediate forms are selected against

30 Selection maintains two or more alleles for the same trait in steady fashion, generation after generation

31 Human newborns weighing an average of 7 pounds are favored

The Origin of Species

The mechanisms of speciation may occur by a completely new species being produced (polyploidy) or by new species arising from parent species (adaptive radiation, cladogenesis).

Matching

Select the most appropriate answer to match the isolating mechanisms; complete the exercise by entering "pre" in the parentheses if the mechanism is prezygotic and "post" if the mechanism is postzygotic.

32 ecological ( )
33 temporal ( )
34 hybrid inviability ( )
35 mechanical ( )
36 zygote mortality ( )
37 gametic mortality ( )
38 behavioral ( )
39 hybrid offspring ( )

A. Potential mates occupy overlapping ranges but reproduce at different times.
B. The first-generation hybrid forms but shows very low fitness.
C. Potential mates occupy different local habitats within the same area.
D. Potential mates meet but cannot figure out what to do about it.
E. Sperm is transferred but the egg is not fertilized (gametes die or gametes are incompatible).
F. The hybrid is sterile or partially so.
G. Potential mates attempt engagement, but sperm cannot be successfully transferred.
H. The egg is fertilized, but the zygote or embryo dies.

Choice

For questions 40-46 choose from the following isolating mechanisms:

a. temporal b. behavioral c. mechanical d. gametic mortality e. ecological f. postzygotic

40 Sterile zebroids
41 Two sage species; each has its flower petals arranged as a "landing platform" for a different pollinator
42 Two species of cicada; one matures, emerges, and reproduces every thirteen years, the other every seventeen years
43 Populations of the manzanita shrub *Arctostaphylos patula* and *A. viscida* demonstrate differing tolerances to water stress at varying distances from water sources; speciation may be underway
44 Pollen grains from one flowering plant species molecularly mismatched with gametes of a different flowering plant species
45 Prior to copulation, male and female birds engage in complex courtship rituals recognized only by birds of their own species
46 Sterile mules

7. The activities of a mining company result in deposition of a new soil type within the range of a widespread plant species. Which of the following phenomena is likely to occur as a result?
   a. Geographic speciation
   b. Sympatric speciation
   c. Parapatric speciation
   d. Allopatric speciation

Plant species *A* ($2n$=20) and *B* ($2n$=14) hybridize to produce species *C*, an allopolyploid. How many chromosomes would be present in the cells of species *C*?
   a. 17
   b. 28
   c. 34
   d. 40

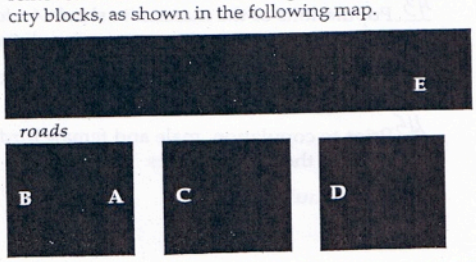
Which type of speciation is most common among flowering plants?
   a. Geographic
   b. Sympatric
   c. Parapatric
   d. Allopatric

Which of the following would *not* be considered an example of a prezygotic reproductive isolating mechanism?
   a. One bird species forages in the tops of trees for flying insects while another forages on the ground for worms and grubs.
   b. The males of one species of moth cannot detect and respond to the sex attractant chemicals produced by the females of another species.
   c. Sperm of one species of sea urchin are unable to penetrate the egg plasma membrane of another species.
   d. Mosquitos of one species are active in foraging and searching for mates at dusk, whereas those of another species are active at dawn.

Which of the following factors would *not* be expected to increase the rate of speciation in a group of organisms?
   a. A species range consisting of fragmented populations
   b. A diet consisting of food items whose abundance varies widely
   c. High birth rates
   d. Increased behavioral complexity

Which of the following observations constitutes conclusive evidence that two overlapping populations that had been geographically separated have *not* diverged into distinct species?
   a. Matings between members of the two populations produce viable hybrids.
   b. A stable hybrid zone exists where their ranges overlap.
   c. Interbreeding is common between members of the two populations.
   d. None of the above.

53 You look at several polymorphic loci in land snails removed from the areas A through E of four adjacent city blocks, as shown in the following map.



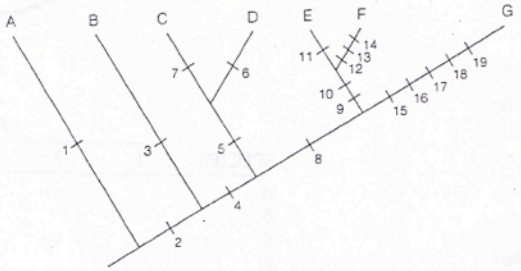
Snails from area A should be genetically most like individuals from area _____ and least like individuals from area _____.

Phylogeny

Biological diversity exists today due to gradual modification, adaptive radiations, geographic changes among other explanations. Determining the evolutionary (or phylogenetic) relationships of organisms and classifying them appropriately is the aim of systematics.

Cladogram Interpretation

54. Study the cladogram of seven taxa below. The vertical bars on the stem of the cladogram represent shared derived traits. Various taxa are indicated by numbers. Answer the questions following the cladogram.



a. On the cladogram above, what types of information could be represented by the numbered traits?

b. Which derived trait is shared by taxa EFG?

c. Which derived trait is shared by taxa CDEFG?

d. Which is the unique derived trait shared by taxa C and D?

e. What does it mean if some taxa are closer together on the cladogram than others?

f. Which taxon on the cladogram represents the outgroup condition?

Matching

Choose the one best answer for each.

55 Monera
56 Protista
57 Fungi
58 Plantae
59 Animalia

A. Multicelled heterotrophs that feed by extracellular digestion and absorption
B. Single-celled prokaryotes; some are autotrophs, others heterotrophs
C. Diverse multicelled heterotrophs, including predators and parasites
D. Multicelled photosynthetic autotrophs
E. Diverse single-celled eukaryotes; some are photosynthetic autotrophs, many heterotrophs

10. Organisms in a higher taxon are _____ similar, usually have diverged from a common ancestor _____ recently, and include _____ species than organisms in a lower, included taxon.
a. less, less, fewer
b. less, more, fewer
c. less, less, more
d. more, more, fewer

61 Which of the following incomplete lists of taxonomic categories ranks them properly from most inclusive to least inclusive?
a. Phylum, order, family, genus
b. Class, phylum, order, species
c. Order, class, family, genus
d. Family, order, class, kingdom

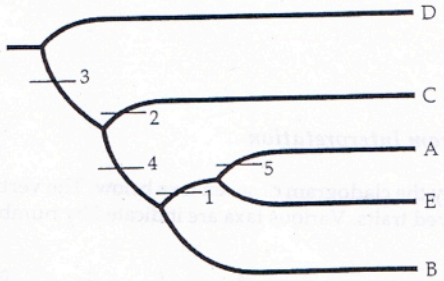
12 The *most* important attribute of a biological classification scheme is that it
a. avoids the ambiguity created by using common names.
b. reflects the evolutionary relationships among organisms.
c. helps us remember organisms and their traits.
d. improves our ability to make predictions about the morphology and behavior of organisms.

13 A derived trait is one that
a. differs from its ancestral form.
b. is homologous with another trait found in a related species.
c. is the product of an evolutionary reversal.
d. has the same function, but not the same evolutionary origin, as a trait found in another species.

14 Which of the following statements about reconstructing phylogenies is *false*?
a. Traits found in the outgroup as well as in the focal group are likely to be ancestral traits.
b. Shared traits are generally assumed to be homoplastic until they can be proven to be homologous.
c. Phylogenies do not include ancestors of modern groups, or date the splits between lineages.
d. Nodes (branching points) in phylogenetic trees have only two branches because during speciation a lineage normally splits into only two daughter species.

Application Questions

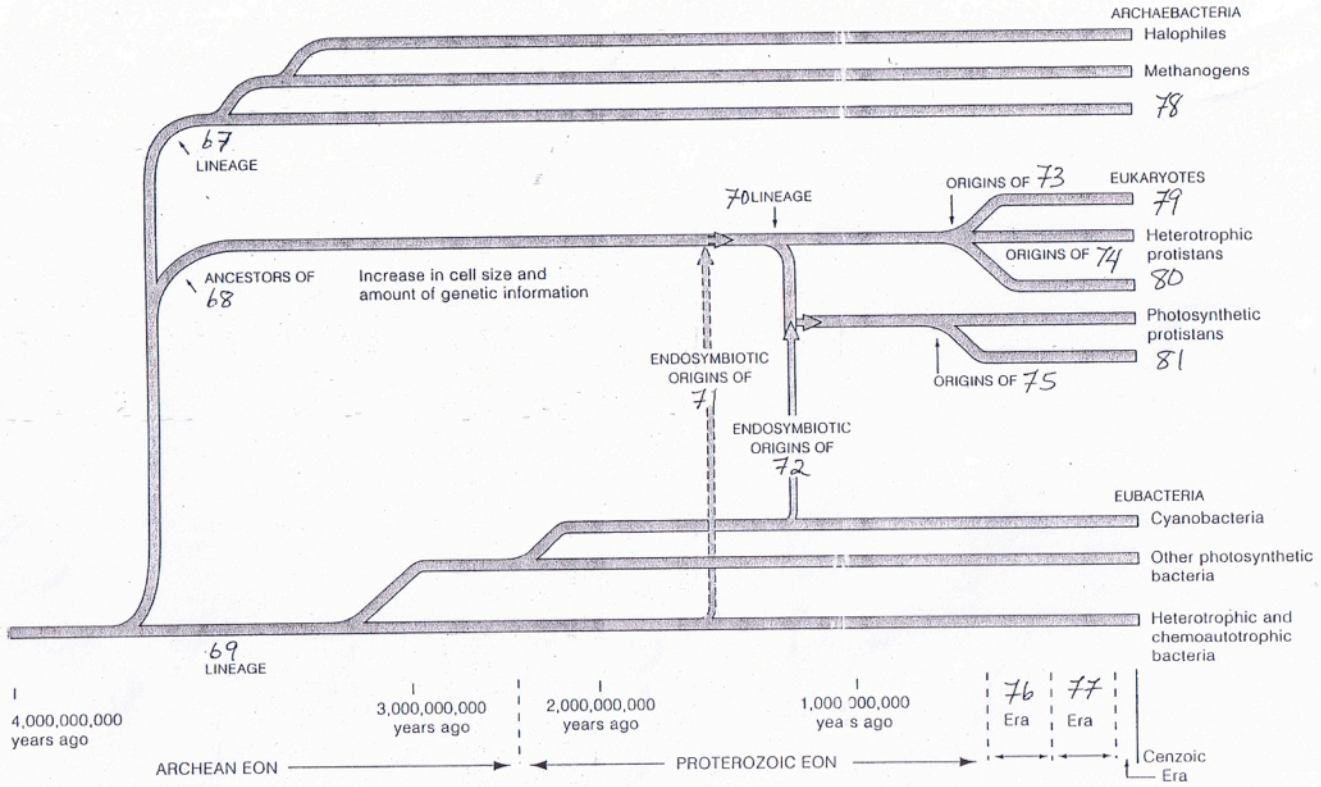
65 Based on the following phylogenetic tree showing the evolutionary relationships of five species (A – E) relative to five traits (1 – 5), fill in the table using 1 to indicate the presence of a derived trait, and 0 to indicate the presence of an ancestral trait.



SPECIES	TRAIT 1	2	3	4	5
A					
B					
C					
D					
E					

66. Question Omitted

The main focus of our study will be an attempt to understand the relationship of the five major kingdoms (monerans, plants, fungus, animals, protists). In addition, our understanding of evolution is intimately intertwined with the history of the earth.



For Questions 67-81 fill in the blanks. Choose from the following: Animals, Archaebacterial, Cenozoic, Chloroplasts, Eubacterial, Eukaryote, Eukaryotes, Fungi, Mesozoic, Mitochondria, Paleozoic, Plants