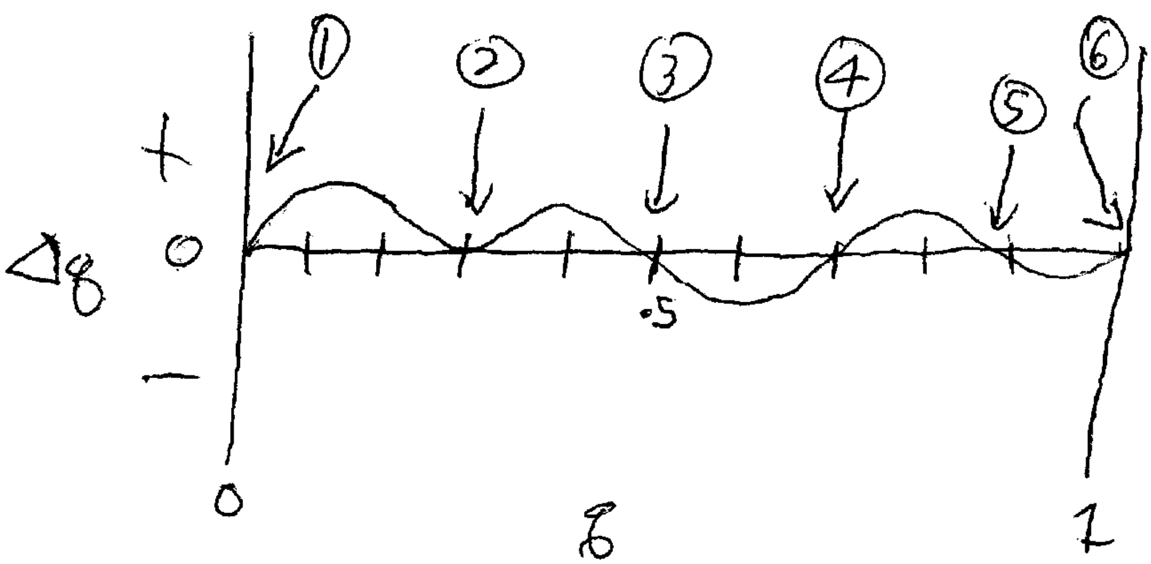
NAME: _______KEY____________________________ SCORE: _____100______/100

Notes:

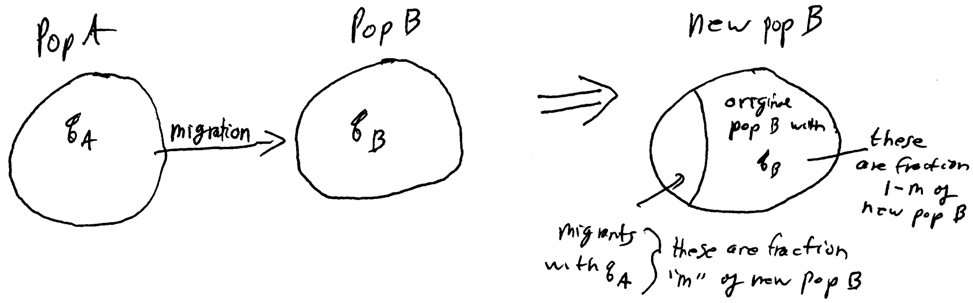
1. Make sure you have your name on the test.
2. Make sure you have the correct number of pages — check now!
3. Be sure to show ALL your work on problems — credit is given for correct steps in solving the problem. The correct answer without a clear showing of the derivation of the answer will receive 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.

1. (20) Interpret the following Δq graph, by filling out the chart for each indicated point:

Point #	Equilibrium? Yes (Y) or NO (N)	IF equilibrium, Trivial (T) or Interesting (I)?	IF equilibrium, Stable (S), Metastable (M) or Unstable (U)?	IF stable equilibrium, Globally stable (G) or Locally stable (L)?
1	Y	T	U	----
2	Y	I	M	----
3	Y	I	S	L
4	Y	I	U	----
5	Y	I	S	L
6	Y	T	U	---



2. (20) Using sketches of the process, derive the recurrence equation for migration.



Some of population A migrate into population B, forming new population B
In new population B, a proportion "m" come from population A, and a proportion "1-m" come from the old population B
The gene frequency of the A_2 allele in new population B is the weighted average of the gene frequencies of the A_2 allele in populations A and B, weighted by their proportions in new population B

q_A = frequency of A2 in population A
q_B = frequency of A2 in old population B

thus, q'_B, the frequency of the A_2 allele in new population B is $mq_A + (1-m)q_B$

<u>For each of the following 20 multiple-choice questions, place the letter of the most nearly correct answer in the space preceding the question. Each is worth 2 points.</u>

__a____ 3. (Ch. 2.2) A region of a DNA molecule that encodes a protein is called a(n): a. gene b. allele c. intron d. genotype e. phenotype

___b___ 4. (Ch. 2.4) When individuals of given genotypes mate together, their offspring appear: a. in all sorts of combinations, which nobody has ever been able to figure out b. in predictable ratios according to Mendelian laws c. at random d. always in a ¼:½:¼ ratio e. in various blends of the factors they received from their parents

___d___ 5. (Ch. 4.1) Over an individual's lifetime, he/she/it will generally produce how many offspring? a. fewer than needed to maintain the population b. just the right number to maintain the population c. between 4 and 40 d. more than can survive e. none of the preceding ___g___ 6. (Ch 4.4) Which of the following is **NOT** one of the major modes of selection: a. selective b. dispersive c. stabilizing d. disruptive e. normative f. all of the preceding g. more than one, but not all, of the preceding

___a___ 7. (Ch 5.1) In the absence of natural selection, mutation and migration, and with random mating in an infinite population, the allele frequencies for each locus will: a. after one generation be in the Hardy-Weinberg proportions and remain in those proportions b. need many generations to form the Hardy-Weinberg proportions, but, once in those proportions, will stay there c. approach the Hardy-Weinberg proportions ever more closely with each succeeding generation d. lose all linkage disequilibrium in one generation e. show reduced heritability

___f___8. (Ch. 5.10) Which of the following is an example of a polymorphism maintained in human populations by heterozygote advantage? a. cystic fibrosis b. polydactyly c. dwarfism d. red-green color blindness e. more than one of the preceding f. none of the preceding

___b___ 9. (Ch 6.5) In a finite small population, what will eventually happen to all loci? a. the allele frequencies will not change because of the Hardy-Weinberg law b. all loci will eventually become homozygous c. all loci will become permanently heterozygous due to the formation of balanced translocations d. either a or c e. none of the preceding

__c or a_ 10. (Ch 6.6) The amount of neutral genetic variability in a population will be a balance between: a. its loss by drift and its creation by migration b. its loss by selection and its creation by migration c. its loss by drift and its creation by mutation d. its loss by selection and its creation by mutation e. none of the preceding

___d___ 11. (Ch 7.1) The neutral theory of molecular evolution says that the frequencies of neutral alleles are due mostly to: a. selection b. migration c. mutation d. genetic drift e. non-random mating

____c__ 12. (Ch 7.6) The so-called 'molecular clock" is a result of: a. a variable rate of molecular evolution b. a variable rate of phenotypic evolution c. a constant rate of molecular evolution d. a constant rate of phenotypic evolution e. the development of neutral theory f. mutation in the third base of codons

___c___ 13. (Ch 9.1) The field of evolutionary study concerned with following the changes in phenotypic and genotypic frequency distributions among generations, rather than following the fate of individual genes is called: a. population genetics b. microevolution c. quantitative genetics d. additive genetics e. none of the preceding ___b___14. (Ch 9.2) If, for a trait, one adds up the variance due to genetic components and the variance due to environmental components, the sum equals the: a. heritability b. phenotypic variance c. mean trait value d. Y_p e. additive genetic effect

___b___ 15. (Ch 10.2) Repeated sequences of DNA are: a. sections of DNA which code for proteins b. noninformational c. lost in meiosis d. the sequences that produce adaptations at the organismal level e. a and d

b, e or f 16. (Ch 10.3) Gene duplication of protein-coding genes takes place by: a. mobile genetic elements b. unequal crossing-over c. normal crossing-over d. pleiotropy e. polyploidy f. b or d g. a or c

___d___ 17. (Ch 11.6) The coevolutionary race between hosts and parasites, and sib competition are two theories which at least partially explain why: a. males often have such bizarre secondary sexual characteristics b. there is usually a 50:50 sex ratio c. there is sexual dimorphism d. sexual recombination exists e. none of the preceding

___a___ 18. (Ch 11.8) The evolution of apparently deleterious secondary sex characteristics (such as the Peacock's tail) is explained by: a. such characteristics increasing their bearers' mating success b. pleiotropy c. the effects of genetic drift producing non-adaptive gene frequency change d. segregation distortion e. group selection

___e___ 19. (Ch 12.9) Adaptations are possessed by genes, tissues, organs, organisms and groups, only because at each of these levels at least some genetic changes can be passed on from generation to generation. Thus, adaptations are only shown by units of life that possess: a. reproductive ability b. mutability c. coadaptation d. homeostasis e. heritability f. linkage disequilibrium

___a___ 20. (Ch 12.11) At the most fundamental level, adaptations evolve because: a. they increase the replication of genes b. they are good for the organism c. natural selection works d. segregation distortion is rare e. there are many levels at which selection takes place

__g____ 21. (Ch 13.4) A character which evolved by natural selection either to perform its current function or which evolved by natural selection to originally perform a different function is a(n): a. analogy b. homology c. coadaptation d. clade e. cline f. either a or b g. none of the preceding

___e___ 22. (Ch. 13.8) The imperfections of living organisms may be due to: a. genetic constraints b. developmental constraints c. historical constraints d. trade-offs among competing demands e. all of the above f. a, c, and d only

23. (10 points) Describe the five major forces causing evolution. For each force, tell whether it is strong, weak, or dependent on condition(s). If dependent on condition(s), tell the condition(s) under which the force would have **greater** effect on changing gene frequencies. **Or fill out the following table.**

Force	**Strong, Weak or Dependent?**	**If dependent, condition(s) under which it would be stronger**
selection	strong	----------
migration	dependent	more migration or greater allele frequency differences
genetic drift	dependent	smaller population size
non-random mating	dependent	very non-random mating
mutation	weak	---------------

23. (10 points) Tell why (a)there are (usually) two sexes, (b)tell how the sexes differ, (c)explain how sex has a 50% disadvantage compared to asexual reproduction, and (d)why females are generally choosier about mating than are males. Also (e) include three criteria by which females might choose males. Use the back of the page if you need more room.

a. why 2 sexes: due to the advantages in producing either larger gametes or more gametes. There are rarely any other choices to gain an advantage.

b. how sexes differ: females produce fewer larger gametes, males produce more smaller gametes

c. sex a 50% disadvantage: each females produces two offspring, then dies:

Generation	Asexual Population	Sexual Population
1	100 females	100 females, 100 males
2	200 females	100 females, 100 males
3	400 females	100 females, 100 males

note that after 3 generations, the asexual population is at 400, the sexual at 200 total individuals

d. females choosier: fewer gametes produced, thus each is a higher proportion of lifetime reproductive effort, and each is more valuable to a female than a sperm is to a male.

e. criteria:

1. sexy son: females choose most "attractive" mates so their sons will also be attractive to females and thus have lots of grandoffspring
2. handicap: females choose males with large apparent handicap: such a male must be highly fit to survive even with such a big handicap.
3. females may chose the most healthy, unparasitized males, since those males carry genes which will produce healthy offspring