Name: _____ Date: _____ Period: _____

NATURAL SELECTION STUDY GUIDE

1. Describe each of the forms of evidence of evolution?

   - Fossil Record – the sequence in which fossils appear within layers of sedimentary rock
   - Biogeography - Organisms resemble organisms that live closer to them than organisms much more distant
   - Homologous Structures - Similarity in characteristics that result from common ancestry
   - Vestigial Structures - Remnants of features that served important functions in the organisms' ancestors.
   - Molecular Biology - Molecular history in the DNA sequences of organisms
   - Embryology – similarities in embryo development between different species.

2. Define *Artificial Selection – The selective breeding of domesticated plants and animals*

3. What are the three points of the theory of natural selection?
   - more offspring are born than can survive
   - natural resources are limited
   - Individuals of a population vary in their characteristics and those traits are passed on to their offspring

4. Darwin's theories were developed during a trip to what island? Galapagos Islands

5. Describe each of these evolutionary forces

   Gene Flow – Gain or loss of alleles from a population by the movement of individuals or gametes

   Genetic Drift – change in gene pool of a small population due to chance

   Non-random mating – Every male in population must have an equal chance of mating with every female in the population

   Natural selection – the process whereby organisms better adapted to their environment tend to survive and produce more offspring.

   Mutation – Random change in an organism's DNA that creates a new allele

6. Who does natural selection effect? <u>population</u>

7. Define *gene pool – all of the alleles present in a population*

8. Define *microevolution – relative frequencies of alleles in a population change over a number of generations*

9. What 5 conditions must be met for the Hardy-Weinberg Equilibrium to be true?

 - Large population
 - Isolated population
 - No mutations
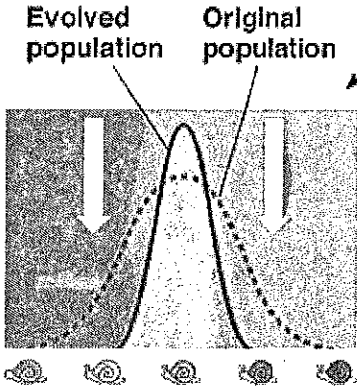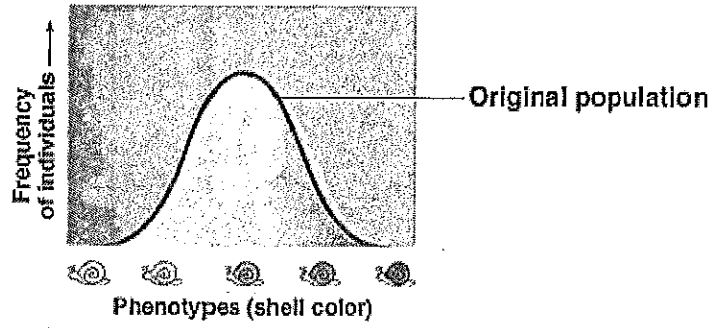 - No natural selection
 - Random mating

10. Define *fitness – contribution an individual makes to the gene pool of the next generation relative to the contribution of other individuals*

11. What type of inheritance produces variation?
 Genetic inheritance through sexual reproduction.

12. Define *bottleneck effect – genetic drift resulting from an event that drastically reduces population size*

13. Define *founder effect – colonization of a new location by a small number of individuals*

14. Describe the three modes of selection and draw the corresponding graph.

Frequency of individuals →

Original population

Phenotypes (shell color)

Evolved population   Original population

Stabilizing selection culls extreme variants from the population, in this case eliminating individuals that are unusually light or dark. The trend is toward reduced phenotypic variation and maintenance of the status quo.
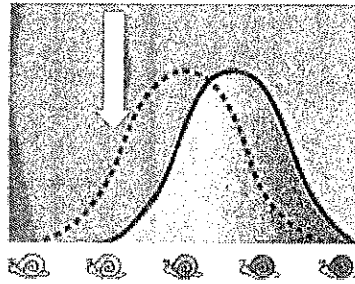
Directional selection shifts the overall makeup of the population by favoring variants of one extreme. In this case, the trend is toward darker color, perhaps because the landscape has been blackened by lava.
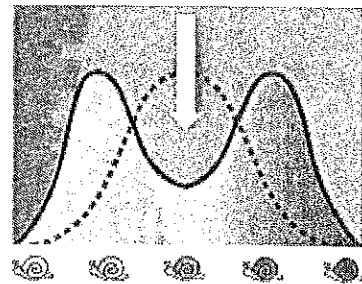
Diversifying selection favors variants of opposite extremes over intermediate individuals. Here, the relative frequencies of very light and very dark snails have increased. Perhaps the snails have colonized a patchy habitat where a background of white sand is studded with lava rocks.

15. Solve the following Hardy-Weinberg Problems

1. The dominant allele frequency is 0.7. What is the frequency of homozygous dominant, heterozygous, and homozygous recessive?

$p = 0.7$

$q = 0.3$

$p^2 = (0.7)^2 \rightarrow$ homozygous dom.

$p^2 = 0.49$

$q^2 = (0.3)^2 \rightarrow$ homozygous rec.

$q^2 = 0.09$

$2pq = 2(0.7)(0.3) \rightarrow$ heterozygous

$2pq = 0.42$

2. The recessive allele frequency is 0.1. What is the frequency of homozygous dominant, heterozygous, and homozygous recessive?

$q = 0.1$

$p = 0.9$

$p^2 = (0.9)^2$

$p^2 = 0.81$

$q^2 = (0.1)^2$

$q^2 = 0.01$

$2pq = 2(0.9)(0.1)$

$2pq = 0.18$

3. In a population of 1000 grasshoppers, 120 show the recessive trait. What are the dominant and recessive allele frequencies? How many of these organisms would be heterozygous?

$$q^2 = \frac{120}{1000}$$

$$\boxed{q^2 = 0.12}$$

$$q = \sqrt{0.12}$$

$$\boxed{q = 0.35}$$

$$1-p = q \quad \text{or} \quad 1-q = p$$

$$1-(0.35) = p$$

$$\boxed{0.65 = p}$$

$$p^2 = (p)^2$$

$$p^2 = (0.65)^2$$

$$\boxed{p^2 = 0.42}$$

$$2pq = 2(0.65)(0.35)$$

$$\boxed{2pq = 0.46}$$

4. In a population of 500 honeybees, 475 show the dominant trait. What are the dominant and recessive allele frequencies?

$$500 - 475 = 25 \text{ recessive individuals}$$

$$q^2 = \frac{25}{500}$$

$$\boxed{q^2 = 0.05}$$

$$q = \sqrt{q^2}$$

$$q = \sqrt{0.05}$$

$$\boxed{q = 0.22}$$

$$1-q = p$$

$$1-0.22 = p$$

$$\boxed{p = 0.78}$$

$$p^2 = (p)^2$$

$$\boxed{p^2 = 0.61}$$

$$2pq = 2(0.78)(0.22)$$

$$\boxed{2pq = 0.34}$$