10/10 Excellent!

Evolution is a change in allele frequency. For evolution to occur there must be mutations, or an alteration in the DNA to create variation. An example of evolution is the evolution of early humans, *Australopithecus afarensis,* from primate ancestors.

Fitness is an organism's genetic contribution to future generations. Organisms having a higher rates of reproductive success have a higher fitness in their genes; however, organisms with a low reproductive success have lower fitness in their genes. An example of fitness is the black moths, which had higher reproductive success in black sooted England, compared to white moths.

Mutations are an heritable change in the DNA that results in variation. Mutations can be beneficial and harmful, and occur in a variety of conditions. An example of a mutation is a sickle cell mutation that results in red blood cells having a sickle structure, making them carry less oxygen.

Natural Selection is the process by which organisms containing favorable heritable traits survive and go on to reproduce, thereby passing their genes. Natural selections explains how allele frequencies shift within large population, and explains how evolutionary change takes place. Natural selection explains that evolution is not "goal" oriented. An example of natural selection are Darwin's finches, which had different phenotype from island to island in the Galapagos Islands, due to differences in the environment in each island. The finches that were evolutionarily fit on a particular island, survived and reproduced, and thus passed on their genes.

Biological Species Concept defines species as a group of organisms that can interbreed and produce fertile offspring. An example of biological species concept is the fact that only humans can interbreed with each other and produce fertile offspring, thus only humans are *Homo sapiens.*

Additive alleles are alleles that influence the phenotype of an organism in a quantitative (summation) manner. Each additive allele has an approximately equal contribution, and the two alleles together make a single quantitative character, giving substantial phenotypic variation. In an experiment done by Hermann Nilsson-Ehle, it was shown that grain color in wheat had a additive allele, and as the amount of that additive allele increased so did the intensity of the red color in the F2 generation.

Heritability describes what proportion of total phenotypic variation in a population is due to genetic factors. A high heritability estimate means that much of the variation in a population is due to genetic factors rather than environmental factors. For example when people selectively breed plants and animals for certain traits they are relaying on heritability factors (genes) rather than environmental influence.

2. $S = 9.96 - 9.42 = 0.54$ mm

$h^2 = 0.82$

$R = h^2 S$

$R = (0.54)(0.82)$

$R = 0.4428$ mm

3. $h^2 = R/S$ = (mean offspring - mean population)/(mean parent - mean population)

$h^2 = (5.4 - 5.33)/(5.5 - 5.33)$

$h^2 = 0.07/0.17$

$h^2 = 0.411$

3a. $h^2 = 0.411$

$h^2 = R/S$ = (mean offspring - mean population)/(mean parent - mean population)

mean parent = 4.8 cm

0.411 = (mean offspring - 5.33)/(4.8-5.33)

mean offspring = 5.11 cm

3b. $h^2 = 0.411$

$h^2 = R/S$ = (mean offspring - mean population)/(mean parent - mean population)

mean offspring = 5.6 cm

0.411 = (5.6 - 5.33)/(mean parent - 5.33)

mean parent = 5.99 cm