Notes: Evolution

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CA State Standards we will cover:

7. The frequency of an allele in a gene pool of a population depends on many factors and may be stable or unstable over time. As a basis for understanding this concept:
   [ ] a. Students know why natural selection acts on the phenotype rather than the genotype of an organism.
   [ ] b. Students know why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool.
   [ ] c. Students know new mutations are constantly being generated in a gene pool.
   [ ] d. Students know variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.
   [ ] e. Students know the conditions for Hardy-Weinberg equilibrium in a population and why these conditions are not likely to appear in nature.
   [ ] f. *Students know how to solve the Hardy-Weinberg equation to predict the frequency of genotypes in a population, given the frequency of phenotypes.

8. Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept:
   [ ] a. Students know how natural selection determines the differential survival of groups of organisms.
   [ ] b. Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment.
   [ ] c. Students know the effects of genetic drift on the diversity of organisms in a population.
   [ ] d. Students know reproductive or geographic isolation affects speciation.
   [ ] e. Students know how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction.
   [ ] f. *Students know how to use comparative embryology, DNA or protein sequence comparisons, and other independent sources of data to create a branching diagram (cladogram) that shows probable evolutionary relationships.
   [ ] g. *Students know how several independent molecular clocks, calibrated against each other and combined with evidence from the fossil record, can help to estimate how long ago various groups of organisms diverged evolutionarily from one another.
10.2 Power Notes: Darwin’s Observations

1) Darwin observed variation among island species.
   (1) Variation is _____________________________________________
   (2) Examples
      (a) Galápagos tortoises that live in areas with __________ have __________;
         wet areas with __________ have __________________________
      (b) Galápagos finches that live in areas w/ __________ have __________;
         those that eat __________ have __________________________

2) Darwin realized species could adapt to their environment.
   (1) An adaptation is ________________________________
      (a) Adaptations can lead to ____________________________

3) Darwin observed fossil and geologic evidence of an ancient Earth.
   (1) Fossil evidence included:
      • Darwin found ________________________________
   (2) Geologic evidence included:
      • He saw that ________________________________

10.3 Power Notes: Theory of Natural Selection
Several key insights led to Darwin’s idea for natural selection.

• Artificial Selection is a process where ____________________________
  o Examples: ____________________________________________

• Heritability is ________________________________
• There is a struggle for survival due to ____________________________
• Natural Selection is a process in which ____________________________

The four main principles of natural selection are:
1) Variation: ____________________________
2) Overproduction: ____________________________
3) Adaptation: ____________________________
4) Descent with Modification: ____________________________

Fitness is the measure of ____________________________ and ____________________________
Natural selection can ____________________________

10.4 Power Notes: Evidence of Evolution
Main Idea: Evidence of common ancestry among species comes from many sources

Fossils
• They are ____________________________ of organisms that once lived
• They show evidence for evolution because ____________________________
  than those in the upper layers.

Geography
• ____________________________________________
  • Examples: The squirrels at the Grand Canyon (Abert vs. Kaibab)
Embryology
• ______________________________________________
• ______________________________________________

Anatomy
• Homologous structures are __________________________________________________
• Are also _____________________________________________________________
• Vestigial structures are ___________________________ that had a function in an early ancestor.
• Examples of vestigial structures: ___________________________________________

Analogous structures are not evidence of a recent common ancestor, but they show that the environment plays a role in putting pressure on organisms to adapt to the same conditions.

11.1 Power Notes: Genetic Variation within Populations
Genetic variation is beneficial.
• Genetic variation lead to _____________________________________________________.
• It __________________ the chance that some individuals will ______________________.

How it’s stored in a population
• Genetic variation is stored in a ________________________________________________.
  o ___________________________ in a population
  o Different allele combinations form when organisms have offspring

How it’s measured
• ______________________________ measure genetic variation.

Two Main Sources
• Mutation is a ______________________________________________________________
  o ____________________________
  o Can be passed on to offspring in reproductive cells
• Recombination forms _______________________________________________________
  o usually occurs during __________________
  o ________________
• Hybridization is ____________________________
  o Occurs when individuals can’t find a mate.

11.2 Power Notes: Natural Selection in Populations
Natural selection acts on distribution of traits
• A normal distribution graphs as a _____________________________________________
• A population follows a normal distribution when that population is ________________

Natural selection can change the distribution of a trait in 3 ways. This is called ______________. It is evolution within a population. There is an ______________.
11.3 Power Notes: Other Mechanisms of Evolution

Gene Flow
• Definition: ____________________________________________________________
• How it works: When animals ___________________________________________ and _________________________________.
• Lots of gene flow between populations ___________________________________
• Limited gene flow results in ____________________________________________

Genetic Drift
• Definition: ____________________________________________________________
• How it works: causes a loss of ________________________________ and is most common in _________________________________.
• Key Terms
  o Bottleneck Effect: ___________________________________________________
  o Founder Effect: _____________________________________________________
• Genetic drift has negative effects on a population.
  o _________________________________________________________________
  o _________________________________________________________________

Sexual Selection
• Definition: ____________________________________________________________
• How it works:
  o Sexual selection occurs due to higher cost of reproduction for females
  o Females ________________________________ with males that ________________________________
• Types
  o Intrasexual: _________________________________________________________
  o Intersexual: _________________________________________________________
11.5 Power Notes: Speciation through Isolation

- Populations become isolated when there is no gene flow.
  - Isolated populations ____________________________________________.
  - Genetic differences can add up over generations.
- **Reproductive isolation** can occur between isolated populations.
  - It is the final stage of speciation
    - **Speciation:** ________________________________________________
- Reproductive isolation can be caused by...
  1. **Behavioral behaviors:** includes differences in ____________________
  2. **Geographical barriers:** ______________________________________
  3. Temporal barriers: ____________________________________________

11.6 Power Notes: Patterns in Evolution

Evolution through natural selection is **not random** and can be seen in patterns

- **Convergent evolution** describes evolution toward ____________________
- **Divergent evolution** describes evolution toward ____________________

Species can shape each other over time.

- When two or more species _________________________, this is called ____________________.
  - Coevolution can occur in **beneficial relationships**.
    - _________________________ from the other as a result of _______________________
      that each species evolved over many generations
- Coevolution can occur in **competitive relationships**, sometimes called **evolutionary arms races**.
- **Both species respond to** _________________________ from the other through adaptations over many generations
- **Species can become extinct.**
  - Extinction is the _________________________.
    - Background extinctions _________________________
      - Usually _________________________ in a small area
      - caused by _________________________
    - Mass extinctions are _________________________
      - Thought to be caused by _________________________ like earthquakes, volcanic eruptions, etc.
- A pattern of **punctuated equilibrium** exists in the fossil record.
  - theory proposed by Eldredge and Gould in 1972
  - ____________________________________________
    - revised Darwin’s idea that species arose through **gradual transformations**
- **Many species evolve from one species during adaptive radiation.**
  - ____________________________________________
    - descendent species usually _________________________