Change Over Time

Big Ideas

Content

Certain factors lead to the development of new species and the extinction of other species.

Inquiry

Natural selection is the mechanism of evolution

Nature of Science

All living things change over time.

Enduring Outcomes

(What will students need to recall, know or do to demonstrate understanding of the Big Idea?

Include a connected set of Analytical, Creative & Practical Outcomes for this Big Idea
Students should be able to:

Analytical and Practical: Compare DNA of multiple organisms to determine relatedness.

Creative: Design a new species with specific traits and adaptations that enable it to live in a particular environment.

Analytical, Creative, Practical: Simulate how specific traits can help an organism survive or lead to extinction.

Include a connected set of Analytical, Creative & Practical Outcomes for this Big Idea
Students should be able to:

Practical: Connect the genetic make-up of an individual to a physical trait.

Analytical and Practical: Simulate natural selection to show how a species can change over time depending on it's adaptations and the environment in which it lives.

Analytical, Creative and Practical: Experiment with a model of how certain adaptations can be an advantage or disadvantage and relate the experience to real life examples.

Include a connected set of Analytical, Creative & Practical Outcomes for this Big Idea
Students should be able to:

Analytical: Compare fossil evidence in an area over time.

Practical: Use fossil evidence to infer what a past environment was like.

Creative and Practical: Predict human impact on extinction of a species and give real-life examples.

Certain factors lead to the development of new species and the extinction of other species.

Enduring Outcomes	Evidence	Tasks
Analytical and Practical: Compare DNA of multiple organisms to determine relatedness	Tell Tale Molecules Activity.	To look at a sequence of DNA from each of the following: Horse, Donkey, Rabbit, Snake, Turtle, and a Whale to help reveal evolutionary relationships.
Creative: Design a new species with specific traits and adaptations that enable it to live in a particular environment.	Designer Animal Activity	Students will be given four specific environments and will be required to design an animal that will fit into the environment they choose, meeting the needs of food, water, protection, shelter and caring for their young.
Analytical, Creative and Practical: Simulate how specific traits can help an organism survive or lead to extinction.	Bird Beak Buffet Activity	Student will use various “tools” to represent beaks. Multiple stations will exist and at each station a specific method for obtaining food will be described. Students will have a specified time to feed, record how much food was obtained, graph results and compile class results to complete an analysis.

Natural selection is the mechanism of evolution.

Enduring Outcomes	Evidence	Tasks
Practical: Connect the genetic make-up of an individual to a physical trait.	Data from Nature at Work Activity.	Students will choose two "mouse cards", all cards having a W or a w to represent the genes for fur color in mice. Student will identify WW as white, Ww as white and ww as brown in the data section.
Analytical and Practical: Simulate natural selection to show how a species can change over time depending on its adaptations and the environment in which it lives.	Nature at Work Activity	Predict how changing environmental conditions will affect natural selection in the model. Make a dynamic model of natural selection in mice.
Analytical, Creative and Practical: Experiment with a model of how certain adaptations can be an advantage or disadvantage and relate the experience to real life examples.	Pepper Moth Natural Selection Activity Woolly Booger Natural Selection	Student will participate in a model where two types of moths (newspaper moths and white paper moths) are hunted in a specific amount of time. Data will be collected and interpreted. In Woolly booger Natural Selection, students will use different tools to represent how Woollyboogers feed. With one food source, students will collect data to see which mouth type was most successful at feeding and which mouth type lead to starvation.

All living Things Change Over Time.

Enduring Outcomes	Evidence	Tasks
Analytical: Compare fossil evidence in an area over time.	Arrange 9 rock samples containing fossils in order from oldest to youngest according to their fossil content using the process of relative dating.	Dating the Fossil Record Activity.
Practical and Creative: Use fossil evidence to infer what a past environment was like.	Extinction and Fossils Group Project	Students will research and select an extinct organism from California's fossil record. They will research the environment in which it lived and will prepare a report for the possible causes of extinction.

Essential Questions

What Essential Question is arguable - and *important* to argue about?

Is it valuable to have differences among living things?

What Essential Question lies at the heart of the subject and helps provide purpose for learning?

Are natural selection and evolution synonymous?

What Essential Question raises more questions – provoking and sustaining engaged inquiry?

What impact do humans have on change over time?

What Essential Question raises important conceptual or philosophical issues?

When protecting an environment or species, are we interfering with natural selection?

Instructional Blueprint

Lesson Topics	**Content Standards**	**Measurable/Observable Learning Objectives** (What should students know, understand and/or be able to do?)	**Instructional Strategies/Tasks to Support Differentiation (Include a balance of *analytical*, *creative*, and *practical* activities)**	**Assessments that match objectives**
1. Pre-Test	3a, 3b, 3c, 3e, 4e,	Students will take a pre-test on the content standards taught in this unit to have a baseline to assess growth	Pre-test on major concepts taught in this unit (fossils, natural selection, Darwin's evidence, variation, etc…)	Actual test- to be used as a baseline to gauge understanding prior to the unit being taught.
2 Dating the Fossil Record	3c, 4e, 7c	1. Students will use various rock samples embedded with fossils to correctly sort and sequence the relative order of the layers. 2. Students will identify the relative ages of the fossils and hypothesize about the environment in which the	1. Students will arrange 9 rock samples containing fossils in order from oldest to youngest according to their fossil content using the process of relative dating. (groups of 2) 2. Students will use the correctly sequenced layers to determine relative age of fossils (Part 1) and will then form a timeline showing absolute ages (Part 2- given the dates of the samples).	1. Teacher check and okay correct order of rock layers. 2. Analysis questions, throughout the activity that students may work on together in their pairs.

		fossil lived.		
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3 **Types of Fossils**	3c, 4e	Students will review the different types of fossils and how they form and will simulate the creation of two types of fossils.	1. Content reading on types of fossils 2. Whole group notes on types of fossils 3. Lab activity creating both a cast and a mold.	Directed reading worksheets Check for understanding during notes and lab activity. Follow up lab questions. Journal question related to lab.
4 **Extinction and Fossils Group Project**	3a, 3c, 3e, 4e, 7b	1. Students will find examples of organism that lived in CA and that no longer exist. 2. Students will create a presentation to share their findings on where the fossil has been found, its characteristics, when it lived, the environment in which it lived, and a possible cause of extinction.	1. Students will be put into groups of five and will individually research an extinct organism whose fossils have been found in CA. 2. Students will meet with group to determine which ONE extinct organism they will research and present to the class. 3. Research tasks will be divided up, with one person taking each of 5 questions: where fossils have been found, when fossil lived, characteristics of organism, environment in which it lived, possible causes of extinction. 4. Decide how group will present findings and prepare written and visual parts to the presentation and present to class.	Built-in teacher checks on due dates for various parts (requiring initials) along the way Worksheet questions regarding planning, individual research and presenting. (written by individuals in the group) Group presentation/ rubric for grading.

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5 **Modeling a Gene Pool**	3a	To show, using a model, that a gene pool is all the genes in a population, not just the genes in an individual.	1. Students will be drawing two disks out of each of two bags and recording the gene pairs- either two red alleles, two black alleles, or one red and one black allele. 2. Students will compare the diversity of organisms produced by the gene pairs in each bag.	Follow Up Lab Question: Which "gene pool"- the first bag or the second bag- shows the most diversity?
6 **Tell Tale Molecules**	3a, 7b,	Students will use the amino acid sequence of a protein to determine evolutionary the evolutionary relationship of several animals. Students will draw conclusions about how close the species are related.	1. Students will examine the sequence of amino acids in on region of protein for six different animals (horse, donkey, rabbit, snake, turtle, and whale). 2. Students will compare the amino acid sequences, make observations and answer some analysis and conclusion questions.	Analysis and Conclusion Questions for Telltale Molecules (students can work together in partners to check their responses). Journal question the following day.
7 **Nature at Work**	3a, 3b, 3e, 7c, 7e	1. Predict how changing environmental conditions will affect the natural selection model. 2. Make a dynamic model of natural selection in mice.	1. Students will simulate natural selection in mice by choosing two mouse cards (each having an allele for the gene for fur color) and recording the color of the mouse they have. 2. They will then choose an event card (disease, predator that kills mice that contrast with environment, predator that kills mice of all color, or mouse survives) to	CFU before starting- How do you think variation of color in a species might affect natural selection? CFU during activity with individual lab groups to see that students assign the right phenotype (mouse color) to

			determine the fate of the mouse. 3. Mouse color and fate data is recorded. A mouse that dies leaves the population for the future generations. 4. Students will complete analysis questions with their partners for each step of the simulation, making attempts to apply to real life examples and to predict the outcome if this model extended beyond 3 generations.	each genotype (mouse cards drawn) Questions on worksheet to analyze data for Part 1 (White Sand environment) and then part 2 (Forest Floor Environment) Explain the point of this lab to Charles Darwin comparing the ways in which this model simulates natural selection and ways this model differs from natural selection.
8 **Bird Beak Buffet**	3a, 3b, 3e, 7c	Students will simulate how specific traits can help an organism survive or lead to extinction. Students will simulate how adaptation can increase the chance for survival of organisms.	1. Students will use various "tools" to represent beaks. 2. Multiple stations will exist and at each station a specific method for obtaining food will be described. 3. Students will have a specified time to "feed", then will record how much food was obtained, graph results and compile class results to complete an analysis.	Analysis questions for lab including questions about data obtained, the tool that was able to collect the most food, pictures of real birds with different beaks, and a question asking them to apply what they learned to a different example and predict the outcome.
9 **Designer Animal**	3a,	Students will design a new species with specific traits and adaptations that enable it to live in a particular environment.	1. Students will be given 4 specific environments and will be required to design an animal that will fit into the environment they choose, meeting the needs of food, water, protection, shelter and caring for their young.	Drawing of animal in its environment showing evidence of how the needs of food, water, shelter, protection and care of the young are addressed.
10 **How Do Living**	3a	Students will observe that the	1. Students will use a ruler to measure the	Informal teacher observation of

Things Vary?		seeds in their sample differ in size, shape, color, or number of stripes.	length and width of 10 sunflower seeds and will record each measurement. 2. Students will use a hand lens to carefully examine each seed, recording each seed's shape, color and number of stripes.	student's data. Individual written reflection on the ways the seeds in the sample are similar and different. Response to how seeds could be classified according to their similarities and differences.
11 **Evolution.**	3b, 3c, 7b, 7c	1. Students will describe the reasoning that led to Darwin's theory 2. Students will use a branching diagram of the to compare beak types, sizes and environments.	1. Content reading to describe the observations that Darwin made. 2. Explain how Darwin explained the differences between similar species, using examples. 3. Use the branching diagram of the 13 species of finches found on the Galapagos Islands to compare and contrast their beak types, the food they eat, and the environment in which each lives.	Directed reading worksheets. Notes on Evolution activity. Follow up questions from Branching Diagram of Finches Activity.
12. **Pepper Moth Natural Selection**	3a, 3e, 7b, 7c	1.Students will do a simulation and describe the importance of coloration in avoiding predation. 2. Students will relate environmental changes to change in organisms (Peppermoth in England between 1845-1890) 3. Students will explain how natural selection causes populations to change.	1. Students will participate in a simulation where two types of moths (newspaper moths and white paper moths) are hunted for a specific amount of time. There will be two different environments in this model. Data will be collected and interpreted.	Data table from simulation. Graph of real-life data and interpretation of graph. Analysis and conclusion questions related to simulation, real-life data, and a creative example of situation where this type of selection might occur.
13. **Woolly Booger Natural Selection**	3a, 3e, 7c	Students will model natural selection by using various	1. Students will use different tools to represent how Woollyboogers feed.	Class notes reviewing evolution, variation, mutation,

		utensils to capture food. * please note this is a different activity than Bird Beak Buffet because the food source does NOT change in this activity.	2. With only one food source, students will "feed" for a specified amount of time, record data, and compile data from their entire group. 3. Students will graph group data for each tool type. 3. Students will analyze group data and class data and relate the experiment to real-life examples.	and adaptation. Woollybooger data and analysis questions. Journal question the following day.

Attachments

California Content Standards, Science, Grade 7

Standard 3: Evolution

Biological evolution accounts for the diversity of species developed through gradual processes over many generations. As a basis for understanding this concept:

a. *Students know* both genetic variation and environmental factors are causes of evolution and diversity of organisms.

b. *Students know* the reasoning used by Charles Darwin in reaching his conclusion that natural selection is the mechanism of evolution.

c. *Students know* how independent lines of evidence from geology, fossils, and comparative anatomy provide the bases for the theory of evolution.

e. *Students know* that extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient for its survival.

Standard 4e: *Students know* fossils provide evidence of how life and environmental conditions have changed.

Standard 7: Investigation and Experimentation

b. Use a variety of print and electronic resources (including the World Wide Web) to collect information and evidence as part of a research project.

c. Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence.

d. Construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge (e.g., motion of Earth's plates and cell structure).

e. Communicate the steps and results from an investigation in written reports and oral presentations.

ASSESSMENT: EXTINCTION AND FOSSILS

What organisms that once lived in California are now extinct? What environmental factors may have caused their extinction? In this investigation, you will select an extinct organism from California's fossil record. Then you will research the environment in which it lived, and the causes for its extinction. At the end of your investigation, you will prepare a report on your findings. In addition, your group will make a presentation to the class.

Investigation Rules

* First, everyone in your group should do some research on the California fossil record. Identify some extinct organisms that once lived in your state. Use references such as books and World Wide Web resources. Web sites of California natural history museums and California fossil sites may be especially useful. Select some extinct organisms that interest you and about which a lot of information is available. Your group will meet with your teacher after you have read Section 1 to discuss your choice.

* After you decide which organism you will investigate, divide up the research tasks among group members. Make a list of group member responsibilities. If you find some information that would be useful to another member of the group, share it. Your group will meet with your teacher at the end of section 3 to review the progress of your investigations.

* Meet regularly with your group to discuss your findings. Questions from other group members can help to focus your investigation. When your investigation is complete, you should write a report that answers your assigned question. The report should include a complete list of the sources of your information.

* After group members finish their individual research, your group should decide how to organize the information for the presentation. Think about how much time you have for each part of the presentation.

* When you have organized your information for your presentation, you need to decide how you will display it to the class. Presentations can include pictures and models. Think about the way museums make displays and explain them to visitors. Discuss which tasks each member will do to prepare the presentation.

* After you have read Section 5, discuss your progress with your teacher. Let your teacher know if you need any special equipment. Practice your final presentation. Time it to see how it fits into the time your teacher set aside for you.

Investigation Timeline

Task	Due Date	Teacher's Initials
1. Choose some possible extinct organism for your investigation.	_____	_____
2. Meet with your group members and choose an organism to research.	_____	_____
3. Divide up the research tasks among the members of the group. Make a list of group member responsibilities.	_____	_____
4. Decide how your group will present your findings.	_____	_____
5. Prepare and label any illustrations you are going to use. Write any parts of your presentation that need to be written. Set up and practice your presentation.	_____	_____
6. Make your presentation to the class.	_____	_____

DOING THE RESEARCH

Worksheet 1

This worksheet will help you select an extinct organism and find out about it.

1. What are some extinct organisms that are found in the California fossil record? Find the names of at least five extinct California organisms.
   _____
_____

2. After you meet with your group members, choose the extinct organism that your group will investigate. Write its name here.
   _____
3. What resources are you using in your research about an extinct organism? List books and magazines and the URLs of any promising Web sites. Use a separate sheet of paper.
4. Do more research to find detailed information about the organism you have chosen. Assign group members to answer the following questions:
   a. Where in California have fossils of this organism been found? _____
      _____
   b. When did the organism live?_____
   c. Describe the characteristics of the organism in detail. _____
      _____

      _____
   d. What kind of environment did the organism probably live in? _____
      _____
   e. What might have caused the organism to become extinct? _____
      _____
      _____
5. What other important information might be included in your presentation? _____
_____

SETTING UP THE PRESENTATION

Worksheet 2

This worksheet will help you organize and prepare your presentation.

1. How will you present your findings to the class? Will you use a Power Point presentation, overhead projector poster, booklet, computer display, presentation board, or some other method? Discuss this with your teacher to make sure your plans are practical.

_____

2. What kind of visuals (drawings and photographs) do you plan to use? Will your presentation include other things, such as models and displays? Who will be responsible for preparing these items?

_____

ORGANIZE THE PRESENTATION

3. How will your group introduce the presentation? What do you want to tell your audience to get them interested? Write a short introduction.
   _____

_____

_____

4. What will be the order of your presentation? Who will deliver each part? _____

_____

_____

5. How will you wrap up your presentation? Write a brief conclusion.

_____

_____

6. How will you conduct the question-and-answer part of the presentation? Will there be a group leader? Or will group members jump in when they know the answer? _____

FINALIZING THE PRESENTATION

7. How much time will you allow for each part? _____

_____

EXTINCTION AND FOSSILS SCORING RUBRIC- (Attachment 3B)

	4	3	2	1
Doing Research/Preparing a Report. *	Student writes a thorough report that includes a clear, accurate answers his/her assigned question*: (where in CA fossil was found, when it lived, characteristics of organism, environment, or possible cause of extinction), and a complete source list with several varied sources.	Student writes a report that includes a mostly accurate answer to his/her assigned question *(where in CA fossil was found, when it lived, characteristics of organism, environment, possible cause of extinction), but something is missing in the answer, and a source list with several sources.	Student writes a report that includes an answer to his/her assigned question *(where in CA fossil was found, when it lived, characteristics of organism, environment, possible cause of extinction), but there is important information missing, and an incomplete source list.	Student writes a report that includes an inaccurate answer to his/her assigned question*, and no source list.
Developing/Using Visuals	Student develops attractive and relevant visuals (poster, media, pictures) that enhance and clarify the presentation.	Student develops relevant visuals (poster, media, pictures) that clarify the presentation.	Student develops visuals (poster, media, pictures) and uses them in the presentation.	Student does not develop or use visuals in the presentation, or the visuals are inaccurate.
Presenting the Investigation to the Class	Student makes a thorough and interesting presentation that includes a clear, accurate answer to the assigned question*.	Student makes a thorough presentation that includes a satisfactory answer to the assigned question*, but there is something missing.	Student makes a presentation that includes a partial answer to the assigned question*,and leaves out something important.	Student makes a presentation that includes an incomplete and/or inaccurate answer to the assigned question*.
Participating in the Group	Student takes a lead in planning, researching, developing, and making the presentation.	Student participates in all aspects of planning, researching, developing, and making the presentation.	Student participates in most aspects of planning, researching, developing, and making the presentation.	Student plays a minor role in planning, researching, developing, and making the presentation.

*** Each student in the group is assigned ONE of the questions that needs to be in the presentation and is responsible for writing a report for his/her question.**