Environmental Science Institute
Hot Science – Cool Talks
Outreach Lecture Series Volume 39

The Striking Behavior of Rattlesnakes
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K - 5th TEKS Suggestions

This file contains suggestions for incorporating material from this CD-ROM into K – 5 curricula using the Texas Essential Knowledge and Skills for Science.

§112.2. Science, Kindergarten.

(K.1) Scientific processes. The student participates in classroom and field investigations following home and school safety procedures. The student is expected to:
(A) demonstrate safe practices during classroom and field investigations;
How can you avoid being bitten by a snake? [Slide 46]
(B) learn how to use and conserve resources and materials.
How can I help save snakes from the bad practice of snake roundups? [Slide 49]

(K.2) Scientific processes. The student develops abilities necessary to do scientific inquiry in the field and the classroom. The student is expected to:
(A) ask questions about organisms, objects, and events;
Are all snakes poisonous? [Slide 4] How many poisonous snakes live in Texas? [Slide 5] How would I recognize a poisonous Texas snake? [Slide 5] How big do rattlesnakes get? [Slide 30] Why could there be snakes in my neighborhood? [Slide 10] What are rattlesnakes' rattles filled with? [Slide 17] How does a snake smell the air? [Slide 28]
(B) plan and conduct simple descriptive investigations
Use a field guide like the ones shown in [Slide 12] to try and find a green snake; a red, black, and yellow snake; a brown snake; and a black snake.
(C) gather information using simple equipment and tools to extend the senses;
Shake a rattle or some other device to mimic a rattlesnake's rattle. Ask the children how a snake moves its rattled tail [slide 19], what a rattle is made out of. [Slide 17], and how a rattle makes a sound.
(D) construct reasonable explanations using information;
Can you tell how old it is by the size of its rattle.[Slide 17] Explain why or why not.
(E) communicate findings about simple investigations.
Draw your favorite picture of a rattlesnake from the presentation (or color a pre-made picture of one) and share it with the class.

(K.3) Scientific processes. The student knows that information and critical thinking are used in making decisions. The student is expected to:
(A) make decisions using information
Should I use a stick to poke at a snake? [Slide 7]
(B) discuss and justify the merits of decisions
Why is it a good idea to hike outside in long pants and tennis shoes? [Slide 46]
(C) explain a problem in his/her own words and propose a solution.
There are a lot of mice in my neighborhood! Why do you think there are so many rodents here? [Slide 10]

(K.4) Scientific processes. The student uses age-appropriate tools and models to verify that organisms and objects and parts of organisms and objects can be observed, described, and measured. The student is expected to:
(A) identify and use senses as tools of observation
Can you close your eyes and hear the sound of a shaking rattle in the room? [Slide 17]
(B) make observations using tools including hand lenses, balances, cups, bowls, and computers.
If you wanted to get a closer look of snake scales or skin, what tool could you use to look at them?

(K.5) Science concepts. The student knows that organisms, objects, and events have properties and patterns. The student is expected to:
(A) describe properties of objects and characteristics of organisms
Do rattlesnakes have patterns down their body? Draw the patterns.
(B) observe and identify patterns including seasons, growth, and day and night and predict what happens next.
On [Slide 39] the picture on the left and the picture on the bottom right are the same snake. Which one of them do you think is only a week old? How big do you think the snake would be after one year?
(C) recognize and copy patterns seen in charts and graphs.
Draw and describe the graph in [Slide 6].

(K.6) Science concepts. The student knows that systems have parts and are composed of organisms and objects. The student is expected to:
(A) sort organisms and objects into groups according to their parts and describe how the groups are formed
How many types of poisonous snakes do we have in Texas? What are they? [Slide 5]
(C) record observations about parts of animals including wings, feet, heads, and tails
What is located on the end of a rattlesnake's tail? [Slide 18]. Do snakes have arms and legs? Do all snakes in these pictures look alike? How are they different?
(D) identify parts that, when separated from the whole, may result in the part or the whole not working, such as cars without wheels and plants without roots;
When the snake in [Slide 27]'s nose was blocked, could he tell which part of the maze was hotter?

(K.7) Science concepts. The student knows that many types of change occur. The student is expected to:
(A) observe, describe, and record changes in size, mass, color, position, quantity, time, temperature, sound, and movement
Can you move like a snake moves? What is the color difference between a coral snake and a copperhead [Slide 5]? How does a rattlesnake make a sound? [Slide 17] Which snake on this slide [Slide 39] is the smallest? Which is the 2nd biggest? Can a rattlesnake "see" heat? [Slide 20-27]
(B) identify that heat causes change, such as ice melting or the Sun warming the air and compare objects according to temperature
In the movie in [Slide 26], what colors are "cool" colors? What colors are "hot" colors?
(C) observe and record weather changes from day to day and over seasons;
In the desert, is it hotter or cooler in the rodent burrows in [Slide 26]?
(D) observe and record stages in the life cycle of organisms in their natural environment.
How many snakes do you see in [Slide 38]? Which one is the mommy? How do you know?
(K.8) Science concepts. The student knows the difference between living organisms and nonliving objects. The student is expected to:
(A) identify a particular organism or object as living or nonliving
Are snakes living organisms? Are the rocks they crawl around on alive?
(B) group organisms and objects as living or nonliving.
Name some other living and nonliving things.

(K.9) Science concepts. The student knows that living organisms have basic needs. The student is expected to:
(A) identify basic needs of living organisms
What do snakes like to eat? [Slide 29]
(B) give examples of how living organisms depend on each other;
What if there were no rodents? Would there be any snakes? Why or why not? [Slide 29]
(C) identify ways that the Earth can provide resources for life.
The presentation showed many different pictures of snakes in their homes. What kinds of places do snakes like to live in? (Desert [Slides 15, 32-33], in the mountains [Slide 16], under rocks [Slide 35], in neighborhoods! [Slide 10], etc.

§112.3. Science, Grade 1.
(1.1) Scientific processes. The student conducts classroom and field investigations following home and school safety procedures. The student is expected to:
(A) demonstrate safe practices during classroom and field investigations;
How can you avoid being bitten by a snake? [Slide 46]
(B) learn how to use and conserve resources and materials.

How can I help save snakes from the cruel practice of snake roundups? [Slide 49]

(1.2) Scientific processes. The student develops abilities necessary to do scientific inquiry in the field and the classroom. The student is expected to:
(A) ask questions about organisms, objects, and events;
How many species of snakes are in the world? Are all snakes poisonous? How many poisonous snakes live in Texas? [Slide 5] How would I recognize a poisonous Texas snake? [Slide 5] How big do rattlesnakes get? [Slide 30] Why could there be snakes in my neighborhood? [Slide 10] How does a snake smell the air? [Slide 28].
(B) plan and conduct simple descriptive investigations;
Use a field guide like the ones shown in [Slide 12] to try and find a green snake; a red, black, and yellow snake; a brown snake; a black snake. What are the common names of the snakes you found?
(C) gather information using simple equipment and tools to extend the senses;
Shake a rattle or some other device to mimic a rattlesnake's rattle. [Slide 17] Ask the children how a snake moves its rattled tail [slide 19] and what a rattle is made out of [Slide 17]. Can you move your hand like a rattlesnake moves its tail?
(D) construct reasonable explanations and draw conclusions;
Does a rattlesnake's rattle have beans in it? What causes the noise that you hear when a snake rattles its tail? [Slide 17]
(E) communicate explanations about investigations.
Draw your favorite picture of a rattlesnake from the presentation (or color a pre-made picture of one) and present your drawing to the class, telling us a little bit about the snake.

(1.3) Scientific processes. The student knows that information and critical thinking are used in making decisions. The student is expected to:
(A) make decisions using information;
Should I use a stick to poke at a snake? [Slide 46]
(B) discuss and justify the merits of decisions;
Why is it a good idea to hike outside in long pants and tennis shoes? [Slide 46]
(C) explain a problem in his/her own words and identify a task and solution related to the problem.
There are a lot of mice in my neighborhood! Why do you think there are so many rodents here? [Slide 10]
(1.4) Scientific processes. The student uses age-appropriate tools and models to verify that organisms and objects and parts of organisms and objects can be observed, described, and measured. The student is expected to:
(A) collect information using tools including hand lenses, clocks, computers, thermometers, and balances;
Look up a coral snake on the internet. What are the colors on its body? Let's weigh a shedded snakeskin on the balances; how many grams does it way? If you wanted to get a closer look of the snake skin, what tool could you use to look at them? (hand or magnifying lens) Using our thermometers, what temperature is the room, in degrees-Celcius?
(B) record and compare collected information;

Compare the temperatures: What is warmer, the inside or the outside (outdoors) of the classroom? Which weighs more in grams: the shed snake skin or an empty paper cup?
(C) measure organisms and objects and parts of organisms and objects, using nonstandard units such as paper clips, hands, and pencils.
How many paperclips does it take to equal the weight of the snakeskin?

(1.5) Science concepts. The student knows that organisms, objects, and events have properties and patterns. The student is expected to:
(A) sort objects and events based on properties and patterns;
Do rattlesnakes have patterns down their body? Draw the patterns.
(B) identify, predict, and create patterns including those seen in charts, graphs, and numbers.
How many colors do you see in [Slide 24]? Do you see a pattern in these colors? What do you think the different colors mean? Compare the colors you saw in [Slide 24] to the colors of the movie seen on [Slide 26]. Do the same colors show up in both slides? What does this mean?

(1.6) Science concepts. The student knows that systems have parts and are composed of organisms and objects. The student is expected to:
(A) sort organisms and objects according to their parts and characteristics;
How many types (groups) of poisonous snakes do we have in Texas? What are they? [Slide 5] How are the groups different?
(B) observe and describe the parts of plants and animals;
What is located on the end of a rattlesnake's tail? [Slide 18] Do snakes have arms and legs? Do all snakes in these pictures look alike? How are they different? What do rattlesnakes' heads look like? Describe where are a snake's heat pits located? [Slide 20]
(C) manipulate objects such as toys, vehicles, or construction sets so that the parts are separated from the whole which may result in the part or the whole not working;
When the snake in [Slide 27]'s heat pits were blocked, could he tell which part of the maze was hotter?
(D) identify parts that, when put together, can do things they cannot do by themselves, such as a working camera with film, a car moving with a motor, and an airplane flying with fuel.
If a rattle snake was born accidentally without heat pits, could it detect where its next meal may be hiding? [Slide 26]

(1.7) Science concepts. The student knows that many types of change occur. The student is expected to:
(A) observe, measure, and record changes in size, mass, color, position, quantity, sound, and movement;
Can you move like a snake moves? What is the color difference between a coral snake and a copperhead [Slide 5]? How does a rattlesnake make a sound? [Slide 17] Which snake in [Slide 38] probably weighs more on this slide? Can a rattlesnake "see" heat? [Slide 20] In the movie in [Slide 26], what differences do you see from start to finish in the landscape?
(B) identify and test ways that heat may cause change such as when ice melts;

How could you test if the desert in [Slide 26] gets hotter throughout the day? How can you test that the rodent burrows are cooler?
(C) observe and record changes in weather from day to day and over seasons;
In the desert, is it hotter or cooler in the rodent burrows in [Slide 26]?
(D) observe and record changes in the life cycle of organisms.
How many snakes do you see in [Slide 38]? Which one is the mommy? How do you know?
(1.8) Science concepts. The student distinguishes between living organisms and nonliving objects. The student is expected to:
(A) group living organisms and nonliving objects;
Are snakes living organisms? Are the rocks they crawl around on living or non-living? How do you know?
(B) compare living organisms and nonliving objects.
Compare some living organisms to nonliving things.

(1.9) Science concepts. The student knows that living organisms have basic needs. The student is expected to:
(A) identify characteristics of living organisms that allow their basic needs to be met;
What do snakes like to eat? [Slide 29] Where do snakes like to live? Do all animals need to eat? What do you like to eat? Do all animals need somewhere to live? Why?
(B) compare and give examples of the ways living organisms depend on each other for their basic needs.
Why is it good to have snakes around? (Hint: think about what they eat). How do the baby snakes depend on their mommy? [Slide 38]

§112.4. Science, Grade 2.
(2.1) Scientific processes. The student conducts classroom and field investigations following home and school safety procedures. The student is expected to:
(A) demonstrate safe practices during classroom and field investigations;
How can you avoid being bitten by a snake? [Slide 46]
(B) learn how to use and conserve resources and dispose of materials.
How can I help save snakes from the cruel practice of snake roundups? [Slide 49] Why is it important to save habitat like hardwood bottomland forests? [Slide 47]

(2.2) Scientific processes. The student develops abilities necessary to do scientific inquiry in the field and the classroom. The student is expected to:
(A) ask questions about organisms, objects, and events;
How many species of snakes are in the world? Are all snakes poisonous? How many poisonous snakes live in Texas? [Slide 5] How would I recognize a poisonous Texas snake? [Slide 5] How big do rattlesnakes get? [Slide 29] Why could there be snakes in my neighborhood? [Slide 10]
(B) plan and conduct simple descriptive investigations;

Use a field guide like the ones shown in [Slide 12] to try and find a green snake; a red, black, and yellow snake; a brown snake; a black snake. What are the common names of the snakes you found? Can you spell the common snake names?
(C) compare results of investigations with what students and scientists know about the world;
Scientists who study snakes are called herpetologists. Herpetologists think that snakes "taste the air" with their tongues. Do you agree with this? Have you ever seen a snake flick its tongue out? Why is it doing this?
(D) gather information using simple equipment and tools to extend the senses;
Shake a rattle or some other device to mimic a rattlesnake's rattle. [Slide 17] Ask the students how a snake moves its rattled tail [slide 19] and what a rattle is made out of [Slide 17]. Can you move your hand like a rattlesnake moves its tail?
(E) construct reasonable explanations and draw conclusions using information and prior knowledge;
Does a rattlesnake's rattle have beans in it? [Slide 17] What is a rattlesnake's rattle made of? Can you tell the age of a snake by looking at its rattles? [Slide 17]
(F) communicate explanations about investigations.
Draw your favorite picture of a rattlesnake from the presentation, present your drawing to the class, and tell us a little bit about the snake.

(2.3) Scientific processes. The student knows that information and critical thinking are used in making decisions. The student is expected to:
(A) make decisions using information;
Should I use a stick to poke or hit a snake? [Slide 7]
(B) discuss and justify the merits of decisions;
Why is it a good idea to hike outside in long pants and tennis shoes? [Slide 46]
Why are rattlesnake roundups a bad thing? [Slides 48-49]
(C) explain a problem in his/her own words and identify a task and solution related to the problem.
Why are snake roundups bad for the environment? (Think about rodent populations). What could you do to stop this practice of rattlesnake roundup? [Slide 49]
(2.4) Scientific processes. The student uses age-appropriate tools and models to verify that organisms and objects and parts of organisms and objects can be observed, described, and measured. The student is expected to:
(A) collect information using tools including rulers, meter sticks, measuring cups, clocks, hand lenses, computers, thermometers, and balances;
Look up a coral snake on the internet. What are the colors on its body? Is there a non-poisonous 'look-alike' to the coral snake? Let's weigh a shed snakeskin on the balances; how many grams does it way? If you wanted to get a closer look of the snake skin, what tool could you use to look at them? (Hand or magnifying lens) Using our thermometers, what temperature is the room, in degrees-Celcius? What temperature is it outside today?
(B) measure and compare organisms and objects and parts of organisms and objects, using standard and non-standard units.
Which weighs more in grams: the shedded snake skin or an empty paper cup? How many paperclips does it take to equal the weight of the snakeskin?

(2.5) Science concepts. The student knows that organisms, objects, and events have properties and patterns. The student is expected to:
(A) classify and sequence organisms, objects, and events based on properties and patterns;
Because snakes grow bigger with age (like we do!), do you think the snake that Dr. LaDuc is holding in [Slide 3] is a baby or an adult? If the color stripes of a snake are red-touching-yellow, then this means that this snake is venomous (this means poisonous). In [Slide 5], do you think the coral snake in the upper left picture is venomous? Why?
(B) identify, predict, replicate, and create patterns including those seen in charts, graphs, and numbers.
How many colors do you see in [Slide 24]? Do you see a pattern in these colors? What do you think the different colors mean? Compare the colors you saw in [Slide 24] to the colors of the movie seen on [Slide 26]. Do the same colors show up in both slides? What does this mean?

(2.6) Science concepts. The student knows that systems have parts and are composed of organisms and objects. The student is expected to:
(A) manipulate, predict, and identify parts that, when separated from the whole, may result in the part or the whole not working, such as flashlights without batteries and plants without leaves;
When the snake in [Slide 27]'s heat pits were blocked, could he tell which part of the maze was hotter? If a rattlesnake was born without heat pits, would he have a difficult time finding food? How do you know? [Slides 23-27]
(D) observe and record the functions of animal parts.
Identify the of the following snake parts, and tell me what it is used for: forked tongue [Slide 28], rattles on a rattlesnake [Slide 18], heat pits [Slide 20]
(2.7) Science concepts. The student knows that many types of change occur. The student is expected to:
(A) observe, measure, record, analyze, predict, and illustrate changes in size, mass, temperature, color, position, quantity, sound, and movement;
Can you move like a snake moves? What is the color difference between a coral snake and a copperhead [Slide 5]? How does a rattlesnake make a sound? [Slide 17] . Which snake on [Slide 38] is probably weighs the most? Can a rattlesnake "see" heat? [Slide 20] In the movie in [Slide 26], what differences do you see from start to finish in the landscape? What do the color changes tell you?
(B) identify, predict, and test uses of heat to cause change such as melting and evaporation;
How could you test if the desert in [Slide 26] getts hotter throughout the day? How can you test that the rodent burrows are cooler?
(C) demonstrate a change in the motion of an object by giving the object a push or a pull;
How does the snake's body change as it strikes the Pikachu doll in [Slide 44]?

(2.8) Science concepts. The student distinguishes between living organisms and nonliving objects. The student is expected to:
(A) identify characteristics of living organisms;

Are snakes living organisms? Are the rocks they crawl around on living or non-living? How do you know? How can you compare a snake to other living organisms?
(B) identify characteristics of nonliving objects.
Why would a rock be considered “non-living”?

(2.9) Science concepts. The student knows that living organisms have basic needs. The student is expected to:
(A) identify the external characteristics of different kinds of plants and animals that allow their needs to be met;
Why are heat pits important to rattlesnakes? [Slide 20] Why is venom important to poisonous snakes? [Slide 45] Why don’t snakes need arms and legs to move around? Why is it easier for snakes to travel underground?
(B) compare and give examples of the ways living organisms depend on each other and on their environments.
Why is it good to have snakes around? (Hint: think about what they eat). How do the baby snakes depend on their mommy? [Slide 38]

§112.5. Science, Grade 3.

(3.1) Scientific processes. The student conducts field and laboratory investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:
(A) demonstrate safe practices during field and laboratory investigations;
How can you avoid being bitten by a snake? [Slide 46]
(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.
How can I help save snakes from the cruel practice of snake roundups? [Slides 48-49] Why is it important to save habitat like hardwood bottomland forests? [Slide 47]

(3.2) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:
(A) plan and implement descriptive investigations including asking well-defined questions, formulating testable hypotheses, and selecting and using equipment and technology;
Form a hypothesis explaining why rattlesnakes in the desert would benefit having heat pits [Slides 20-27].
(B) collect information by observing and measuring;
Where could you find the information on rattlesnakes and heat pits? Where could you find information on a desert?
(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;
How could you link the information you found about snake pits and deserts and temperature?
(D) communicate valid conclusions;

Do you feel reasonably certain about your information? Can you explain it to the class?
(E) construct simple graphs, tables, maps, and charts to organize, examine and evaluate information.
Draw a flow chart explaining the benefits of rattlesnakes having heat pits and the temperature of rodent burrows in a hot desert.

(3.3) Scientific processes. The student knows that information, critical thinking, and scientific problem solving are used in making decisions. The student is expected to:
(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
The herpetologists (scientists who study reptiles and amphibians) hypothesized that rattlesnakes could make their heat pits more effective at higher temperatures by keeping their heads cooler at higher temperatures. [Slide 23-27]. Do you think the experiment of the maze in [Slide 27] supported this hypothesis? Why or why not?
(C) represent the natural world using models and identify their limitations;
The video on [Slide 26] shows a thermal image of a desert scene throughout the course of a day. Do you think this supports the cooler burrow hypothesis? Can you think of a better way to show that rodent burrows are cooler than the desert around them?
(D) evaluate the impact of research on scientific thought, society, and the environment;
Do you think studying reptiles such as rattlesnakes is a valid science? Why or Why not? Do you think rattlesnake roundups are a good idea? Why or why not? [Slides 48-49]
(E) connect Grade 3 science concepts with the history of science and contributions of scientists.
[Slide 13] shows an amateur herpetologist named Lawrence Klauber. Do you think he contributed to the study of rattlesnakes? How could you find out?

(3.4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:
(A) collect and analyze information using tools including calculators, microscopes, cameras, safety goggles, sound recorders, clocks, computers, thermometers, hand lenses, meter sticks, rulers, balances, magnets, and compasses;
If you were a herpetologist looking for snakes in the desert, which of the following tools would be useful to carry out with you to track snakes and their habitats: calculators, microscopes, cameras, safety goggles, sound recorders, clocks, computers, thermometers, hand lenses, meter sticks, rulers, balances, magnets, compasses?
(B) demonstrate that repeated investigations may increase the reliability of results.
Why was it important that more than one run in the heat pit maze experiment in [Slide 27] be performed? How many times do you think the scientists should run snakes through the maze to get more reliable results?

(3.7) Science concepts. The student knows that matter has physical properties. The student is expected to:
(A) gather information including temperature, magnetism, hardness, and mass using appropriate tools to identify physical properties of matter;
The desert can be a hot, dry place to live. Could you design an experiment to measure the temperature of a certain rodent burrow (snake food) throughout the course of 24 hours? Could you measure the amount of rainfall a desert receives in a year? How?

(3.8) Science concepts. The student knows that living organisms need food, water, light, air, a way to dispose of waste, and an environment in which to live. The student is expected to:
(A) observe and describe the habitats of organisms within an ecosystem;
Describe the habitat of the blacktail rattlesnake [Slides 32-34].
(B) observe and identify organisms with similar needs that compete with one another for resources such as oxygen, water, food, or space;
Why are the snakes fighting in [Slide 36]?
(C) describe environmental changes in which some organisms would thrive, become ill, or perish;
What could happen to snakes if people keep moving the suburbs into more rural places? [Slide 10 and Slide 47] Is this good for wildlife like snakes? What happens if rattlesnake roundups keep happening? [Slide 48] How could this change the rodent population?
(D) describe how living organisms modify their physical environment to meet their needs such as beavers building a dam or humans building a home.
What are different habitats that snakes can acquire to live in?

(3.9) Science concepts. The student knows that species have different adaptations that help them survive and reproduce in their environment. The student is expected to:
(A) observe and identify characteristics among species that allow each to survive and reproduce;
Define the following adaptations of rattlesnakes for survival and why they are important: Heat pits [Slides 20-27], forked tongue [Slide 28], poison glands with venom [Slide 45], rattle [Slide 18], quadrate bony jaw [Slide 29]
(B) analyze how adaptive characteristics help individuals within a species to survive and reproduce.
How would you conduct an experiment to prove that heat pits are a necessary adaptation for rattlesnakes and other vipers? [Slide 27]

(3.10) Science concepts. The student knows that many likenesses between offspring and parents are inherited from the parents. The student is expected to:
(B) identify some inherited traits of animals.
Compare the mother rattlesnake with her babies in [Slide 38]. What do the babies look like? Do they look like the mother? Why is this so? What kind of characteristics would you expect the baby rattlesnakes to have inherited?

§112.6. Science, Grade 4.

(4.1) Scientific processes. The student conducts field and laboratory investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:
(A) demonstrate safe practices during field and laboratory investigations;
How can you avoid being bitten by a snake? [Slide 45]
(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.
How can I help save snakes from the cruel practice of snake roundups? [Slides 48-49] Why is it important to save habitat like hardwood bottomland forests? [Slide 47]

(4.2) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:
(A) plan and implement descriptive investigations including asking well-defined questions, formulating testable hypotheses, and selecting and using equipment and technology;
Form a hypothesis explaining why rattlesnakes in the desert would benefit having heat pits. [Slide 20-27].
(B) collect information by observing and measuring;
Where could you find the information on rattlesnakes and heat pits? Where could you find information on a desert?
(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;
How could you link the information you found about snake pits and deserts and temperature?
(D) communicate valid conclusions;
Do you feel reasonably certain about your information? Can you explain it to the class?
(E) construct simple graphs, tables, maps, and charts to organize, examine, and evaluate information.
Draw a flow chart explaining the benefits of rattlesnakes having heat pits and the temperature of rodent burrows in a hot desert.

(4.3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
The herpetologists (scientists who study reptiles and amphibians) hypothesized that rattlesnakes could make their heat pits more effective at higher temperatures by keeping their heads cooler at higher temperatures. [Slides 24-27] Do you think the experiment of the maze in [Slide 27] supported this hypothesis? Why or why not?
(C) represent the natural world using models and identify their limitations;

The video on [Slide 26] shows a thermal image of a desert scene throughout the course of a day. Do you think this supports the cooler burrow hypothesis? Can you think of a better way to show that rodent burrows are cooler than the desert around them?
(D) evaluate the impact of research on scientific thought, society, and the environment;
Do you think studying reptiles such as rattlesnakes is a valid science? Why or Why not? Do you think rattlesnake roundups are a good idea? Why or why not? [Slides 48-49]
(E) connect Grade 4 science concepts with the history of science and contributions of scientists.
[Slide 13] shows an amateur herpetologist named Lawrence Klauber. Do you think he contributed to the study of rattlesnakes? How could you find out?

(4.4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:
(A) collect and analyze information using tools including calculators, safety goggles, microscopes, cameras, sound recorders, computers, hand lenses, rulers, thermometers, meter sticks, timing devices, balances, and compasses;
If you were a herpetologist looking for snakes in the desert, which of the following tools would be useful to carry out with you to track snakes and their habitats: Calculators, microscopes, cameras, safety goggles, sound recorders, clocks, computers, thermometers, hand lenses, meter sticks, rulers, balances, magnets, compasses? Describe how you would use these tools.
(B) demonstrate that repeated investigations may increase the reliability of results.
Why is it important that more than one run in the heat pit maze experiment in [Slide 27] be performed? How many times do you think the scientists should run snakes through the maze to get more reliable results?

(4.5) Science concepts. The student knows that complex systems may not work if some parts are removed. The student is expected to:
(A) identify and describe the roles of some organisms in living systems such as plants in a schoolyard, and parts in nonliving systems such as a light bulb in a circuit;
How are rattlesnakes ecologically connected to rodents like mice, rabbits, and rats?
(B) predict and draw conclusions about what happens when part of a system is removed.
What would happen to the local rodent population in central Texas if all the rattlesnakes were rounded up and killed?

(4.8) Science concepts. The student knows that adaptations may increase the survival of members of a species. The student is expected to:
(A) identify characteristics that allow members within a species to survive and reproduce;
Define the following adaptations of rattlesnakes for survival and why they are important: Heat pits [Slide 20], forked tongue [Slide 28], poison glands with venom [Slide 45], rattle [Slide 18], quadrate bony jaw. [Slide 29]

(B) compare adaptive characteristics of various species;
Do all snakes have heat pits? [Slide 20] Are all snakes poisonous? [Slide 4] Do all snakes have rattles? [Slide 18]
(C) identify the kinds of species that lived in the past and compare them to existing species.
How could you do research to see how snakes evolved without arms or legs from 4-limbed reptiles?

(4.9) Science concepts. The student knows that many likenesses between offspring and parents are inherited or learned. The student is expected to:
(A) distinguish between inherited traits and learned characteristics;
Are the patterns on a rattlesnake's body inherited or learned?
(B) identify and provide examples of inherited traits and learned characteristics.
Compare the mother rattlesnake with her babies in [Slide 38]. What do the babies look like? Do they look like the mother? Why is this so? What kind of characteristics would you expect the baby rattlesnakes to have inherited? Do you think the baby snakes need to be taught by their mother about how to hunt for food? Do you think the babies needed to learn to avoid cactus?

(4.10) Science concepts. The student knows that certain past events affect present and future events. The student is expected to:
(A) identify and observe effects of events that require time for changes to be noticeable including growth, erosion, dissolving, weathering, and flow; and
Can you tell how old a rattlesnake is from the size of its rattle? [Slide 17]
(B) draw conclusions about "what happened before" using fossils or charts and tables.
How could you determine that snakes actually evolved without limbs from earlier reptiles with limbs?

§112.7. Science, Grade 5.

(5.1) Scientific processes. The student conducts field and laboratory investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:
(A) demonstrate safe practices during field and laboratory investigations;
How can you avoid being bitten by a snake? [Slide 45]
(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.
How can I help save snakes from the cruel practice of snake roundups? [Slides 48-49] Why is it important to save habitat like hardwood bottomland forests? [Slide 47]
(5.2) Scientific processes. The student uses scientific methods during field and laboratory investigations. The student is expected to:

(A) plan and implement descriptive and simple experimental investigations including asking well-defined questions, formulating testable hypotheses, and selecting and using equipment and technology;
How could herpetologists get information about the life of a single rattlesnake in all of the Trans-Pecos Desert? [Slides 31-34]
(B) collect information by observing and measuring;
How could PIT tags be a helpful tool in tracking snakes?
(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;
If you had 10 years of information (data) on a single snake, what could you learn?
(D) communicate valid conclusions;
Present conclusions to the class
(E) construct simple graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate information.
Draw a graph of snake size (Y axis in meters) over time (X axis in years) to show how snakes grow over time.

(5.3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
The herpetologists (scientists who study reptiles and amphibians) hypothesized that rattlesnakes could make their heat pits more effective at higher temperatures by keeping their heads cooler at higher temperatures. [Slide 24-27]. Do you think the experiment of the maze in [Slide 27] supported this hypothesis? Why or why not?
(C) represent the natural world using models and identify their limitations;
The video on [Slide 26] shows a thermal image of a desert scene throughout the course of a day. Do you think this supports the cooler burrow hypothesis? Can you think of a better way to show that rodent burrows are cooler than the desert around them?
(D) evaluate the impact of research on scientific thought, society, and the environment;
Do you think studying reptiles such as rattlesnakes is a valid science? Why or Why not? Do you think rattlesnake roundups are a good idea? Why or why not? [Slides 48-49]
(E) connect Grade 5 science concepts with the history of science and contributions of scientists.
[Slide 13] shows an amateur herpetologist named Lawrence Klauber. Do you think he contributed to the study of rattlesnakes? How could you find out?

(5.4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:
(A) collect and analyze information using tools including calculators, microscopes, cameras, sound recorders, computers, hand lenses, rulers, thermometers, compasses, balances, hot plates, meter sticks, timing devices, magnets, collecting nets, and safety goggles;

If you were a herpetologist looking for snakes in the desert, which of the following tools would be useful to carry out with you to track snakes and their habitats: calculators, microscopes, cameras, collecting nets, timing devices, hot plates, safety goggles, sound recorders, clocks, computers, thermometers, hand lenses, meter sticks, rulers, balances, magnets, compasses? Why would the items that you chose be helpful in the field?
(B) demonstrate that repeated investigations may increase the reliability of results.
Why was it important that more than one run in the heat pit maze experiment in [Slide 27] be performed? How many times do you think the scientists should run snakes through the maze to get more reliable results?

(5.5) Science concepts. The student knows that a system is a collection of cycles, structures, and processes that interact. The student is expected to:
(B) describe some interactions that occur in a simple system.
How are rattlesnakes ecologically connected to rodents like mice, rabbits, and rats?

(5.6) Science concepts. The student knows that some change occurs in cycles. The student is expected to:
(C) describe and compare life cycles of plants and animals.
You can do some simple investigative research to find out the average lifespan of a diamondback rattlesnake. Can you find the average lifespan of the desert rodents it likes to eat?

(5.8) Science concepts. The student knows that energy occurs in many forms. The student is expected to:
(B) identify and demonstrate everyday examples of how light is reflected, such as from tinted windows, and refracted, such as in cameras, telescopes, and eyeglasses;
How can high-speed video footage be used to film a rattlesnake rattle its tail? [Slide 19] How can this be used for scientific research? How can thermal imaging cameras be useful in studying the heat pits and prey items of vipers and rattlesnakes? [Slides 23-26]
(D) verify that vibrating an object can produce sound.
The noise we hear as a rattlesnake rattles its tail is caused by the combination of all the rattle segments contacting with each other at high rate [Slide 17]. What kind of camera could we use to test this statement? [Slide 19]

(5.9) Science concepts. The student knows that adaptations may increase the survival of members of a species. The student is expected to:
(A) compare the adaptive characteristics of species that improve their ability to survive and reproduce in an ecosystem;
Define the following adaptations of rattlesnakes for survival and why they are important: Heat pits [Slide 20], forked tongue [Slide 28], poison glands with venom [Slide 45], rattle [Slide 18], quadrate bony jaw [Slide 29] What kind of snakes have heat pits, rattles, and venom?
(B) analyze and describe adaptive characteristics that result in an organism's unique niche in an ecosystem; and

How is scaly skin important to snakes in a desert habitat? How are not having appendages like arms and legs beneficial to a burrowing animal like a snake? How are not having appendages beneficial to a tree-climbing animal like a snake?
(C) predict some adaptive characteristics required for survival and reproduction by an organism in an ecosystem.
How are heat pits in a rattlesnake a necessary adaptation for living in an extreme desert? [Slide 23-27] How is a rattle a necessary adaptation for warding off potential predators? [Slide18]

(5.10) Science concepts. The student knows that likenesses between offspring and parents can be inherited or learned. The student is expected to:
(A) identify traits that are inherited from parent to offspring in plants and animals;
Compare the mother rattlesnake with her babies in [Slide 38]. What do the babies look like? Do they look like the mother? Why is this so? What kind of characteristics would you expect the baby rattlesnakes to have inherited?
(B) give examples of learned characteristics that result from the influence of the environment.
Do you think the baby snakes need to learn to avoid cactus?

Environmental Science Institute
Hot Science – Cool Talks
Outreach Lecture Series Volume 39

The Striking Behavior of Rattlesnakes
Dr. Travis J. LaDuc

6th - 8th TEKS Suggestions

This file contains suggestions for incorporating material from this CD-ROM into 6th – 8th grade curricula using the Texas Essential Knowledge and Skills for Science.

§112.22. Science, Grade 6.

(6.1) Scientific processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
(A) demonstrate safe practices during field and laboratory investigations;
How can you avoid being bitten by a snake? [Slide 46]
(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.
How can I help save snakes from the cruel practice of snake roundups? [Slide 49] Why is it important to save habitat like hardwood bottomland forests? [Slide 47]

(6.2) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:
(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology;
How could herpetologists get information about the life of a rattlesnake in the Trans-Pecos Desert? [Slides 31-34]
(B) collect data by observing and measuring;
How could PIT tags be useful tools in tracking snakes? [Slide 31]
(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;
If you had 10 years of information (data) on a single snake, what could you learn? (How it moves around and uses its habitat, grows, has families, etc).
(D) communicate valid conclusions; and
Present conclusions to the class.
(E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data.

Draw a graph of snake size (Y axis in meters) over time (X axis in years) to show how snakes grow over time.

(6.3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
The herpetologists (scientists who study reptiles and amphibians) hypothesized that rattlesnakes could make their heat pits more effective at higher temperatures by keeping their heads cooler at higher temperatures. [Slide 24-27]. Do you think the experiment of the maze in [Slide 27] supported this hypothesis?
(B) draw inferences based on data related to promotional materials for products and services;
What do you think scientists at the Texas Herpetological Society talk about? [Slide 51]
(C) represent the natural world using models and identify their limitations;
The video on [Slide 26] shows a thermal image of a desert scene throughout the course of a day. Do you think this supports the cooler burrow hypothesis? Can you think of a better way to show that rodent burrows are cooler than the desert around them?
(D) evaluate the impact of research on scientific thought, society, and the environment; and
Do you think studying reptiles such as rattlesnakes is a valid science? Why or Why not? Do you think rattlesnake roundups are socially and environmentally acceptable? Why or why not? [Slides 48-49]
(E) connect Grade 6 science concepts with the history of science and contributions of scientists.
[Slide 13] shows an amateur herpetologist named Lawrence Klauber. Do you think he contributed to the study of rattlesnakes? How could you find out?

(6.4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:
(A) collect, analyze, and record information using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, timing devices, hot plates, test tubes, safety goggles, spring scales, magnets, balances, microscopes, telescopes, thermometers, calculators, field equipment, compasses, computers, and computer probes;
If you were a herpetologist looking for a blacktail rattlesnake (*Crotalus molossus nigrescens)* in the desert, which of the following tools would be useful to carry out with you to track snakes and their habitats: beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, timing devices, hot plates, test tubes, safety goggles, spring scales, magnets, balances, microscopes, telescopes, thermometers, calculators, compasses, computers, and computer probes? Why would the items that you chose be helpful in the field? Compose a detailed list of how you would use your chosen items to track snakes in the desert.

(B) identify patterns in collected information using percent, average, range, and frequency.
How could you find information regarding the geographic range distribution of timber rattlesnakes? What is the average length of a rattlesnake? [Slide 30] What is the average strike speed of a rattlesnake? [Slide 41] How many people in the United States died from snakebites in 2002? [Slide 6] Is this more or less than the number of people who died from a car accident? [Slide 6] What percentage of snakebite victims are women? [Slide 7]

(6.5) Scientific concepts. The student knows that systems may combine with other systems to form a larger system. The student is expected to:
(A) identify and describe a system that results from the combination of two or more systems such as in the solar system;
There are 11 venomous species of snakes in Texas. These can be divided into what 4 major groups? [Slide 5]

(6.6) Science concepts. The student knows that there is a relationship between force and motion. The student is expected to:
(A) identify and describe the changes in position, direction of motion, and speed of an object when acted upon by force;
According to the experiment in [Slide 40-42], would smaller snakes strike at faster accelerations because they had les mass to move, or would larger snakes strike more quickly because they had more muscle mass to put behind a predatory strike?
(B) demonstrate that changes in motion can be measured and graphically represented; and
Graph a speed (y-axis) over time (x-axis) equation of a snake striking its prey. [Slide 42]

(6.7) Science concepts. The student knows that substances have physical and chemical properties. The student is expected to:
(B) classify substances by their physical and chemical properties.
Name the two main types of venom and what physiological systems are affected by them. [Slide 45]

(6.8) Science concepts. The student knows that complex interactions occur between matter and energy. The student is expected to:
(C) describe energy flow in living systems including food chains and food webs.
Draw a simple food chain including producers, herbivores, carnivores (snake), other carnivores (snake eaters) and decomposers. Expand your food chain to include more organisms linked in a food web.

(6.10) Science concepts. The student knows the relationship between structure and function in living systems. The student is expected to:
(A) differentiate between structure and function;
Name 3 anatomical structures on a rattlesnake and list the functions of each [ideas include: rattles, heat pits, tongue, poison glands, fangs, etc]
(B) determine that all organisms are composed of cells that carry on functions to sustain life;

Diagram and label the inside of a heat pit [Slide 22]

(6.11) Science concepts. The student knows that traits of species can change through generations and that the instructions for traits are contained in the genetic material of the organisms. The student is expected to:
(A) identify some changes in traits that can occur over several generations through natural occurrence and selective breeding;
What are the hypotheses for the origin of the rattles? [Slide 18]
Research the idea that, over time, snakes have lost their need for arms and legs. How would you support your findings?

(6.12) Science concepts. The student knows that the responses of organisms are caused by internal or external stimuli. The student is expected to:
(A) identify responses in organisms to internal stimuli such as hunger or thirst;
According to the experiment on [Slide 24] how does a rattlesnake's internal head temperature differ from its surrounding external environment?
(B) identify responses in organisms to external stimuli such as the presence or absence of heat or light;
How does a snake's head-body temperature change when the snake is threatened? [Slide 25] Why is this a useful response? [Slide 24]
(C) identify components of an ecosystem to which organisms may respond.
How do rattlesnakes "see" the thermal landscape when comparing desert land to rodent burrows? [Slide 26] How did the western diamondback rattlesnake respond to the Pikachu doll in [Slide 44]? What did this tell us about predatory vs. defensive strikes?

§112.23. Science, Grade 7.

(7.1) Scientific processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
(A) demonstrate safe practices during field and laboratory investigations;
How can you avoid being bitten by a snake? [Slide 46]
(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.
How can I help save snakes from the cruel practice of snake roundups? [Slide 49] Why is it important to save habitat like hardwood bottomland forests? [Slide 47]

(7.2) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:
(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology;

How could herpetologists get information about the life of a rattlesnake in the Trans-Pecos Desert? [Slides 31-34]

(B) collect data by observing and measuring;

How could PIT tags be useful tools in tracking snakes? [Slide 31]

(C) organize, analyze, make inferences, and predict trends from direct and indirect evidence;

If you had 10 years of information (data) on a single snake, what could you learn? (How it moves around and uses its habitat, grows, has families, etc). Could you map out growth trends over time? Could you map out habitat loss over time? How?

(D) communicate valid conclusions;

Present conclusions to the class

(E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data.

Draw a graph of snake size (Y axis in meters) over time (X axis in years) to show how snakes grow over time. Map the research site. Show a visual display of snake distribution compared with habitat loss. How would you visually display this information?

(7.3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

The herpetologists hypothesized that rattlesnakes could make their heat pits more effective at higher temperatures by keeping their heads cooler at higher temperatures. [Slides 24-27] Do you think the experiment of the maze in [Slide 27] supported this hypothesis? Why or why not?

(B) draw inferences based on data related to promotional materials for products and services;

What do you think scientists at the Texas Herpetological Society discuss? Do you think they talk about environmental concerns? What do you think is the biggest concern with rattlesnake populations today?

(C) represent the natural world using models and identify their limitations;

The video on [Slide 26] shows a thermal image of a desert scene throughout the course of a day. Do you think this supports the cooler burrow hypothesis? Can you think of a better way to show that rodent burrows are cooler than the desert around them?

(D) evaluate the impact of research on scientific thought, society, and the environment;

Do you think studying reptiles such as rattlesnakes is a valid science? Why or Why not? Do you think rattlesnake roundups are socially and environmentally acceptable? Why or why not? [Slides 48-49] If you were a wildlife conservationist, what would you do to save the rattlesnakes from habitat loss and roundups?

(F) connect Grade 7 science concepts with the history of science and contributions of scientists.

[Slide 13] shows an amateur herpetologist named Lawrence Klauber. Do you think he contributed to the study of rattlesnakes? How could you find out?

(7.4) Scientific processes. The student knows how to use tools and methods to conduct science inquiry. The student is expected to:
(A) collect, analyze, and record information to explain a phenomenon using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, balances, microscopes, telescopes, thermometers, calculators, field equipment, computers, computer probes, timing devices, magnets, and compasses;
If you were a herpetologist looking for a blacktail rattlesnake (*Crotalus molossus nigrescens)* in the desert, which of the following tools would be useful to carry out with you to track snakes and their habitats: beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, magnets, balances, microscopes, telescopes, thermometers, calculators, compasses, timing devices, computers, and computer probes? Why would the items that you chose be helpful in the field? Compose a detailed list of how you would use your chosen items to track snakes in the desert.
(B) collect and analyze information to recognize patterns such as rates of change.
How could you find information regarding the geographic range distribution of timber rattlesnakes? What is the average length of a rattlesnake? [Slide 30] What is the average strike speed of a rattlesnake? [Slide 41] How many people in the United States died from snakebites in 2002? [Slide 6] Is this more or less than the number of people who died from a car accident? [Slide 6] What percentage of snakebite victims are women? [Slide 7]

(7.5) Science concepts. The student knows that an equilibrium of a system may change. The student is expected to:
(B) observe and describe the role of ecological succession in maintaining an equilibrium in an ecosystem.
Would the removal of snakes cause a disruption in the equilibrium of an ecosystem? How?
(7.6) Science concepts. The student knows that there is a relationship between force and motion. The student is expected to:
(C) relate forces to basic processes in living organisms including the flow of blood and the emergence of seedlings.
Explain 'respiratory cooling' as a physiological process that rattlesnakes use. [Slide 25]

(7.8) Science concepts. The student knows that complex interactions occur between matter and energy. The student is expected to:
(A) illustrate examples of potential and kinetic energy in everyday life such as objects at rest, movement of geologic faults, and falling water;
Describe the kinetic motion as a rattlesnake rattles its tail [Slide 19]. Describe the kinetic motion as a rattlesnake exhibit a predatory strike [Slide 41].

(7.9) Science concepts. The student knows the relationship between structure and function in living systems. The student is expected to:
(B) describe how organisms maintain stable internal conditions while living in changing external environments.
Research how exothermic animals like reptiles maintain their internal homeostasis, using environmental processes.

(7.10) Science concepts. The student knows that species can change through generations and that the instructions for traits are contained in the genetic material of the organisms. The student is expected to:
(B) compare traits of organisms of different species that enhance their survival and reproduction;
Name 3 anatomical structures on a rattlesnake and list the functions of each [ideas include: rattles, heat pits, tongue, poison glands, fangs, etc]. How does each of these traits enhance a rattlesnake's survival?

(7.11) Science concepts. The student knows that the responses of organisms are caused by internal or external stimuli. The student is expected to:
(B) identify responses in organisms to external stimuli found in the environment such as the presence or absence of light.
According to the experiment on [Slide 24], how does a rattlesnake's internal head temperature differ from its surrounding external environment? How does this benefit life in the hot desert? [Slide 26]

(7.12) Science concepts. The student knows that there is a relationship between organisms and the environment. The student is expected to:
(A) identify components of an ecosystem;
Draw a simple food chain including producers, herbivores, carnivores (snake), other carnivores (snake eaters) and decomposers. Expand your food chain to include more organisms linked in a food web.
(C) describe how different environments support different varieties of organisms;
Why do snakes live in a wide variety of habitats throughout the world? (Think of food availability and competition).

§112.24. Science, Grade 8.

(8.1) Scientific processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
(A) demonstrate safe practices during field and laboratory investigations;
How can you avoid being bitten by a snake? [Slide 46]
(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.
How can I help save snakes from the cruel practice of snake roundups? [Slide 49] Why is it important to save habitat like hardwood bottomland forests? [Slide 47]

(8.2) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:
(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology;
How could herpetologists get information about the life of a rattlesnake in the Trans-Pecos Desert? [Slides 31-34]
(B) collect data by observing and measuring;
How could PIT tags be useful tools in tracking snakes? [Slide 31]
(C) organize, analyze, evaluate, make inferences, and predict trends from direct and indirect evidence;
If you had 10 years of information (data) on a single snake, what could you learn? (How it moves around and uses its habitat, grows, has families, etc). Could you map out growth trends over time? Could you map out habitat loss over time? How?
(D) communicate valid conclusions;
Present conclusions to the class
(E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data.
Draw a graph of snake size (Y axis in meters) over time (X axis in years) to show how snakes grow over time. Map the research site. Show a visual display of snake distribution compared with habitat loss. How would you visually display this information?

(8.3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
The herpetologists hypothesized that rattlesnakes could make their heat pits more effective at higher temperatures by keeping their heads cooler at higher temperatures. [Slides 24-27] Do you think the experiment of the maze in [Slide 27] supported this hypothesis? Why or why not?
(B) draw inferences based on data related to promotional materials for products and services;
What do you think scientists at the Texas Herpetological Society discuss? Do you think they talk about environmental concerns? What do you think is the biggest concern with rattlesnake populations today?
(C) represent the natural world using models and identify their limitations;
The video on [Slide 26] shows a thermal image of a desert scene throughout the course of a day. Do you think this supports the cooler burrow hypothesis? Can you think of a better way to show that rodent burrows are cooler than the desert around them?
(D) evaluate the impact of research on scientific thought, society, and the environment;
Do you think studying reptiles such as rattlesnakes is a valid science? Why or Why not? Do you think rattlesnake roundups are socially and environmentally acceptable? Why or why not? [Slides 48-49] If you were a wildlife

conservationist, what would you do to save the rattlesnakes from habitat loss and roundups?

(E) connect Grade 8 science concepts with the history of science and contributions of scientists.

[Slide 13] shows an amateur herpetologist named Lawrence Klauber. Do you think he contributed to the study of rattlesnakes? How could you find out?

(8.4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:

(A) collect, record, and analyze information using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, balances, microscopes, telescopes, thermometers, calculators, field equipment, computers, computer probes, water test kits, and timing devices; and

If you were a herpetologist looking for a blacktail rattlesnake (*Crotalus molossus nigrescens)* in the desert, which of the following tools would be useful to carry out with you to track snakes and their habitats: beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, magnets, balances, microscopes, telescopes, thermometers, calculators, compasses, timing devices, computers, and computer probes? Why would the items that you chose be helpful in the field? Compose a detailed list of how you would use your chosen items to track snakes in the desert.

(B) extrapolate from collected information to make predictions.

After one year of data collecting the high daily temperatures in the Trans-Pecos desert, could you make reasonable predictions about the average yearly high temperatures in that desert for the next 2 years?

(8.5) Scientific processes. The student knows that relationships exist between science and technology. The student is expected to:

(A) identify a design problem and propose a solution

Design another way to test the heat pits of rattlesnakes based on the questions asked in [Slide 24].

(B) design and test a model to solve the problem;

Draw a possible new 'maze' or test model to analyze your problem.

(C) evaluate the model and make recommendations for improving the model.

Do you think your model is better than the one in [Slide 27]? Why or why not? How would you test it?

(8.6) Science concepts. The student knows that interdependence occurs among living systems. The student is expected to:

(B) identify feedback mechanisms that maintain equilibrium of systems such as body temperature, turgor pressure, and chemical reactions;

According to the experiment on [Slide 24] how does a rattlesnake's internal head temperature differ from its surrounding external environment? How does this benefit life in the hot desert? [Slides 24-26]

(C) describe interactions within ecosystems.

Where does a rattlesnake fit in with a food web diagram and trophic flow of an ecosystem?

(8.7) Science concepts. The student knows that there is a relationship between force and motion. The student is expected to:
(B) recognize that waves are generated and can travel through different media.
Describe the S-wave motion of a rattle shown in [Slide 19]. Why do we hear rattles? [Slide 17]

(8.9) Science concepts. The student knows that substances have chemical and physical properties. The student is expected to:
(C) recognize the importance of formulas and equations to express what happens in a chemical reaction;;
Why would it be important to know the chemical make up of rattlesnake venom if you were bit? [Slide 45]
(D) identify that physical and chemical properties influence the development and application of everyday materials such as cooking surfaces, insulation, adhesives, and plastics.
How can antivenom be useful? [Slide 45]

(8.10) Science concepts. The student knows that complex interactions occur between matter and energy. The student is expected to:
(C) identify and demonstrate that loss or gain of heat energy occurs during exothermic and endothermic chemical reactions.
According to the experiment on [Slide 24] how does a rattlesnake's internal head temperature differ from its surrounding external environment? How does this benefit life in the hot desert? [Slides 24-26] Research how exothermic animals like reptiles maintain their internal homeostasis, using environmental processes. What is 'respiratory cooling'?

(8.11) Science concepts. The student knows that traits of species can change through generations and that the instructions for traits are contained in the genetic material of the organisms. The student is expected to:
(A) identify that change in environmental conditions can affect the survival of individuals and of species;
Make a prediction as to how global climate change could affect wild populations of desert animals over time.
(B) distinguish between inherited traits and other characteristics that result from interactions with the environment;
Make a prediction about how you think heat pits evolved in viper snakes. What are the hypotheses for how rattles evolved? [Slide 18] What do you think?

(8.14) Science concepts. The student knows that natural events and human activities can alter Earth systems. The student is expected to:
(C) describe how human activities have modified soil, water, and air quality.
How have new urban developments caused negative consequences for the snakes? [Slide 10] Could urbanization (urban sprawl) cause damage to air, water, and soil quality? How? How could this affect snakes?

Environmental Science Institute
Hot Science – Cool Talks
Outreach Lecture Series Volume 39

The Striking Behavior of Rattlesnakes
Dr. Travis J. LaDuc

9th - 12th TEKS Suggestions

This file contains suggestions for incorporating material from this CD-ROM into High School curricula using the Texas Essential Knowledge and Skills for Science.

§112.42. Integrated Physics and Chemistry.

(1) Scientific processes. The student, for at least 40% of instructional time, conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
(A) demonstrate safe practices during field and laboratory investigations;
How can you avoid being bitten by a snake? [Slide 46]
(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.
How can I help save snakes from the cruel practice of snake roundups? [Slide 49] Why is it important to save habitat like hardwood bottomland forests? [Slide 47]

(2) Scientific processes. The student uses scientific methods during field and laboratory investigations. The student is expected to:
(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology;
How could herpetologists get information about the life of a rattlesnake the Trans-Pecos Desert? [Slide 31-34]
(B) collect data and make measurements with precision;
How could PIT tags be useful tools in tracking snakes? [Slide 31]
(C) organize, analyze, evaluate, make inferences, and predict trends from data;
If you had 10 years of data (information) on a single snake, what could you learn about this snake? (How it moves around and uses its habitat, grows, has families, etc). Could you map out growth trends over time? Could you map out habitat loss over time?
(D) communicate valid conclusions.
Draw a graph of snake size (Y axis in meters) over time (X axis in years) to show how snakes grow over time. Map the research site. Show a visual display of snake distribution compared with habitat loss. How would you visually display this information? Present info to class.

(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
The herpetologists hypothesized that rattlesnakes could make their heat pits more effective at higher temperatures by keeping their heads cooler at higher temperatures. [Slide 24-27]. Do you think the experiment of the maze in [Slide 26] supported this hypothesis? Why or why not?
(B) draw inferences based on data related to promotional materials for products and services;
What do you think scientists at the Texas Herpetological Society discuss? Do you think they talk about environmental concerns? What do you think is the biggest concern with rattlesnake populations today?
(C) evaluate the impact of research on scientific thought, society, and the environment;
Do you think studying reptiles such as rattlesnakes is a valid science? Why or Why not? Do you think rattlesnake roundups are socially and environmentally acceptable? Why or why not? [Slide 48] If you were a wildlife conservationist, what would you do to save the rattlesnakes from habitat loss and roundups?
(D) describe connections between physics and chemistry, and future careers;
How would knowledge of chemistry be desirable if you were working with snake venom in the medical fields? [Slide 45]

(4) Science concepts. The student knows concepts of force and motion evident in everyday life. The student is expected to:
(A) calculate speed, momentum, acceleration, work, and power in systems such as in the human body, moving toys, and machines;
According to the experiment in [Slide 40-42], would smaller snakes strike at faster accelerations because they had less mass to move, or would larger snakes strike more quickly because they had more muscle mass to put behind a predatory strike? Calculate the speed of a snake strike that has a strike distance of 5.3 cm and a velocity of 4.4 m/sec^2.

(5) Science concepts. The student knows the effects of waves on everyday life. The student is expected to:
(A) demonstrate wave types and their characteristics through a variety of activities such as modeling with ropes and coils, activating tuning forks, and interpreting data on seismic waves;
How could you model an S-wave with a rattlesnake's rattle? [Slide 19]

(6) Science concepts. The student knows the impact of energy transformations in everyday life. The student is expected to:
(B) investigate and demonstrate the movement of heat through solids, liquids, and gases by convection, conduction, and radiation;
Define the rattlesnake's process of respiratory cooling. [Slide 24]
(H) analyze the effects of heating and cooling processes in systems such as weather, living, and mechanical.

Define the rattlesnake's process of respiratory cooling. [Slide 24]

§112.43. Biology.

(1) Scientific processes. The student, for at least 40% of instructional time, conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
(A) demonstrate safe practices during field and laboratory investigations;
How can you avoid being bitten by a snake? [Slide 46]
(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.
How can I help save snakes from the cruel practice of snake roundups? [Slide 49] Why is it important to save habitat like hardwood bottomland forests? [Slide 47]

(2) Scientific processes. The student uses scientific methods during field and laboratory investigations. The student is expected to:
(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology;
How could herpetologists get information about the life of a rattlesnake in the Trans-Pecos Desert? [Slide 31-34]
(B) collect data and make measurements with precision;
How could PIT tags be useful tools in tracking snakes?
(C) organize, analyze, evaluate, make inferences, and predict trends from data;
If you had 10 years of information (data) on a single snake, what could you learn? (How it moves around and uses its habitat, grows, has families, etc). Could you map out growth trends over time? Could you map out habitat loss over time?
(D) communicate valid conclusions.
Draw a graph of snake size (Y axis in meters) over time (X axis in years) to show how snakes grow over time. Map the research site. Show a visual display of snake distribution compared with habitat loss. How would you visually display this information? Present info to class.

(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
The herpetologists hypothesized that rattlesnakes could make their heat pits more effective at higher temperatures by keeping their heads cooler at higher temperatures. [Slide 24-25]. Do you think the experiment of the maze in [Slide 26] supported this hypothesis? Why or why not?
(B) evaluate promotional claims that relate to biological issues such as product labeling and advertisements;

What do you think scientists at the Texas Herpetological Society discuss? Do you think they talk about environmental concerns? What do you think is the biggest concern with rattlesnake populations today?

(C) evaluate the impact of research on scientific thought, society, and the environment;

Do you think studying reptiles such as rattlesnakes is a valid science? Why or Why not? Do you think rattlesnake roundups are socially and environmentally acceptable? Why or why not? [Slide 48] If you were a wildlife conservationist, what would you do to save the rattlesnakes from habitat loss and roundups?

(D) describe the connection between biology and future careers;

Do you think a knowledge base in the structure and function of organisms, ecology, and animal behavior would benefit a career in herpetology? What other biological concepts would be important for a herpetologist to know?

(E) evaluate models according to their adequacy in representing biological objects or events;

Do you think your model is better than the one in [Slide 27]? Why or why not? How would you test it?

(F) research and describe the history of biology and contributions of scientists.

[Slide 13] shows an amateur herpetologist named Lawrence Klauber. Do you think he contributed to the study of rattlesnakes? How could you find out?

(7) Science concepts. The student knows the theory of biological evolution. The student is expected to:

(B) illustrate the results of natural selection in speciation, diversity, phylogeny, adaptation, behavior, and extinction.

Research the idea that, over time, snakes have lost their need for arms and legs. How would you support your findings? Name 3 anatomical structures on a rattlesnake and list the functions of each [ideas include: rattles, heat pits, tongue, poison glands, fangs, etc]. How does each of these traits enhance a rattlesnake's survival? Why don't all snakes have these traits that a rattlesnake has? What are the three main hypotheses for the origin of the rattles? [Slide 18]

(8) Science concepts. The student knows applications of taxonomy and can identify its limitations. The student is expected to:

(A) collect and classify organisms at several taxonomic levels such as species, phylum, and kingdom using dichotomous keys;

Classify a diamondback rattlesnake into Kingdom, Phylum, Class, Order, Family, Genus, Species

(9) Science concepts. The student knows metabolic processes and energy transfers that occur in living organisms. The student is expected to:

(D) analyze the flow of matter and energy through different trophic levels and between organisms and the physical environment.

Where does a rattlesnake fit in with a food web diagram and trophic flow of an ecosystem?

(11) Science concepts. The student knows that organisms maintain homeostasis. The student is expected to:

(A) identify and describe the relationships between internal feedback mechanisms in the maintenance of homeostasis;

According to the experiment on [Slide 24] how does a rattlesnake's internal head temperature differ from its surrounding external environment? How does this benefit life in the hot desert? Research how exothermic animals like reptiles maintain their internal homeostasis, using environmental processes.
What is 'respiratory cooling'?
(B) investigate and identify how organisms, including humans, respond to external stimuli;
How did the rattlesnake behave when the Pikachu doll was moved in front of it? [Slide 44]

(12) Science concepts. The student knows that interdependence and interactions occur within an ecosystem. The student is expected to:
(B) interpret interactions among organisms exhibiting predation, parasitism, commensalism, and mutualism;
List a predator – prey relationship discussed in this presentation. Could you see how this predator-prey relationship could lead to symbiotic mutualism due to population health and control?
(C) compare variations, tolerances, and adaptations of plants and animals in different biomes;
How might snakes from different global ecosystems be adapted differently from one another? List some examples.
(D) identify and illustrate that long-term survival of species is dependent on a resource base that may be limited; and
Describe how habitat is a limiting factor for snakes. [Slides 10 and 47] How are roundups limiting factors? [Slides 48-49]
(E) investigate and explain the interactions in an ecosystem including food chains, food webs, and food pyramids.
Draw a simple food chain including producers, herbivores, carnivores (snake), other carnivores (snake eaters) and decomposers. Expand your food chain to include more organisms linked in a food web. Expand your diagram further to incorporate trophic levels in a trophic pyramid.

§112.44. Environmental Systems.

(1) Scientific processes. The student, for at least 40% of instructional time, conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
(A) demonstrate safe practices during field and laboratory investigations;
How can you avoid being bitten by a snake? [Slide 46]
(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

How can I help save snakes from the cruel practice of snake roundups? [Slide 49] Why is it important to save habitat like hardwood bottomland forests? [Slide 47]

(2) Scientific processes. The student uses scientific methods during field and laboratory investigations. The student is expected to:
(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology;
How could herpetologists get information about the life of a single rattlesnake in all of the Trans-Pecos Desert? [Slide 31-33]
(B) collect data and make measurements with precision;
How could PIT tags be useful tools in tracking snakes?
(C) organize, analyze, evaluate, make inferences, and predict trends from data;
If you had 10 years of information (data) on a single snake, what could you learn? (How it moves around and uses its habitat, grows, has families, etc). Could you map out growth trends over time? Could you map out habitat loss over time? How?
(D) communicate valid conclusions.
Draw a graph of snake size (Y axis in meters) over time (X axis in years) to show how snakes grow over time. Map the research site. Show a visual display of snake distribution compared with habitat loss. How would you visually display this information? Present info to class.

(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
The herpetologists hypothesized that rattlesnakes could make their heat pits more effective at higher temperatures by keeping their heads cooler at higher temperatures. [Slide 24-27]. Do you think the experiment of the maze in [Slide 26] supported this hypothesis?
(B) make responsible choices in selecting everyday products and services using scientific information;
How could you responsibly avoid supporting urban sprawl and/or snake roundups?

(C) evaluate the impact of research on scientific thought, society, and the environment;
Do you think studying reptiles such as rattlesnakes is a valid science? Why or Why not? Do you think rattlesnake roundups are socially and environmentally acceptable? Why or why not? [Slide 48] If you were a wildlife conservationist, what would you do to save the rattlesnakes from habitat loss and roundups?
(D) describe the connection between environmental science and future careers;
Do you think a knowledge base in the structure and function of organisms, ecology, environmental sciences and animal behavior would benefit a career in herpetology? What other environmental science classes would be appropriate?
(E) research and describe the history of environmental science and contributions of scientists.

[Slide 13] shows an amateur herpetologist named Lawrence Klauber. Do you think he contributed to the study of rattlesnakes? How could you find out?

(4) Science concepts. The student knows the relationships of biotic and abiotic factors within habitats, ecosystems, and biomes. The student is expected to:
(A) identify indigenous plants and animals, assess their role within an ecosystem, and compare them to plants and animals in other ecosystems and biomes;
Where in the world would you find the Horn-nose Viper? Where would you find the Green Mamba, the double-collar coral snake, and/or the temple viper? [Slide 4] Which state has all 4 groups of venomous snakes in it? [Slide 5]
(D) predict how the introduction, removal, or reintroduction of an organism may alter the food chain and affect existing populations;
Predict how the introduction, removal, or reintroduction of a Norwegian rat into the desert alter the food chain and affect existing snake and rodent populations.

(5) Science concepts. The student knows the interrelationships among the resources within the local environmental system. The student is expected to:
(A) summarize methods of land use and management;
How could snakes be more protected? What laws and regulations might be important to research state protected lands?

(7) Science concepts. The student knows the relationship between carrying capacity and changes in populations and ecosystems. The student is expected to:
(A) relate carrying capacity to population dynamics;
What would the population curve of rodents looks like if we removed predators such as snakes?
(D) analyze and make predictions about the impact on populations of geographic locales, natural events, diseases, and birth and death rates.
Could an over population of mice (due to removal of predators like snakes) lead to diseases in the human population? Why? How? Are there historic events that have paralleled this trend?