HOUSTON MUSEUM
*of* NATURAL SCIENCE

# Texas Essential Knowledge and Skills

## *MORIAN HALL OF PALEONTOLOGY*

*UPDATED OCTOBER 2024*

Thank you for choosing the Houston Museum of Natural Science for your class field trip. We are delighted to have the opportunity to enrich your students' learning experience. To simplify planning your trip, we have provided the Texas Essential Knowledge and Skills (TEKS) for the Morian Hall of Paleontology by grade level. This resource is designed to help you align your trip with your curriculum, ensuring your visit is educational and enjoyable.

We look forward to welcoming you and your students for an unforgettable journey through the wonders of discovery.

## Kindergarten

### Science.K.5.F

The student is expected to describe the relationship between the structure and function of objects, organisms, and systems.

Dinosaurs were a group of reptiles that lived millions of years ago. Key physical features made them different from other reptiles. By studying these features, students can develop an eye for identifying these features and distinguishing dinosaurs from other prehistoric and modern animals.

- Leg Position: Dinosaurs' legs were positioned directly under their bodies, which helped them support their weight and move more efficiently.
- Hip Structure: Dinosaurs have unique hips. There are two types of hip structures in dinosaurs: one like a lizard (saurischian) and one like a bird (ornithischian).

### Science.K.5.G

The student is expected to describe how factors or conditions can cause objects, organisms, and systems to either change or stay the same.

The extinction event that killed the dinosaurs, known as the Cretaceous-Paleogene (K-Pg) extinction, shows how external factors can drastically alter natural history. About 66 million years ago, a massive asteroid hit Earth near the Yucatán Peninsula, unleashing energy comparable to billions of atomic bombs. This impact caused fires, tsunamis, and a "nuclear winter," where dust blocked sunlight and significantly cooled the planet.

**Science.K.13.B**

The student is expected to identify the different structures that animals have that allow them to interact with their environment such as seeing, hearing, moving, and grasping objects.

Invite students to observe and analyze these structures:

Bone Structure: Examining bones' size, shape, and arrangement reveals clues about an animal's movement and posture, such as whether dinosaurs were bipedal or quadrupedal.

Skull Examination: The skull's structure, including eye sockets, nasal passages, and ear openings, indicates how an animal saw, smelled, and heard.

Teeth and Jaws: The shape of teeth suggests diet, providing insights into how an animal interacted with its environment.

## 1st Grade

**Science.1.5.F**

The student is expected to describe the relationship between structure and function of objects, organisms, and systems.

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**Science.1.5.G**

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**Science.1.12.A**

The student is expected to classify living and nonliving things based upon whether they have basic needs and produce young.

Invite students to observe and analyze Fossil Evidence:

- Structure and Anatomy: Examine the structure of the fossils. Bones, teeth, and other features indicate that the organism once had a complex structure typical of living things.
- Trace Fossils: Look for trace fossils, such as footprints, burrows, or coprolites (poop), that suggest behaviors such as movement, feeding, or caring for young.
- Growth Patterns: Analyze growth rings in bones or shells that indicate the organism grew over time.
- Reproductive Structures: Search for eggs or evidence of young animals indicating that the organisms reproduced.

**Science.1.12.C**

The student is expected to identify and illustrate how living organisms depend on each other through food chains.

Invite students to find fossils that show energy flow in ancient ecosystems. Many specimens in the hall are displayed to illustrate parts of a potential food chain. Examples include:

- Producers: Fossilized plants (e.g., ancient ferns)
- Primary Consumers: Herbivorous dinosaurs like Triceratops
- Secondary Consumers: Carnivorous dinosaurs like Tyrannosaurus *rex*

**Science.1.13.A**

The student is expected to identify the external structures of different animals and compare how those structures help different animals live, move, and meet basic needs for survival.

Invite students to observe and analyze these structures:

- Bone Structure: Examining bones' size, shape, and arrangement reveals clues about an animal's movement and posture, such as whether dinosaurs were bipedal or quadrupedal.
- Skull Examination: The skull's structure, including eye sockets, nasal passages, and ear openings, indicates how an animal saw, smelled, and heard.
- Teeth and Jaws: The shape of teeth suggests diet, providing insights into how an animal interacted with its environment.

## 2nd Grade

**Science.2.5.F**

The student is expected to describe the relationship between structure and function of objects, organisms, and systems.

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**Science.2.5.G**

The student is expected to describe how factors or conditions can cause objects, organisms, and systems to either change or stay the same.

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**Science.2.12.B**

The student is expected to create and describe food chains identifying producers and consumers to demonstrate how animals depend on other living things.

Invite students to find fossils that show energy flow in ancient ecosystems. Many specimens in the hall are displayed to illustrate parts of a potential food chain. Examples include:

- Producers: Fossilized plants (e.g., ancient ferns)
- Primary Consumers: Herbivorous dinosaurs like Triceratops
- Secondary Consumers: Carnivorous dinosaurs like Tyrannosaurus *rex*

**Science.2.13.B**

The student is expected to record and compare how the structures and behaviors of animals help them find and take in food, water, and air;

Invite students to observe and analyze these structures:

- Teeth and Jaws: Examine the shape and size of teeth and jaws. Carnivores typically have sharp, pointed teeth for tearing flesh, while herbivores have flat, grinding teeth for chewing plants.
- Limbs and Claws: Look at the limbs and claws. Predators might have strong, sharp claws for catching prey, while other animals might have limbs adapted for digging or climbing to find food.

## 3rd Grade

**Science.3.5.F**

The student is expected to explain the relationship between the structure and function of objects, organisms, and systems.

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**Science.3.5.G**

The student is expected to explain how factors or conditions impact stability and change in objects, organisms, and systems.

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**Science.3.12.D**

The student is expected to identify fossils as evidence of past living organisms and environments, including common Texas fossils.

Observe and analyze the surrounding sediment or rock in which the fossils were found. This can give insights into the environment:

- Sedimentary Rock: Indicates ancient rivers, lakes, or oceans.
- Coal Beds: Suggest dense, ancient forests.
- Limestone: Often formed in warm, shallow marine environments.

**Science.3.13.A**

The student is expected to explore and explain how external structures and functions of animals such as the neck of a giraffe or webbed feet on a duck enable them to survive in their environment.

Invite students to practice comparative anatomy using the specimens in the hall and their knowledge of modern animals. For example, A fossilized diplodocus's long neck can be compared to a giraffe's.

Then, discuss the function of these structures. The long neck might have enabled diplodocus and modern giraffes to reach high vegetation, suggesting an adaptation to their environment.

## 4th Grade

**Science.4.5.F**

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**Science.4.5.G**

The student is expected to explain how factors or conditions impact stability and change in objects, organisms, and systems.

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**Science.4.12.C**

The student is expected to identify and describe past environment based on fossil evidence, including common Texas fossils.

Observe and analyze the surrounding sediment or rock in which the fossils were found. This can give insights into the environment:

- Sedimentary Rock: Indicates ancient rivers, lakes, or oceans.
- Coal Beds: Suggest dense, ancient forests.
- Limestone: Often formed in warm, shallow marine environments.

**Science.4.13.B**

The student is expected to differentiate between inherited and acquired physical traits of organisms.

Invite the students to observe the many trilobites in the exhibit and identify consistent features. Similar structures in multiple species suggest these traits are inherited.

## 5th Grade

**Science.5.5.F**

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**Science.5.5.G**

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**Science.5.12.A**

The student is expected to observe and describe how a variety of organisms survive by interacting with biotic and abiotic factors in a healthy ecosystem.

Invite students to identify the fossils on display as plants or animals or trace fossils like footprints and burrows. Encourage them to determine if the organism was a predator or prey to understand its role in the food web. Then, information about the geological period can be used to infer the climate, such as marine, desert, or forest environments. This helps students understand the abiotic factors like temperature, water availability, and terrain, revealing how the organism adapted to survive.

**Science.5.13.A**

The student is expected to analyze the structures and functions of different species to identify how organisms survive in the same environment.

Invite students to examine various fossils' size, shape, and texture and note any distinguishing features, such as teeth, claws, or shells. Then, use the text panels to classify fossils (e.g., dinosaurs, marine life, plants). Next, encourage the students to analyze the various features and infer their functions. Then, they will compare fossils from different species found in the same period and location, looking for similarities and differences in environmental adaptations.

## 6th Grade

**Science.6.5.F**

The student is expected to analyze and explain the complementary relationship between the structure and function of objects, organisms, and systems.

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**Science.6.5.G**

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**Science.6.12.B**

The student is expected to describe and give examples of predatory, competitive, and symbiotic relationships between organisms, including mutualism, parasitism, and commensalism.

Encourage students to find fossils that show evidence of predation, such as bite marks. Locate fossils of predators and their prey found interacting with one another in the exhibit or even fossilized remains of prey within the stomach contents of predators.

Look for fossils that suggest competition for resources. For example, two species of herbivores with similar tooth structures found in the same area might indicate competition for the same type of plant.

## 7th Grade

**Science.7.4.C**

The student is expected to research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field to investigate STEM careers.

These paleontology careers require a strong STEM foundation and often involve interdisciplinary collaboration, contributing to our understanding of the ancient world.

- Paleontologist: Studies fossils to understand ancient life and environments.

- Geologist: Focuses on Earth's physical structure, with paleogeologists specializing in fossil-containing sedimentary layers.
- Biologist: Evolutionary biologists collaborate with paleontologists to study the evolution and relationships of species.
- Geochemist: Analyzes rock and fossil chemistry to understand Earth's conditions during fossil formation.
- Data Scientist: Uses technology to analyze large datasets, predict fossil locations, and reconstruct ancient climates.

**Science.7.5.F**

The student is expected to analyze and explain the complementary relationship between structure and function of objects, organism, and system.

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**Science.7.5.G**

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**Science.7.10.A**

The student is expected to describe the evidence that supports that Earth has changed over time, including fossil evidence, plate tectonics, and superposition.

Invite the students to observe the changes in physical characteristics of the various trilobites by comparing fossils of the same or similar species from different geological periods. These morphological changes can show how species adapted to changing environments, supporting the theory of evolution and indicating that Earth's conditions have shifted.

## 8th Grade

**Science.8.5.F**

The student is expected to analyze and explain the complementary relationship between the structure and function of objects, organism, and system.

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**Science.8.5.G**

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**Science.8.12.C**

The student is expected to describe how biodiversity contributes to the stability and sustainability of an ecosystem and the health of the organisms within the ecosystem.

Fossils can reveal how species adapted to environmental changes over time. Invite students to look for specific adaptations in the various fossils that allowed the organism to survive and thrive, thereby contributing to the resilience of the ecosystem.

**Science.8.13.C**

The student is expected to describe how variations of traits within a population lead to structural, behavioral, and physiological adaptations that influence the likelihood of survival and reproductive success of a species over generations.

Encourage students to compare the physical structures of animals from different periods. For example, examine the limb structures of diplococcus, an early tetrapod found in the Permian period, and compare them with modern amphibians. This highlights the changes that allowed for better movement on land.

## High School

**BIO.1**

Biology. Students in Biology focus on patterns, processes, and relationships of living organisms through four main concepts: biological structures, functions, and processes; mechanisms of genetics; biological evolution; and interdependence within environmental systems. By the end of Grade 12, students are expected to gain sufficient knowledge of the scientific and engineering practices across the disciplines of science to make informed decisions using critical thinking and scientific problem solving.

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**BIO.4.C**

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**BIO.9.A**

The student is expected to analyze and evaluate how evidence of common ancestry among groups is provided by the fossil record, biogeography, and homologies, including anatomical, molecular, and developmental.

Invite the students to carefully observe the various fossils in the hall and note their physical characteristics, such as size, shape, and distinguishing features. Then, by comparing these features across different fossil specimens, they can identify patterns of similarity and difference, which may suggest evolutionary relationships. Students can also look for transitional fossils that exhibit traits of both ancestral and more modern organisms. These fossils can provide direct evidence of evolutionary changes.

**BIO.9.B**

The student is expected to examine scientific explanations for varying rates of change such as gradualism, abrupt appearance, and stasis in the fossil record.

Invite the students to examine the fossils, noting their physical characteristics, estimated ages, and represented organisms. Encourage them to identify similarities

and differences between fossils from different periods, looking for patterns in shape and structure that may indicate gradual changes over time. Ask them to determine if there are continuous changes in features (supporting gradualism) or periods where species appear unchanged (indicating stasis). Can they find examples of new species appearing abruptly without transitional forms, suggesting rapid evolutionary events?

**BIO.13.A**

The student is expected to investigate and evaluate how ecological relationships, including predation, parasitism, commensalism, mutualism, and competition, influence ecosystem stability.

Explore the fossils to find examples of the following:

- Predation: Examine dinosaur specimens for evidence of predation and analyze these marks to hypothesize predator-prey relationships. This helps students understand how predation influences prey populations and ecosystem stability.
- Parasitism: Identify fossils with signs of parasitism, such as marks from parasitic worms or burrows within bones or shells, indicating parasitic activity.
- Commensal Relationships: Look for fossils showing evidence of commensalism, where one organism benefits while the other is neither helped nor harmed.
- Competition: Analyze fossils with similar habitats and resources to infer competition, noting similar morphological traits suggesting overlapping niches.