

SCIENCE CONTENT STANDARDS GRADE 5/6 Year A

Grade 5/6 students can be introduced to the principles and models of the structure of matter, extending their understanding from previous years. Students are familiar with physical changes in matter and should recognize changes in phase (solid, liquid, and gas). Students learn about chemical reactions and discover the special (and shared) properties of metallic elements. They distinguish clearly between molecules and atoms, chemical compounds and mixtures, and learn about the organization of atoms on the Periodic Table of the Elements. Having been introduced to these concepts, students can then be shown how the specific chemical reactions, such as photosynthesis and respiration, drive the physiological processes of living cells.

Organisms require nutrients and energy to live and grow, and grade 5 students learn about some of the fundamental principles of plant and animal physiology. They learn about blood circulation and respiration, digestion of food and collection and excretion of wastes. Students learn how plants move water and minerals from the roots to the leaves, and transport sugar generated during photosynthesis from leaves to the other parts of the plant.

Plate tectonics is a unifying geological theory that explains the formation of major features of the earth's surface and important geologic events. Today we know that tectonic forces have been responsible for most of the major features of the Earth's crust, from continental configuration, to mountains and valleys, to ocean floors and trenches. Tectonic plate movement results in continental drift and mountain building, and is the chief source of construction and elevation of crustal geologic features. Plate tectonic processes, driven by the flow of heat within the earth, cause stresses in the Earth's crust that are released through earthquakes, lava flows and volcanoes. Mountain building processes counter the constant destructive effects of weathering and erosion that wear down the Earth's surface features over time.

Through time, many changes have occurred in the Earth's features. Forces related to plate tectonics have elevated mountains. Atmospheric constituents (mostly water, oxygen and carbon dioxide) interact with minerals and rocks at the Earth's surface, weakening and breaking them down through a process called weathering. Plants, alternate wetting and drying, or freezing and thawing contribute to the weathering process. Fragmented products of the weathering process are transported down slope by wind, water, and ice under the influence of gravity. The force of gravity acting alone moves material down slopes by landslides and slumps (called mass wasting). The ultimate destination of most of the products of weathering is the ocean as deposits of marine sediments. In time, the mountains are laid low, the rivers change their courses and disappear, and lakes and seas expand or dry up. Eventually sediments, which have found their way to the oceans along continental margins, will be compacted and changed to rock, and uplifted by continental collision or subducted and melted under the crust. New mountains are formed and the cycle (called the geologic cycle) is renewed. Each cycle takes tens of millions of years.

Students formulate hypotheses, make predictions, and design simple experiments. Students develop testable questions and plan their own investigations, selecting appropriate tools to make quantitative observations. They use graphs to make inferences based on the data and analyze the data to draw logical conclusions.

Physical Sciences (Matter)

- Elements and their combinations account for all the varied types of matter in the world. As a basis for understanding this concept, students know:
 - during chemical reactions, the atoms in the reactants rearrange to form products with different properties.
 - **all matter is made of atoms (too small to see with our eyes), which may combine to form molecules.**
 - metals have properties in common, such as electrical and thermal conductivity. Some metals, such as aluminum (Al), iron (Fe), nickel (Ni), copper (Cu), silver (Ag), gold (Au) are pure elements while others, such as steel and brass, are composed of a combination of elemental metals.
 - **each element is made of one kind of atom. These elements are organized in the Periodic Table by their chemical properties.**
 - differences in chemical and physical properties of substances are used to separate mixtures and identify compounds.
 - **properties of solid, liquid, and gaseous substances.**
 - living organisms and most materials are composed of just a few elements.

Life Sciences (Cells to Organisms)

- Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials. As a basis for understanding this concept, students know:
 - **many multicellular organisms have specialized structures to support the transport of materials.**
 - how blood circulates through the heart chambers, lungs, and body, and how carbon dioxide and oxygen are exchanged in the lungs and tissues.
 - the sequential steps of digestion and the roles of teeth and the mouth, esophagus, stomach, small intestine, large intestine, and colon in the function of the digestive system.
 - the role of the kidney in removing cellular waste from blood and converting it into urine, which is stored in the bladder.
 - how sugar, water, and minerals are transported in a vascular plant.
 - **plants use carbon dioxide (CO₂) and energy from sunlight to build molecules of sugar and release oxygen.**
 - plant and animal cells break down sugar to obtain energy, forming carbon dioxide (CO₂) and water (respiration).

Earth Sciences (Dynamic Earth)

- Forces work on the Earth to cause change. Plate tectonics explains the important features of the Earth's surface and major geologic events. As a basis for understanding, students know:
 - **the fit of the continents, location of earthquakes, volcanoes, and mid-ocean ridges, and the distribution of fossils and rock types provide evidence for plate tectonics.**
 - the solid Earth is layered with cold, brittle lithosphere; hot, convecting mantle; and dense, metallic core.
 - lithospheric plates move at rates of centimeters per year in response to movements in the mantle.
 - earthquakes are sudden motions along breaks in the crust called faults, and volcanoes/fissures are locations where magma reaches the surface.
 - **major geologic events, such as earthquakes, volcanic eruptions, and mountain building result from plate motions.**

- ⊖ major features of California geology are a result of plate tectonics (including mountains, faults, volcanoes).
 - ⊖ the effects of an earthquake vary with its size, distance from the epicenter, local geology, and the type of construction involved.
- Topography is reshaped by weathering of rock and soil and by the transportation and deposition of sediment. As the basis for understanding this concept, students know:
 - ⊖ water running downhill is the dominant process in shaping the landscape, including California's landscape.
 - ⊖ **rivers and streams are dynamic systems that erode and transport sediment, change course, and flood their banks in natural and recurring patterns.**
 - ⊖ beaches are dynamic systems in which sand is supplied by rivers and moved along the coast by wave action.
 - ⊖ earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.
 - ⊖ how to read a topographic map and a geologic map for evidence provided on the maps.
- Waves, wind, water, and ice shape and reshape the Earth's land surface. As a basis for understanding this concept, students know:
 - ⊖ **some changes in the Earth are due to slow processes, such as erosion, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.**
 - ⊖ natural processes, including freezing/thawing and growth of roots, cause rocks to break down into smaller pieces.
 - ⊖ moving water erodes landforms, reshaping the land by taking it away from some places and depositing it as pebbles, sand, silt, and mud in other places (weathering, transport, and deposition).

Process Skills (Investigation and Experimentation)

- Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content of the other three strands, students should develop their own questions and perform investigations. Students will:
 - ⊖ classify objects (e.g., rocks, plant, leaves) based on appropriate criteria.
 - ⊖ develop a testable question.
 - ⊖ plan and conduct a simple investigation based on a student-developed question, and write instructions others can follow to carry out the procedure.
 - ⊖ identify the dependent (responding) and controlled variables in an investigation.
 - ⊖ identify a single independent (manipulated) variable in a scientific investigation and explain what will be learned by collecting data on this variable.
 - ⊖ **use appropriate tools (e.g., thermometers, meter sticks, balances, and graduated cylinders) and make quantitative observations.**
 - ⊖ **record data using appropriate graphic representation (including charts, graphs, and labeled diagrams), and make inferences based on those data.**
 - ⊖ draw conclusions based on scientific evidence and indicate whether further information is needed to support a specific conclusion.
 - ⊖ write a report of an investigation that includes tests conducted, data collected or evidence examined, and conclusions drawn.