# Middle Grades General Science
# 5–9

# Section 04

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## 1 Conceptual and quantitative knowledge of the structure and behavior of matter

1. Analyze the physical and chemical properties of matter (e.g., mass, volume, density, chemical reactivity).
2. Distinguish between the states of matter.
3. Apply knowledge of the gas laws.
4. Identify the major discoveries in the development of the atomic theory.
5. Identify the characteristics of elements, compounds, and mixtures.
6. Apply knowledge of symbols, formulas, and equations for common elements and compounds (e.g., acids, bases, salts, carbon compounds) and their reactions.
7. Identify characteristics and functions of the components of an atom.
8. Identify chemical or physical properties of elements based on their placement on the periodic table.
9. Identify characteristics of types of chemical bonding (e.g., covalent, ionic, metallic, hydrogen).
10. Identify types of chemical reactions and their characteristics.

## 2 Conceptual and quantitative knowledge of forces and motion

1. Differentiate between the types and characteristics of contact forces and forces acting at a distance, and their interactions.
2. Identify applications of Newton's laws of motion.
3. Solve problems involving force or motion.
4. Identify types, characteristics, and properties of waves.
5. Analyze characteristics of wave phenomena (e.g., intensity, refraction, interference, Doppler effect, wave-particle duality) as they apply to real-world situations.
6. Identify origins, characteristics, and examples of electricity.
7. Identify types of magnets and characteristics of magnetic fields.
8. Apply knowledge of magnets and magnetic fields to real-world situations (e.g., generators, solenoids).

9. Identify characteristics of motion as they apply to real-world situations (e.g., speed, velocity, acceleration, linear and angular momentum).

**3 Conceptual and quantitative knowledge of energy and its effects**

1. Differentiate between forms of energy and their transformations.
2. Relate energy to transitions between states of matter.
3. Distinguish between temperature, heat, and thermal energy.
4. Distinguish between the types of thermal energy transfer (e.g., radiation, conduction, convection).
5. Apply the laws of thermodynamics to real-world situations.
6. Differentiate between potential and kinetic energy.
7. Identify characteristics of nuclear reactions.
8. Identify the regions of the electromagnetic spectrum and energy associated with each.
9. Identify the use of light and optics in real-world applications (e.g., optical instruments, communication).
10. Solve problems involving energy, work, power, mechanical advantage, and efficiency.
11. Apply the laws of conservation of mass and energy to chemical reactions, nuclear reactions, physical processes, and biological processes.
12. Identify types, characteristics, and measurements of electrical quantities.
13. Apply knowledge of currents, circuits, conductors, insulators, and resistors to real-world situations.
14. Solve mathematical problems involving current, voltage, resistance, power, and energy in direct current (DC) circuits.

**4 Knowledge of Earth and the processes that affect it**

1. Relate surface and subsurface geologic processes to the movement of tectonic plates.
2. Trace the development of the theory of continental drift to the current theory of plate tectonics.
3. Relate the characteristics of geologic structures to the mechanisms by which they are formed.
4. Identify the evidence used to define geologic eras (e.g., geologic events, biotic factors, abiotic factors).

5. Apply methods for determining geologic age (e.g., law of superposition, radioactive decay, relative dating).

6. Interpret various charts and models (e.g., topographic, geologic, weather).

7. Identify the characteristics of ocean currents and how they influence weather patterns.

8. Identify characteristics of Florida's geology and its formation.

9. Identify the major processes of formation and properties of rocks, minerals, and fossils.

10. Distinguish between the processes of weathering, erosion, and deposition and their products.

11. Identify the characteristics and functions of the atmospheric layers.

12. Relate atmospheric conditions to weather.

13. Identify the factors that contribute to the climate of a geographic area.

14. Identify the movement of water in the hydrologic cycle, including sources of water, types of precipitation, and causes of condensation.

15. Analyze ways in which earth and water interact (e.g., soil absorption, runoff, leaching, groundwater, karst topography).

16. Identify various forms of water storage (e.g., aquifers, reservoirs, watersheds).

17. Analyze interactions between the atmosphere, geosphere, hydrosphere, biosphere, and cryosphere and the effects of these interactions.

**5 Knowledge of space science**

1. Identify consequences of Earth's motions and orientation (e.g., seasons, tides, lunar phases).

2. Identify the properties of stars and the factors that affect their evolutionary patterns.

3. Identify devices and techniques for collecting and analyzing data about stars and other celestial objects.

4. Explain the role of space exploration and its impact on technological advancements.

5. Identify the components of the solar system (e.g., Kuiper belt, Oort cloud), their characteristics, how they interact (e.g., solar winds, impacts, gravitational attraction), and how they evolve.

6. Evaluate celestial objects in order to determine formation, age, location, characteristics, and evolution.

## 6 Knowledge of processes of life

1. Identify the relationship between biological and chemical processes (e.g., cellular respiration, ATP energy transfer) necessary for life.

2. Compare prokaryotes and eukaryotes.

3. Relate cell organelles to their functions.

4. Identify the sequence of events, the significance of the process, and the consequences of irregularities during mitosis and meiosis.

5. Apply principles of Mendelian genetics to monohybrid and dihybrid crosses and crosses involving linked genes.

6. Apply principles of human genetics, including relationships between genotypes and phenotypes and causes and effects of disorders.

7. Analyze the genetic code and the roles of DNA and RNA in replication and protein synthesis.

8. Classify organisms based on the levels of biological taxonomy.

9. Identify characteristics of viruses, bacteria, protists, and fungi.

10. Differentiate between structures and processes of plant and animal cells and their organelles.

11. Identify plant structures and their functions.

12. Identify the major steps of plant processes (e.g., photosynthesis, respiration, electron transport, transpiration, reproduction).

13. Identify the processes of animal physiology (e.g., digestion, respiration).

14. Identify the structures of the organs and organ systems of various kinds of animals, including humans.

15. Analyze behaviors or adaptations of animals and plants that enable them to survive.

16. Interpret cell theory and how its discovery relates to the process of science.

17. Identify how evolution is supported by the fossil record, comparative anatomy, embryology, biogeography, molecular biology, genetics, and observed change.

18. Evaluate the roles of adaptation, genetic variation, mutation, and extinction in natural selection.

19. Interpret the impact of biotechnology on the individual, society, and the environment, including medical and ethical issues.

**7 Knowledge of the effects of physical and biological factors on the environment**

1. Identify components and sequences of biogeochemical cycles (e.g., carbon, oxygen, hydrogen, nitrogen).

2. Identify issues related to the development, use, and conservation of natural resources.

3. Evaluate environmental factors and their impact on the adaptation and survival rates of organisms.

4. Identify the major characteristics of world biomes and communities, including succession and interrelationships of organisms.

5. Identify how biotic and abiotic factors influence ecosystems.

6. Analyze interactions between microorganisms and the environment.

7. Identify the effects of homeostasis on the survivability of an organism.

8. Relate the interactions of biotic and abiotic factors to the flow of energy and biomass within a system.

9. Analyze the relationship between natural factors and human activities as they affect Florida's ecosystems.

**8 Knowledge of the science learning environment**

1. Identify legal and ethical requirements for proper use, care, handling, and disposal of organisms.

2. Identify the safe and appropriate techniques used in the preparation, storage, dispensing, and supervision of materials used in science instruction.

3. Identify appropriate substitutions for materials and activities necessary for effective science instruction.

4. Identify the federal and state legal requirements for safe preparation, use, storage, and disposal of chemicals and other materials.

5. Use multiple assessment tools and strategies to identify and address student misconceptions.

6. Select appropriate strategies for teaching scientific inquiry.

7. Identify appropriate technological tools that facilitate the learning of science.

**9 Knowledge of process skills and application of scientific inquiry**

1. Apply appropriate scientific process skills to observe and analyze natural phenomena and communicate findings.

2. Apply scientific inquiry, including scientific methods, to investigations.

3. Apply knowledge of mathematics and technology to scientific investigation.

4. Compare the methods used in the pursuit of a scientific explanation as applied in different fields of science such as geology, astronomy, physics, and biology.

5. Identify the traits of scientists and how they affect the development of scientific knowledge.

6. Identify the assumptions of scientific knowledge (e.g., durable, open to change).

7. Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation.

8. Evaluate the impact of the historical and cultural development of science on the advancement of scientific knowledge.

9. Compare the development, use, benefits, and limitations of theories, laws, hypotheses, and models.

10. Analyze the interdependence between scientific knowledge and economic, political, social, and ethical concerns.