Science
Grade-Level Expectations

Grades PreK–K
Prekindergarten

Science as Inquiry
The Abilities Necessary to Do Scientific Inquiry
1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (PK-CS-I1) (SI-E-A1)
2. Pose questions that can be answered by using students' own observations and scientific knowledge (PK-CS-I1) (SI-E-A1)
3. Use the five senses to describe observations (PK-CS-P3) (SI-E-A3)
4. Select and use developmentally appropriate equipment and tools and units of measurement to observe and collect data (PK-CS-I4) (SI-E-A4)
5. Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps, and oral and written explanations as appropriate (PK-CS-I5) (SI-E-A5) (SI-E-B4)
6. Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) (PK-CS-I5) (SI-E-A6)
7. Identify and use appropriate safety procedures and equipment when conducting investigations (e.g., gloves, goggles, hair ties) (PK-CS-I4) (SI-E-A7)

Understanding Scientific Inquiry
8. Recognize that a variety of tools can be used to examine objects at different degrees of magnification (e.g., hand lens, microscope) (PK-CS-I4) (SI-E-B3)

Physical Science
Properties of Objects and Materials
9. Sort objects using one characteristic (PK-CS-P2) (PS-E-A1)
10. Determine whether objects float or sink through investigations (PK-CS-P1) (PS-E-A1)
11. Describe properties of materials by using observations made with the aid of equipment such as magnets, magnifying glasses, pan balances, and mirrors (PK-CS-P4) (PS-E-A2)
12. Determine whether one object weighs more or less than another by using a pan balance (PK-CS-I4) (PS-E-A2)
13. Compare the properties of different solids and liquids through observation (PK-CS-P1) (PS-E-A4)
14. Identify components of simple mixtures (e.g., salt/water, rice/beans, iron filings/sand) (PK-CS-P1) (PS-E-A5)

Position and Motion of Objects
15. Demonstrate motion by using students' own bodies (PK-CS-P3) (PS-E-B3)
16. Explore the motion of objects by using balls, toy cars, or spinning tops (PK-CS-I2) (PS-E-B3)

Forms of Energy
17. Identify different sounds as *soft* or *loud* (PK-CS-P3) (PS-E-C1)
18. Identify selected substances as *hot* or *cold* (PK-CS-P2) (PS-E-C3)

Science
Grade-Level Expectations

Life Science
Characteristics of Organisms
19. Identify parts of the body and how they move (PK-CS-L1) (LS-E-A3)
20. Give examples of different kinds of plants and different kinds of animals (PK-CS-L1) (LS-E-A4)
21. Distinguish food items from nonfood items (PK-CS-L1) (LS-E-A6)

Life Cycles of Organisms
22. Learn about animals and plants through nonfiction literature (PK-CS-L1) (LS-E-B1)
23. Observe and care for pets and plants (PK-CS-L1) (LS-E-B1)

Organisms and Their Environments
24. Describe plants and animals in the schoolyard or home environments (PK-CS-L1) (LS-E-C1)

Earth and Space Science
Properties of Earth Materials
25. Explore and describe various properties of rocks, minerals, and soils (PK-CS-L2) (ESS-E-A1)
26. Describe the weather and its daily changes (PK-CS-ES2) (ESS-E-A4)
27. Describe different types of weather students have experienced and give examples of how daily activities and appropriate attire are affected by weather conditions (PK-CS-ES2) (ESS-E-A4)

Objects in the Sky
28. Learn about objects in the sky through nonfiction literature (PK-CS-ES3) (ESS-E-B1)

Kindergarten

Science as Inquiry
The Abilities to Do Scientific Inquiry
1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
2. Pose questions that can be answered by using students' own observations and scientific knowledge (SI-E-A1)
3. Predict and anticipate possible outcomes (SI-E-A2)
4. Use the five senses to describe observations (SI-E-A3)
5. Measure and record length and temperature in both metric system and U.S. system units (SI-E-A4)
6. Select and use developmentally appropriate equipment and tools and units of measurement to observe and collect data (SI-E-A4)
7. Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps, and oral and written explanations as appropriate (SI-E-A5) (SI-E-B4)
8. Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) (SI-E-A6)
9. Identify and use appropriate safety procedures and equipment when conducting investigations (e.g., gloves, goggles, hair ties) (SI-E-A7)

Science
Grade-Level Expectations

Understanding Scientific Inquiry

10. Recognize that a variety of tools can be used to examine objects at different degrees of magnification (e.g., hand lens, microscope) (SI-E-B3)

Physical Science

Properties of Objects and Materials

11. Identify objects by using the senses (PS-E-A1)
12. Construct patterns by using color, size, and shape of objects (PS-E-A1)
13. Sort objects based on their properties (e.g., size, weight, texture) (PS-E-A1)
14. Determine whether objects are magnetic or nonmagnetic (PS-E-A1)
15. Create and separate mixtures (e.g., oil/water, rice/beans) (PS-E-A5)

Position and Motion of Objects

16. Follow directions using vocabulary such as *front/back*, *above/below*, *right/left*, and *next to* (PS-E-B1)
17. Trace the motion of an object, such as a ball or toy car, as it rolls (PS-E-B3)
18. Sequence the relative order of the speed of various objects (e.g., snails, turtles, tricycles, bicycles, cars, airplanes) (PS-E-B3)

Forms of Energy

19. Demonstrate and identify sounds as *soft* or *loud* (PS-E-C1)
20. Identify objects that give off heat, such as people, animals, and the Sun (PS-E-C3)

Life Science

Characteristics of Organisms

21. Record observations on the growth of plant seeds (LS-E-A1)
22. Classify objects in a variety of settings as *living (biotic)* or *nonliving (abiotic)* (LS-E-A2)
23. Compare the human body at various stages of development (LS-E-A3)
24. Compare the human body with plants and animals (LS-E-A3)
25. Identify easily observable variations within types of plants and animals (e.g., features of classmates, varieties of trees, breeds of dogs) (LS-E-A4)
26. Classify various foods into the major groups (e.g., bread, meat, vegetable, fruit) (LS-E-A6)
27. Determine which foods are superior for developing a healthy body (LS-E-A6)

Life Cycles of Organisms

28. Observe life cycles and describe changes (e.g., humans, dogs, insects) (LS-E-B1)
29. Match models of baby animals with their parents (LS-E-B3)

Earth and Space Science

Properties of Earth Materials

30. Distinguish between areas of Earth covered by land and water (ESS-E-A2)
31. Identify the patterns in information recorded on a weather calendar (ESS-E-A4)

Objects in the Sky

32. Discuss and differentiate objects seen in the day and/or night sky (e.g., clouds, Sun, stars, Moon) (ESS-E-B1)

Science
Grade-Level Expectations

Elementary
Grade 1

Science as Inquiry
The Abilities to Do Scientific Inquiry

1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
2. Pose questions that can be answered by using students' own observations and scientific knowledge (SI-E-A1)
3. Predict and anticipate possible outcomes (SI-E-A2)
4. Use a variety of methods and materials and multiple trials to investigate ideas (observe, measure, accurately record data) (SI-E-A2)
5. Use the five senses to describe observations (SI-E-A3)
6. Measure and record length and temperature in both metric system and U.S. system units (SI-E-A4)
7. Select and use developmentally appropriate equipment and tools and units of measurement to observe and collect data (SI-E-A4)
8. Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps, and oral and written explanations as appropriate (SI-E-A5) (SI-E-B4)
9. Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) (SI-E-A6)
10. Identify and use appropriate safety procedures and equipment when conducting investigations (e.g., gloves, goggles, hair ties) (SI-E-A7)

Understanding Scientific Inquiry

11. Recognize that a variety of tools can be used to examine objects at different degrees of magnification (e.g., hand lens, microscope) (SI-E-B3)
12. Explain and give examples of how scientific discoveries have affected society (SI-E-B6)

Physical Science
Properties of Objects and Materials

13. Sort a group of objects by using multiple characteristics (PS-E-A1)
14. Order objects by weight/mass (PS-E-A1)
15. Measure length and width of a variety of objects and materials by using nonstandard tools, such as a paper clip, cube, shoe, and hands (PS-E-A2)
16. Observe and describe common properties of solids, liquids, and gases (PS-E-A4)
17. Sort and classify objects by their state of matter (PS-E-A4)

Forms of Energy

18. Demonstrate how sound is made in a variety of ways (e.g., singing, whispering, striking an object) (PS-E-C1)
19. Describe and demonstrate the volume of sound (e.g., soft, loud) (PS-E-C1)
20. Use a flashlight and various objects and materials to determine if light is transmitted or reflected (PS-E-C2)
21. Demonstrate that light can be reflected onto another object by using a mirror (PS-E-C2)
22. Identify some examples where heat is released (e.g., burning candles, rubbing hands, running) (PS-E-C3)
23. Identify materials attracted by magnets (PS-E-C5)

24. Determine, through experimentation, which poles of magnets are attracted to each other and which poles repel each other (PS-E-C5)
25. Discuss what type of energy makes objects work (e.g., car/gasoline, waterwheel/water, lamp/electricity) (PS-E-C6) (PS-E-C7)

Life Science
Characteristics of Organisms
26. Describe the differences between plants and animals (LS-E-A1)
27. Identify what animals and plants need to grow and develop (LS-E-A1)
28. Describe the characteristics of *living (biotic)* and *nonliving (abiotic)* things (LS-E-A2)
29. Describe basic functions of parts of the body (e.g., lungs, heart, bones, muscles) (LS-E-A3)

Life Cycles of Organisms
30. Record and share observations of changes in developing plants (LS-E-B1)
31. Describe how animals and their offspring are similar and how they are different (LS-E-B3)

Organisms and Their Environments
32. Describe features of some animals that benefit them in their environments (LS-E-C1)
33. Explain how pets' needs are met in their habitats (LS-E-C1)
34. Record evidence of plants and animals in the schoolyard or other environments (LS-E-C2)

Earth and Space Science
Properties of Earth Materials
35. Examine soils to determine that they are often found in layers (ESS-E-A1)
36. Locate and compare the relative proportions of land and water found on Earth (ESS-E-A2)
37. Illustrate how water changes from one form to another (e.g., freezing, melting, evaporating) (ESS-E-A3)
38. Compare weather patterns as they relate to seasonal changes in students' immediate environment (ESS-E-A4)
39. Identify the characteristics of soil, according to color, texture, and components, including *living (biotic)* and *nonliving (abiotic)* substances (ESS-E-A6)

Grade 2

Science as Inquiry
The Abilities to Do Scientific Inquiry
1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
2. Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
3. Use observations to design and conduct simple investigations or experiments to answer testable questions (SI-E-A2)
4. Predict and anticipate possible outcomes (SI-E-A2)
5. Use a variety of methods and materials and multiple trials to investigate ideas (observe, measure, accurately record data) (SI-E-A2)
6. Use the five senses to describe observations (SI-E-A3)

7. Measure and record length and temperature in both metric system and U.S. system units (SI-E-A4)
8. Select and use developmentally appropriate equipment and tools (e.g., magnifying lenses, graduated cylinders) and units of measurement to observe and collect data (SI-E-A4)
9. Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps, and oral and written explanations as appropriate (SI-E-A5) (SI-E-B4)
10. Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) (SI-E-A6)
11. Identify and use appropriate safety procedures and equipment when conducting investigations (e.g., gloves, goggles, hair ties) (SI-E-A7)

Understanding Scientific Inquiry

12. Recognize that a variety of tools can be used to examine objects at different degrees of magnification (e.g., hand lens, microscope) (SI-E-B3)
13. Explain and give examples of how scientific discoveries have affected society (SI-E-B6)

Physical Science

Properties of Objects and Materials

14. Classify objects as *bendable* or *rigid* (PS-E-A1)
15. Record the temperature of objects (Celsius and Fahrenheit) (PS-E-A1)
16. Measure weight/mass and volume of a variety of objects and materials by using a pan balance and various containers (PS-E-A2)
17. Use standard tools to measure objects or materials (e.g., ruler, meter stick, measuring tape, pan balance, thermometer, graduated cylinder) (PS-E-A2)
18. Observe, describe, and record the characteristics of materials that make up different objects (e.g., metal, nonmetal, plastic, rock, wood, paper) (PS-E-A3)
19. Describe and illustrate what remains after water evaporates from a salt or sugar solution (PS-E-A5)

Position and Motion of Objects

20. Observe and describe differences in motion between objects (e.g., toward/away, cardinal directions) (PS-E-B3)

Forms of Energy

21. Use students' own voices to demonstrate pitch (e.g., low, high) (PS-E-C1)
22. Give examples of objects that vibrate to produce sound (e.g., drum, stringed instrument, end of a ruler, cymbal) (PS-E-C1)
23. Change the direction of light by using a mirror and/or lens (PS-E-C2)
24. Describe how light behaves when it strikes objects and materials (e.g., transparent, translucent, opaque) (PS-E-C2)
25. Investigate ways of producing static electricity and describe its effects (PS-E-C4)
26. Identify and describe sources of energy used at school, home, and play (PS-E-C7)

Life Science

Characteristics of Organisms

27. Match the appropriate food source and habitat for a variety of animals (e.g., cows/grass/field, fish/tadpoles/water) (LS-E-A1)
28. Describe structures of plants (e.g., roots, leaves, stems, flowers, seeds) (LS-E-A3)

29. Compare differences and similarities among a variety of seed plants (LS-E-A3)
30. Identify physical characteristics of organisms (e.g., worms, amphibians, plants) (LS-E-A4)
31. Identify and discuss the arrangement of the food pyramid (LS-E-A6)
32. Analyze selected menus to determine whether they include representatives of all the required food groups (LS-E-A6)

Life Cycles of Organisms

33. Compare the life cycles of selected organisms (e.g., mealworm, caterpillar, tadpole) (LS-E-B1)
34. Describe inherited characteristics of living things (LS-E-B3)

Organisms and Their Environments

35. Identify the components of a variety of habitats and describe how organisms in those habitats depend on each other (LS-E-C1)

Earth and Space Science
Properties of Earth Materials

36. Observe and record the properties of rocks, minerals, and soils gathered from their surroundings (e.g., color, texture, odor) (ESS-E-A1)
37. Compare bodies of water found on Earth (e.g., oceans, seas, lakes, rivers, glaciers) (ESS-E-A2)
38. Explain why most of the water on Earth cannot be used as drinking (potable) water (ESS-E-A2)
39. Design an experiment involving evaporation (ESS-E-A3)
40. Gather, record, and graph weather data (e.g., precipitation, wind speed, wind direction, temperature) using appropriate instruments (ESS-E-A4)
41. Analyze recorded daily temperatures and weather conditions from newspapers, television, the Internet, and home/outdoor thermometers (ESS-E-A4)
42. Identify and use appropriate tools to gather and study rocks, minerals, and fossils (ESS-E-A5)

Objects in the Sky

43. Describe characteristics of the Sun, stars, and Earth's moon (e.g., relative size, shape, color, production of light/heat) (ESS-E-B1)
44. Give examples of how the Sun affects Earth's processes (e.g., weather, water cycle) (ESS-E-B5)

Science and the Environment

45. Locate and identify plants and animals within an ecosystem (SE-E-A2)
46. Illustrate and describe a simple food chain located within an ecosystem (SE-E-A2)
47. Identify the Sun as the primary energy source in a food chain (SE-E-A2)
48. Describe a variety of activities related to preserving the environment (SE-E-A3)
49. Describe how consumption of resources can be reduced by recycling, reusing, and conserving (SE-E-A4)
50. Describe ways in which habitat loss or change can occur as a result of natural events or human impact (SE-E-A5)
51. Describe and give examples of threatened or endangered species (SE-E-A5)

Science
Grade-Level Expectations

Grade 3

Science as Inquiry
The Abilities to Do Scientific Inquiry

1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
2. Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
3. Use observations to design and conduct simple investigations or experiments to answer testable questions (SI-E-A2)
4. Predict and anticipate possible outcomes (SI-E-A2)
5. Use a variety of methods and materials and multiple trials to investigate ideas (observe, measure, accurately record data) (SI-E-A2)
6. Use the five senses to describe observations (SI-E-A3)
7. Measure and record length, temperature, mass, volume, and area in both metric system and U.S. system units (SI-E-A4)
8. Select and use developmentally appropriate equipment and tools (e.g., magnifying lenses, microscopes, graduated cylinders) and units of measurement to observe and collect data (SI-E-A4)
9. Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps, and oral and written explanations as appropriate (SI-E-A5) (SI-E-B4)
10. Combine information, data, and knowledge from one or more of the science content areas to reach a conclusion or make a prediction (SI-E-A5)
11. Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) (SI-E-A6)
12. Identify and use appropriate safety procedures and equipment when conducting investigations (e.g., gloves, goggles, hair ties) (SI-E-A7)

Understanding Scientific Inquiry

13. Identify questions that need to be explained through further inquiry (SI-E-B1)
14. Distinguish between what is known and what is unknown in scientific investigations (SI-E-B1)
15. Recognize that a variety of tools can be used to examine objects at different degrees of magnification (e.g., hand lens, microscope) (SI-E-B3)
16. Describe procedures and communicate data in a manner that allows others to understand and repeat an investigation or experiment (SI-E-B5)
17. Explain and give examples of how scientific discoveries have affected society (SI-E-B6)

Physical Science
Properties of Objects and Materials

18. Compare and classify objects on properties determined through experimentation (e.g., ability to conduct electricity, tendency to float or sink in water) (PS-E-A1)
19. Select the appropriate metric system and U.S. system tools for measuring length, width, temperature, volume, and mass (PS-E-A2)
20. Measure temperature by using Fahrenheit and Celsius thermometers and compare results (PS-E-A2)
21. Compare common objects and identify the original material from which they are made (e.g., paper, pencil, comb) (PS-E-A3)

22. Investigate and explain conditions under which matter changes physical states: heating, freezing, evaporating, condensing, boiling (PS-E-A4)

Position and Motion of Objects

23. Demonstrate how force is a *push* or a *pull* by using students' bodies, toy cars, or balls (PS-E-B2)
24. Explain how the amount and direction of force exerted on an object (e.g., push, pull, friction, gravity) determine how much the object will move (PS-E-B2)
25. Observe and analyze motion and position of objects over time (e.g., shadows, apparent path of the Sun across the sky) (PS-E-B3)
26. Explain the effect of varying amounts of force on the motion of an object (PS-E-B4)

Forms of Energy

27. Use the words *high/low* to compare the pitch of sound and the words *loud/soft* to compare the volume (amplitude) of sound (PS-E-C1)
28. Describe the reflection/absorption properties of various colored objects (PS-E-C2)
29. Determine which materials insulate best by using experimental data (PS-E-C3)
30. Demonstrate and explain the movement of electricity in closed and open circuits (PS-E-C4)
31. Compare and describe the common forms of energy and explain how they are used in everyday life (e.g., light, electricity, heat, mechanical) (PS-E-C6)
32. Give examples of how energy can be used to move or lift objects (PS-E-C6)
33. Identify simple machines and the tasks they make possible (PS-E-C6)

Life Science
Characteristics of Organisms

34. Describe what the human body needs to grow and be healthy (LS-E-A1)
35. Compare structures (parts of the body) in a variety of animals (e.g., fish, mammals, reptiles, amphibians, birds, insects) (LS-E-A3)
36. Compare structures (e.g., roots, leaves, stems, flowers, seeds) and their functions in a variety of plants (LS-E-A3)
37. Describe how plant structures enable the plant to meet its basic needs (LS-E-A3)
38. Classify groups of organisms based on common characteristics (LS-E-A4)
39. Compare organisms from different groups (e.g., birds with mammals, terrestrial plants with aquatic plants) (LS-E-A4)
40. Explain how the organs of the digestive system function (LS-E-A5)
41. Describe how the components of the skeletal system function (LS-E-A5)
42. Describe the relationship between eating habits and maintaining a healthy body (LS-E-A6)
43. Identify a meal that includes representatives from each group of the food pyramid (LS-E-A6)

Life Cycles of Organisms

44. Graph, analyze, and interpret personal and class data (LS-E-B4)

Earth and Space Science
Properties of Earth Materials

45. Recognize and describe that rock is composed of different combinations of minerals (ESS-E-A1) (ESS-E-A5)
46. Describe earth processes that have affected selected physical features in students' neighborhoods (e.g., rusting, weathering, erosion) (ESS-E-A1)

47. Describe the difference between weather and climate (ESS-E-A2)
48. Identify examples of the processes of a water cycle (e.g., evaporation, condensation, precipitation, collection of runoff) (ESS-E-A3)
49. Describe climate patterns from recorded weather conditions over a period of time (ESS-E-A4)
50. Compare and group common rocks according to their characteristics (i.e., igneous, metamorphic, sedimentary) (ESS-E-A5)
51. Identify and compare the components found in soil (ESS-E-A6) (ESS-E-A1)
52. Identify characteristics of selected fossils and explain how fossil records are used to learn about the past (ESS-E-A7)

Objects in the Sky

53. Identify, in order, the planets of the solar system (ESS-E-B1)
54. Describe the patterns of apparent change in the position of the Sun (ESS-E-B2)
55. Explain the results of the rotation and revolution of Earth (e.g., day and night, year) (ESS-E-B4)
56. Compare shadow direction and length at different times of day and year (ESS-E-B4)

Science and the Environment

57. Describe the interrelationships of *living (biotic)* and *nonliving (abiotic)* components within various ecosystems (e.g., terrarium, swamp, backyard) (SE-E-A1)
58. Describe how humans have had negative and positive effects on organisms and their environments (SE-E-A3) (SE-E-A5)
59. Classify manufactured products according to the natural resources from which they are made (e.g., copper wire from copper ore, plastic from petroleum) (SE-E-A4)
60. Explain how renewable and nonrenewable resources can be replenished or depleted (SE-E-A4)
61. Explain how selected animals once classified as endangered have recovered (SE-E-A5)
62. Identify animals in Louisiana that have recovered and that are no longer considered endangered (SE-E-A5)

Grade 4

Science as Inquiry
The Abilities to Do Scientific Inquiry

1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
2. Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
3. Use observations to design and conduct simple investigations or experiments to answer testable questions (SI-E-A2)
4. Predict and anticipate possible outcomes (SI-E-A2)
5. Identify variables to ensure that only one experimental variable is tested at a time (SI-E-A2)
6. Use a variety of methods and materials and multiple trials to investigate ideas (observe, measure, accurately record data) (SI-E-A2)
7. Use the five senses to describe observations (SI-E-A3)
8. Measure and record length, temperature, mass, volume, and area in both metric system and U.S. system units (SI-E-A4)

9. Select and use developmentally appropriate equipment and tools (e.g., magnifying lenses, microscopes, graduated cylinders) and units of measurement to observe and collect data (SI-E-A4)
10. Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps, and oral and written explanations as appropriate (SI-E-A5) (SI-E-B4)
11. Combine information, data, and knowledge from one or more of the science content areas to reach a conclusion or make a prediction (SI-E-A5)
12. Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) (SI-E-A6)
13. Identify and use appropriate safety procedures and equipment when conducting investigations (e.g., gloves, goggles, hair ties) (SI-E-A7)

Understanding Scientific Inquiry

14. Identify questions that need to be explained through further inquiry (SI-E-B1)
15. Distinguish between what is known and what is unknown in scientific investigations (SI-E-B1)
16. Select the best experimental design to answer a given testable question (SI-E-B2)
17. Recognize that a variety of tools can be used to examine objects at different degrees of magnification (e.g., hand lens, microscope) (SI-E-B3)
18. Base explanations and logical inferences on scientific knowledge, observations, and scientific evidence (SI-E-B4)
19. Describe procedures and communicate data in a manner that allows others to understand and repeat an investigation or experiment (SI-E-B5)
20. Determine whether further investigations are needed to draw valid conclusions (SI-E-B6)
21. Use evidence from previous investigations to ask additional questions and to initiate further explorations (SI-E-B6)
22. Explain and give examples of how scientific discoveries have affected society (SI-E-B6)

Physical Science

Properties of Objects and Materials

23. Determine linear, volume, and weight/mass measurements by using both metric system and U.S. system units to compare the results (PS-E-A2)
24. Illustrate how heating/cooling affects the motion of small particles in different phases of matter (PS-E-A4)
25. Describe various methods to separate mixtures (e.g., evaporation, condensation, filtration, magnetism) (PS-E-A5)

Position and Motion of Objects

26. Measure, record, and graph changes in position over time (e.g., speed of cars, ball rolling down inclined plane) (PS-E-B3)
27. Describe how the amount of force needed to cause an object to change its motion depends on the mass of the object (PS-E-B4)

Forms of Energy

28. Explain the relationship between volume (amplitude) of sound and energy required to produce the sound (PS-E-C1)
29. Compare the rates at which sound travels through solids, liquids, and gases (PS-E-C1)

30. Explain the relationship between frequency (rate of vibration) and pitch (PS-E-C1)
31. Diagram what happens to white light as it passes through a prism (PS-E-C2)
32. Describe how light bends or refracts when traveling through various materials (e.g., pencil in a glass of water) (PS-E-C2)
33. Describe how heat energy moves through a material by conduction (PS-E-C3)
34. Give examples of ways heat can be generated through friction (e.g., rubbing hands) (PS-E-C3)
35. Give examples of ways heat can be produced by conversion from other sources of energy (PS-E-C3)
36. Test and classify materials as *conductors* and *insulators* of electricity (PS-E-C4)
37. Demonstrate how a complete circuit is needed for conducting electricity (PS-E-C4)
38. Explain the effects of Earth's gravity on all objects at or near the surface of Earth (PS-E-C5)
39. Describe energy transformations (e.g., electricity to light, friction to heat) (PS-E-C6)

Life Science
Characteristics of Organisms

40. Explain the functions of plant structures in relation to their ability to make food through photosynthesis (e.g., roots, leaves, stems, flowers, seeds) (LS-E-A3)
41. Describe how parts of animals' bodies are related to their functions and survival (e.g., wings/flying, webbed feet/swimming) (LS-E-A3)
42. Describe how the organs of the circulatory and respiratory systems function (LS-E-A5)
43. Explain the primary role of carbohydrates, fats, and proteins in the body (LS-E-A6)
44. Analyze food labels to compare nutritional content of foods (e.g., amounts of carbohydrates, fats, proteins) (LS-E-A6)

Life Cycles of Organisms

45. Identify reproductive structures in plants and describe the functions of each (LS-E-B1)
46. Describe how some plants can be grown from a plant part instead of a seed (LS-E-B1)
47. Sequence stages in the life cycles of various organisms, including seed plants (LS-E-B1)
48. Classify examples of plants and animals based on a variety of criteria (LS-E-B2)
49. Compare similarities and differences between parents and offspring in plants and animals (LS-E-B3)

Organisms and Their Environments

50. Explain how some organisms in a given habitat compete for the same resources (LS-E-C1)
51. Describe how organisms can modify their environment to meet their needs (e.g., beavers making dams) (LS-E-C1)
52. Describe how some plants and animals have adapted to their habitats (LS-E-C2)
53. Identify the habitat in which selected organisms would most likely live and explain how specific structures help organisms to survive (LS-E-C2)
54. Describe the effect of sudden increases or decreases of one group of organisms upon other organisms in the environment (LS-E-C3)

Earth and Space Science
Properties of Earth Materials

55. Recognize that sedimentary rocks are composed of particles that result from weathering and erosion (e.g., sandstones, conglomerates) (ESS-E-A1)
56. Investigate the properties of soil (e.g., color, texture, capacity to retain water, ability to support plant growth) (ESS-E-A1)
57. Explain how unequal heating of Earth's land and water affects climate and weather by using a model (ESS-E-A2)
58. Draw, label, and explain the components of a water cycle (ESS-E-A3)
59. Measure, chart, and predict the weather using various instruments (e.g., thermometer, barometer, anemometer) (ESS-E-A4)
60. Identify various types of weather-related natural hazards and effects (e.g., lightning, storms) (ESS-E-A4)
61. Identify safety measures applicable to natural hazards (ESS-E-A4)
62. Classify rocks and minerals according to texture, color, luster, hardness, and effervescence (ESS-E-A5)
63. Demonstrate and explain how Earth's surface is changed as a result of slow and rapid processes (e.g., sand dunes, canyons, volcanoes, earthquakes) (ESS-E-A5) (ESS-E-A1)

Objects in the Sky

64. Describe and sequence the phases of the Moon and eclipses (ESS-E-B2)
65. Compare a solar and a lunar eclipse (ESS-E-B2)
66. Diagram the movement of the Moon around Earth and the movement of Earth around the Sun (ESS-E-B2)
67. Explain the changing appearance of the Moon and its location in the sky over the course of a month (ESS-E-B3)
68. Identify the relationship between Earth's tilt and revolution and the seasons (ESS-E-B4)
69. Explain how technology has improved our knowledge of the universe (e.g., Hubble telescope, space stations, lunar exploration) (ESS-E-B6)

Science and the Environment

70. Design an ecosystem that includes *living (biotic)* and *nonliving (abiotic)* components and illustrates interdependence (SE-E-A1)
71. Describe and explain food chains/webs and the directional flow of energy in various ecosystems (e.g., construct a model, drawing, diagram, graphic organizer) (SE-E-A2)
72. Predict and describe consequences of the removal of one component in a balanced ecosystem (e.g., consumer, herbivores, nonliving component) (SE-E-A2)

Grade 5

Science as Inquiry
The Abilities to Do Scientific Inquiry

1. Generate testable questions about objects, organisms, and events that can be answered through scientific investigation (SI-M-A1)
2. Identify problems, factors, and questions that must be considered in a scientific investigation (SI-M-A1)
3. Use a variety of sources to answer questions (SI-M-A1)

4. Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)
5. Identify independent variables, dependent variables, and variables that should be controlled in designing an experiment (SI-M-A2)
6. Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)
7. Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)
8. Use consistency and precision in data collection, analysis, and reporting (SI-M-A3)
9. Use computers and/or calculators to analyze and interpret quantitative data (SI-M-A3)
10. Identify the difference between description and explanation (SI-M-A4)
11. Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)
12. Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
13. Identify patterns in data to explain natural events (SI-M-A4)
14. Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)
15. Identify and explain the limitations of models used to represent the natural world (SI-M-A5)
16. Use evidence to make inferences and predict trends (SI-M-A5)
17. Recognize that there may be more than one way to interpret a given set of data, which can result in alternative scientific explanations and predictions (SI-M-A6)
18. Identify faulty reasoning and statements that misinterpret or are not supported by the evidence (SI-M-A6)
19. Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)
20. Write clear, step-by-step instructions that others can follow to carry out procedures or conduct investigations (SI-M-A7)
21. Distinguish between *observations* and *inferences* (SI-M-A7)
22. Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)
23. Use relevant safety procedures and equipment to conduct scientific investigations (SI-M-A8)
24. Provide appropriate care and utilize safe practices and ethical treatment when animals are involved in scientific field and laboratory research (SI-M-A8)

Understanding Scientific Inquiry

25. Compare and critique scientific investigations (SI-M-B1)
26. Use and describe alternate methods for investigating different types of testable questions (SI-M-B1)
27. Recognize that science uses processes that involve a logical and empirical, but flexible, approach to problem solving (SI-M-B1)
28. Recognize that investigations generally begin with a review of the work of others (SI-M-B2)
29. Explain how technology can expand the senses and contribute to the increase and/or modification of scientific knowledge (SI-M-B3)
30. Describe why all questions cannot be answered with present technologies (SI-M-B3)
31. Recognize that there is an acceptable range of variation in collected data (SI-M-B3)

32. Explain the use of statistical methods to confirm the significance of data (e.g., mean, median, mode, range) (SI-M-B3)
33. Evaluate models, identify problems in design, and make recommendations for improvement (SI-M-B4)
34. Recognize the importance of communication among scientists about investigations in progress and the work of others (SI-M-B5)
35. Explain how skepticism about accepted scientific explanations (i.e., hypotheses and theories) leads to new understanding (SI-M-B5)
36. Explain why an experiment must be verified through multiple investigations and yield consistent results before the findings are accepted (SI-M-B5)
37. Critique and analyze their own inquiries and the inquiries of others (SI-M-B5)
38. Explain that, through the use of scientific processes and knowledge, people can solve problems, make decisions, and form new ideas (SI-M-B6)
39. Identify areas in which technology has changed human lives (e.g., transportation, communication, geographic information systems, DNA fingerprinting) (SI-M-B7)
40. Evaluate the impact of research on scientific thought, society, and the environment (SI-M-B7)

Physical Science
Properties and Changes of Properties in Matter

1. Measure a variety of objects in metric system units (PS-M-A1)
2. Compare the physical properties of large and small quantities of the same type of matter (PS-M-A1)
3. Describe the structure of atoms and the electrical charge of protons, neutrons, and electrons (PS-M-A2)
4. Identify the physical and chemical properties of various substances and group substances according to their observable and measurable properties (e.g., conduction, magnetism, light transmission) (PS-M-A3)
5. Describe the properties and behavior of water in its solid, liquid, and gaseous phases (states) (PS-M-A5)
6. Describe new substances formed from common chemical reactions (e.g., burning paper produces ash) (PS-M-A6)

Motions and Forces

7. Compare, calculate, and graph the average speeds of objects in motion using both metric system and U.S. system units (PS-M-B1)
8. Explain that gravity accelerates all falling objects at the same rate in the absence of air resistance (PS-M-B3)
9. Demonstrate a change in speed or direction of an object's motion with the use of unbalanced forces (PS-M-B5)

Transformations of Energy

10. Compare potential and kinetic energy and give examples of each (PS-M-C1)
11. Classify energy resources as *renewable*, *non-renewable*, or *inexhaustible* (PS-M-C1)
12. Identify the Sun as Earth's primary energy source and give examples (e.g., photosynthesis, water cycle) to support that conclusion (PS-M-C3)
13. Investigate how changes in the position of a light source and an object alter the size and shape of the shadow (PS-M-C4)
14. Identify other types of energy produced through the use of electricity (e.g., heat, light, mechanical) (PS-M-C6)

Science
Grade-Level Expectations

Life Science
Structure and Function in Living Systems

15. Identify the cell as the basic unit of living things (LS-M-A1)
16. Observe, identify, and describe the basic components of cells and their functions (e.g., cell wall, cell membrane, cytoplasm, nucleus) (LS-M-A1)
17. Compare plant and animal cells and label cell components (LS-M-A2)
18. Describe the metamorphosis of an amphibian (e.g., frog) (LS-M-A3)
19. Describe the processes of photosynthesis and respiration in green plants (LS-M-A4)
20. Describe the levels of structural organization in living things (e.g., cells, tissues, organs, organ systems) (LS-M-A5)
21. Identify diseases caused by germs and how they can be transmitted from person to person (LS-M-A7)

Populations and Ecosystems

22. Develop and use a simple dichotomous key to classify common plants and animals (LS-M-C1)
23. Construct food chains that could be found in ponds, marshes, oceans, forests, or meadows (LS-M-C2)
24. Describe the roles of producers, consumers, and decomposers in a food chain (LS-M-C2)
25. Compare food chains and food webs (LS-M-C2)
26. Identify and describe ecosystems of local importance (LS-M-C3)
27. Compare common traits of organisms within major ecosystems (LS-M-C3)
28. Explain and give examples of predator/prey relationships (LS-M-C4)

Adaptations of Organisms

29. Describe adaptations of plants and animals that enable them to thrive in local and other natural environments (LS-M-D1)

Earth and Space Science
Structure of the Earth

30. Identify organic and inorganic matter in soil samples with the aid of a hand lens or microscope (ESS-M-A4)
31. Identify common rocks and minerals and explain their uses and economic significance (ESS-M-A5)
32. Demonstrate the results of constructive and destructive forces using models or illustrations (ESS-M-A7)
33. Identify the processes that prevent or cause erosion (ESS-M-A7)
34. Identify the components of the hydrosphere (ESS-M-A11)
35. Identify the atmosphere as a mixture of gases, water vapor, and particulate matter (ESS-M-A11)
36. Identify, describe, and compare climate zones (e.g., polar, temperate, tropical) (ESS-M-A11)
37. Identify typical weather map symbols and the type of weather they represent (ESS-M-A12)

Earth History

38. Estimate the range of time over which natural events occur (e.g., lightning in seconds, mountain formation over millions of years) (ESS-M-B3)

Earth in the Solar System

39. Identify the physical characteristics of the Sun (ESS-M-C1)
40. Describe the significance of Polaris as the North Star (ESS-M-C1)
41. Explain why the Moon, Sun, and stars appear to move from east to west across the sky (ESS-M-C1)
42. Differentiate among moons, asteroids, comets, meteoroids, meteors, and meteorites (ESS-M-C2)
43. Describe the characteristics of the inner and outer planets (ESS-M-C2)
44. Explain rotation and revolution by using models or illustrations (ESS-M-C4)
45. Identify Earth's position in the solar system (ESS-M-C5)
46. Identify and explain the interaction of the processes of the water cycle (ESS-M-C6) (ESS-M-A10)
47. Identify and explain advances in technology that have enabled the exploration of space (ESS-M-C8)

Science and the Environment

48. Determine the ability of an ecosystem to support a population (carrying capacity) by identifying the resources needed by that population (SE-M-A2)
49. Identify and give examples of pollutants found in water, air, and soil (SE-M-A3)
50. Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)
51. Describe naturally occurring cycles and identify where they are found (e.g., carbon, nitrogen, water, oxygen) (SE-M-A7)

Middle School
Grades 5–8

Science as Inquiry

The Abilities Necessary to Do Scientific Inquiry

1. Generate testable questions about objects, organisms, and events that can be answered through scientific investigation (SI-M-A1)
2. Identify problems, factors, and questions that must be considered in a scientific investigation (SI-M-A1)
3. Use a variety of sources to answer questions (SI-M-A1)
4. Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)
5. Identify independent variables, dependent variables, and variables that should be controlled in designing an experiment (SI-M-A2)
6. Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)
7. Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)
8. Use consistency and precision in data collection, analysis, and reporting (SI-M-A3)
9. Use computers and/or calculators to analyze and interpret quantitative data (SI-M-A3)
10. Identify the difference between description and explanation (SI-M-A4)
11. Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)

12. Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
13. Identify patterns in data to explain natural events (SI-M-A4)
14. Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)
15. Identify and explain the limitations of models used to represent the natural world (SI-M-A5)
16. Use evidence to make inferences and predict trends (SI-M-A5)
17. Recognize that there may be more than one way to interpret a given set of data, which can result in alternative scientific explanations and predictions (SI-M-A6)
18. Identify faulty reasoning and statements that misinterpret or are not supported by the evidence (SI-M-A6)
19. Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)
20. Write clear, step-by-step instructions that others can follow to carry out procedures or conduct investigations (SI-M-A7)
21. Distinguish between *observations* and *inferences* (SI-M-A7)
22. Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)
23. Use relevant safety procedures and equipment to conduct scientific investigations (SI-M-A8)
24. Provide appropriate care and utilize safe practices and ethical treatment when animals are involved in scientific field and laboratory research (SI-M-A8)

Understanding Scientific Inquiry

25. Compare and critique scientific investigations (SI-M-B1)
26. Use and describe alternate methods for investigating different types of testable questions (SI-M-B1)
27. Recognize that science uses processes that involve a logical and empirical, but flexible, approach to problem solving (SI-M-B1)
28. Recognize that investigations generally begin with a review of the work of others (SI-M-B2)
29. Explain how technology can expand the senses and contribute to the increase and/or modification of scientific knowledge (SI-M-B3)
30. Describe why all questions cannot be answered with present technologies (SI-M-B3)
31. Recognize that there is an acceptable range of variation in collected data (SI-M-B3)
32. Explain the use of statistical methods to confirm the significance of data (e.g., mean, median, mode, range) (SI-M-B3)
33. Evaluate models, identify problems in design, and make recommendations for improvement (SI-M-B4)
34. Recognize the importance of communication among scientists about investigations in progress and the work of others (SI-M-B5)
35. Explain how skepticism about accepted scientific explanations (i.e., hypotheses and theories) leads to new understanding (SI-M-B5)
36. Explain why an experiment must be verified through multiple investigations and yield consistent results before the findings are accepted (SI-M-B5)
37. Critique and analyze their own inquiries and the inquiries of others (SI-M-B5)
38. Explain that, through the use of scientific processes and knowledge, people can solve problems, make decisions, and form new ideas (SI-M-B6)
39. Identify areas in which technology has changed human lives (e.g., transportation, communication, geographic information systems, DNA fingerprinting) (SI-M-B7)

40. Evaluate the impact of research on scientific thought, society, and the environment (SI-M-B7)

Grade 5

Physical Science

Properties and Changes of Properties in Matter

1. Measure a variety of objects in metric system units (PS-M-A1)
2. Compare the physical properties of large and small quantities of the same type of matter (PS-M-A1)
3. Describe the structure of atoms and the electrical charge of protons, neutrons, and electrons (PS-M-A2)
4. Identify the physical and chemical properties of various substances and group substances according to their observable and measurable properties (e.g., conduction, magnetism, light transmission) (PS-M-A3)
5. Describe the properties and behavior of water in its solid, liquid, and gaseous phases (states) (PS-M-A5)
6. Describe new substances formed from common chemical reactions (e.g., burning paper produces ash) (PS-M-A6)

Motions and Forces

7. Compare, calculate, and graph the average speeds of objects in motion using both metric system and U.S. system units (PS-M-B1)
8. Explain that gravity accelerates all falling objects at the same rate in the absence of air resistance (PS-M-B3)
9. Demonstrate a change in speed or direction of an object's motion with the use of unbalanced forces (PS-M-B5)

Transformations of Energy

10. Compare potential and kinetic energy and give examples of each (PS-M-C1)
11. Classify energy resources as *renewable*, *non-renewable*, or *inexhaustible* (PS-M-C1)
12. Identify the Sun as Earth's primary energy source and give examples (e.g., photosynthesis, water cycle) to support that conclusion (PS-M-C3)
13. Investigate how changes in the position of a light source and an object alter the size and shape of the shadow (PS-M-C4)
14. Identify other types of energy produced through the use of electricity (e.g., heat, light, mechanical) (PS-M-C6)

Life Science

Structure and Function in Living Systems

15. Identify the cell as the basic unit of living things (LS-M-A1)
16. Observe, identify, and describe the basic components of cells and their functions (e.g., cell wall, cell membrane, cytoplasm, nucleus) (LS-M-A1)
17. Compare plant and animal cells and label cell components (LS-M-A2)
18. Describe the metamorphosis of an amphibian (e.g., frog) (LS-M-A3)
19. Describe the processes of photosynthesis and respiration in green plants (LS-M-A4)
20. Describe the levels of structural organization in living things (e.g., cells, tissues, organs, organ systems) (LS-M-A5)
21. Identify diseases caused by germs and how they can be transmitted from person to person (LS-M-A7)

Science
Grade-Level Expectations

Populations and Ecosystems

22. Develop and use a simple dichotomous key to classify common plants and animals (LS-M-C1)
23. Construct food chains that could be found in ponds, marshes, oceans, forests, or meadows (LS-M-C2)
24. Describe the roles of producers, consumers, and decomposers in a food chain (LS-M-C2)
25. Compare food chains and food webs (LS-M-C2)
26. Identify and describe ecosystems of local importance (LS-M-C3)
27. Compare common traits of organisms within major ecosystems (LS-M-C3)
28. Explain and give examples of predator/prey relationships (LS-M-C4)

Adaptations of Organisms

29. Describe adaptations of plants and animals that enable them to thrive in local and other natural environments (LS-M-D1)

Earth and Space Science
Structure of Earth

30. Identify organic and inorganic matter in soil samples with the aid of a hand lens or microscope (ESS-M-A4)
31. Identify common rocks and minerals and explain their uses and economic significance (ESS-M-A5)
32. Demonstrate the results of constructive and destructive forces using models or illustrations (ESS-M-A7)
33. Identify the processes that prevent or cause erosion (ESS-M-A7)
34. Identify the components of the hydrosphere (ESS-M-A11)
35. Identify the atmosphere as a mixture of gases, water vapor, and particulate matter (ESS-M-A11)
36. Identify, describe, and compare climate zones (e.g., polar, temperate, tropical) (ESS-M-A11)
37. Identify typical weather map symbols and the type of weather they represent (ESS-M-A12)

Earth History

38. Estimate the range of time over which natural events occur (e.g., lightning in seconds, mountain formation over millions of years) (ESS-M-B3)

Earth in the Solar System

39. Identify the physical characteristics of the Sun (ESS-M-C1)
40. Describe the significance of Polaris as the North Star (ESS-M-C1)
41. Explain why the Moon, Sun, and stars appear to move from east to west across the sky (ESS-M-C1)
42. Differentiate among moons, asteroids, comets, meteoroids, meteors, and meteorites (ESS-M-C2)
43. Describe the characteristics of the inner and outer planets (ESS-M-C2)
44. Explain rotation and revolution by using models or illustrations (ESS-M-C4)
45. Identify Earth's position in the solar system (ESS-M-C5)
46. Identify and explain the interaction of the processes of the water cycle (ESS-M-C6) (ESS-M-A10)
47. Identify and explain advances in technology that have enabled the exploration of space (ESS-M-C8)

Science and the Environment

48. Determine the ability of an ecosystem to support a population (carrying capacity) by identifying the resources needed by that population (SE-M-A2)
49. Identify and give examples of pollutants found in water, air, and soil (SE-M-A3)
50. Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)
51. Describe naturally occurring cycles and identify where they are found (e.g., carbon, nitrogen, water, oxygen) (SE-M-A7)

Grade 6

Physical Science
Properties and Changes of Properties in Matter

1. Measure and record the volume and mass of substances in metric system units (PS-M-A1)
2. Calculate the density of large and small quantities of a variety of substances (e.g., aluminum foil, water, copper, clay, rock) (PS-M-A1)
3. Construct models that replicate atomic structure for selected common elements from the periodic table (PS-M-A2)
4. Differentiate between the physical and chemical properties of selected substances (PS-M-A3)
5. Compare physical and chemical changes (PS-M-A3)
6. Draw or model the movement of atoms in solid, liquid, and gaseous states (PS-M-A4)
7. Simulate how atoms and molecules have kinetic energy exhibited by constant motion (PS-M-A4)
8. Determine the temperatures at which water changes physical phases (e.g., freezing point, melting point, boiling point) (PS-M-A5)
9. Describe the properties of reactants and products of chemical reactions observed in the lab (PS-M-A6)
10. Identify the average atomic masses of given elements using the periodic table (PS-M-A7)
11. Compare the masses of reactants and products of a chemical reaction (PS-M-A7)
12. Determine the effect of particle size of the same reactants on the rate of chemical reactions during a lab activity (e.g., powdered vs. solid forms) (PS-M-A8)
13. Use a variety of resources to identify elements and compounds in common substances (PS-M-A9)

Motions and Forces

14. Construct and analyze graphs that represent one-dimensional motion (i.e., motion in a straight line) and predict the future positions and speed of a moving object (PS-M-B1)
15. Explain why velocity is expressed in both speed and direction (PS-M-B1)
16. Compare line graphs of acceleration, constant speed, and deceleration (PS-M-B1)
17. Describe and demonstrate that friction is a force that acts whenever two surfaces or objects move past one another (PS-M-B2)
18. Explain how the resistance of materials affects the rate of electrical flow (PS-M-B2)
19. Identify forces acting on all objects (PS-M-B3)
20. Draw and label a diagram to represent forces acting on an object (PS-M-B4)

21. Determine the magnitude and direction of unbalanced (i.e., net) forces acting on an object (PS-M-B4)
22. Demonstrate that an object will remain at rest or move at a constant speed and in a straight line if it is not subjected to an unbalanced force (PS-M-B5) (PS-M-B3)
23. Predict the direction of a force applied to an object and how it will change the speed and direction of the object (PS-M-B5)

Transformations of Energy

24. Describe and give examples of how all forms of energy may be classified as potential or kinetic energy (PS-M-C1)
25. Compare forms of energy (e.g., light, heat, sound, electrical, nuclear, mechanical) (PS-M-C1)
26. Describe and summarize observations of the transmission, reflection, and absorption of sound, light, and heat energy (PS-M-C1)
27. Explain the relationship between work input and work output by using simple machines (PS-M-C2)
28. Explain the law of conservation of energy (PS-M-C2)
29. Compare and/or investigate the relationships among work, power, and efficiency (PS-M-C2)
30. Trace energy transformations in a simple system (e.g., flashlight) (PS-M-C2)
31. Compare types of electromagnetic waves (PS-M-C3)
32. Identify and illustrate key characteristics of waves (e.g., wavelength, frequency, amplitude) (PS-M-C4)
33. Predict the direction in which light will refract when it passes from one transparent material to another (e.g., from air to water, from prism to air) (PS-M-C4)
34. Apply the law of reflection and law of refraction to demonstrate everyday phenomena (e.g., how light is reflected from tinted windows, how light is refracted by cameras, telescopes, eyeglasses) (PS-M-C4)
35. Determine through experimentation whether light is reflected, transmitted, and/or absorbed by a given object or material (PS-M-C4)
36. Explain the relationship between an object's color and the wavelength of light reflected or transmitted to the viewer's eyes (PS-M-C4)
37. Compare how heat is transferred by conduction, convection, and radiation (PS-M-C5)
38. Identify conditions under which thermal energy tends to flow from a system of higher energy to a system of lower energy (PS-M-C5)
39. Describe how electricity can be produced from other types of energy (e.g., magnetism, solar, mechanical) (PS-M-C6)
40. Identify heat energy gains and losses during exothermic and endothermic chemical reactions (PS-M-C7)
41. Identify risks associated with the production and use of coal, petroleum, hydroelectricity, nuclear energy, and other energy forms (PS-M-C8)

Science and the Environment

42. Identify energy types from their source to their use and determine if the energy types are renewable, nonrenewable, or inexhaustible (SE-M-A6)
43. Explain how the use of different energy resources affects the environment and the economy (SE-M-A6)
44. Explain how an inexhaustible resource can be harnessed for energy production (SE-M-A6)
45. Describe methods for sustaining renewable resources (SE-M-A6)

46. Identify ways people can reuse, recycle, and reduce the use of resources to improve and protect the quality of life (SE-M-A6)
47. Illustrate how various technologies influence resource use in an ecosystem (e.g., forestry management, soil conservation, fishery improvement) (SE-M-A8)

Grade 7

Physical Science
Properties and Changes of Properties in Matter

1. Identify the elements most often found in living organisms (e.g., C, N, H, O, P, S, Ca, Fe) (PS-M-A9)

Life Science
Structure and Function in Living Systems

2. Compare the basic structures and functions of different types of cells (LS-M-A1)
3. Illustrate and demonstrate osmosis and diffusion in cells (LS-M-A1)
4. Compare functions of plant and animal cell structures (i.e., organelles) (LS-M-A2)
5. Compare complete and incomplete metamorphosis in insects (e.g., butterflies, mealworms, grasshoppers) (LS-M-A3)
6. Compare the life cycles of a variety of organisms, including non-flowering and flowering plants, reptiles, birds, amphibians, and mammals (LS-M-A3)
7. Construct a word equation that illustrates the processes of photosynthesis and respiration (LS-M-A4)
8. Distinguish between *aerobic* respiration and *anaerobic* respiration (LS-M-A4)
9. Relate structural features of organs to their functions in major systems (LS-M-A5)
10. Describe the way major organ systems in the human body interact to sustain life (LS-M-A5)
11. Describe the growth and development of humans from infancy to old age (LS-M-A6)
12. Explain how external factors and genetics can influence the quality and length of human life (e.g., nutrition, smoking, drug use, exercise) (LS-M-A6)
13. Identify and describe common communicable and noncommunicable diseases and the methods by which they are transmitted, treated, and prevented (LS-M-A7)

Reproduction and Heredity

14. Differentiate between sexual and asexual reproduction (LS-M-B1)
15. Contrast the processes of mitosis and meiosis in relation to growth, repair, reproduction, and heredity (LS-M-B1)
16. Explain why chromosomes in body cells exist in pairs (LS-M-B2)
17. Explain the relationship of genes to chromosomes and genotypes to phenotypes (LS-M-B2)
18. Recognize genetic errors caused by changes in chromosomes (LS-M-B2)
19. Apply the basic laws of Mendelian genetics to solve simple monohybrid crosses, using a Punnett square (LS-M-B3)
20. Explain the differences among the inheritance of dominant, recessive, and incomplete dominant traits (LS-M-B3)
21. Use a Punnett square to demonstrate how sex-linked traits are inherited (LS-M-B3)
22. Give examples of the importance of selective breeding (e.g., domestic animals, livestock, horticulture) (LS-M-B3)

Populations and Ecosystems

23. Classify organisms based on structural characteristics, using a dichotomous key (LS-M-C1)
24. Analyze food webs to determine energy transfer among organisms (LS-M-C2)
25. Locate and describe the major biomes of the world (LS-M-C3)
26. Describe and compare the levels of organization of living things within an ecosystem (LS-M-C3)
27. Identify the various relationships among plants and animals (e.g., mutualistic, parasitic, producer/consumer) (LS-M-C4)
28. Differentiate between ecosystem components of habitat and niche (LS-M-C4)
29. Predict the impact changes in a species' population have on an ecosystem (LS-M-C4)

Adaptations of Organisms

30. Differentiate between structural and behavioral adaptations in a variety of organisms (LS-M-D1)
31. Describe and evaluate the impact of introducing nonnative species into an ecosystem (LS-M-D1)
32. Describe changes that can occur in various ecosystems and relate the changes to the ability of an organism to survive (LS-M-D2)
33. Illustrate how variations in individual organisms within a population determine the success of the population (LS-M-D2)
34. Explain how environmental factors impact survival of a population (LS-M-D2)

Science and the Environment

35. Identify resources humans derive from ecosystems (SE-M-A1)
36. Distinguish the essential roles played by biotic and abiotic components in various ecosystems (SE-M-A1)
37. Identify and describe the effects of limiting factors on a given population (SE-M-A2)
38. Evaluate the carrying capacity of an ecosystem (SE-M-A2)
39. Analyze the consequences of human activities on ecosystems (SE-M-A4)
40. Construct or draw food webs for various ecosystems (SE-M-A5)
41. Describe the nitrogen cycle and explain why it is important for the survival of organisms (SE-M-A7)
42. Describe how photosynthesis and respiration relate to the carbon cycle (SE-M-A7)
43. Identify and analyze the environmental impact of humans' use of technology (e.g., energy production, agriculture, transportation, human habitation) (SE-M-A8)

Grade 8

Physical Science
Properties and Changes of Properties in Matter

1. Determine that all atoms of the same element are similar to but different from atoms of other elements (PS-M-A2)
2. Recognize that elements with the same number of protons may or may not have the same charge (PS-M-A2)
3. Define ions and describe them in terms of the number of protons, electrons, and their charges (PS-M-A2)

Science
Grade-Level Expectations

Motions and Forces

4. Demonstrate that Earth has a magnetic field by using magnets and compasses (PS-M-B2)
5. Define gravity and describe the relationship among the force of gravity, the mass of objects, and the distance between objects (PS-M-B2)
6. Predict how the gravitational attraction between two masses will increase or decrease when changes are made in the masses or in the distance between the objects (PS-M-B2)
7. Explain the relationships among force, mass, and acceleration (PS-M-B5)

Earth and Space Science
Structure of Earth

8. Identify and describe the four density layers of Earth (ESS-M-A1)
9. Explain the historical development of the theories of plate tectonics, including continental drift and sea-floor spreading (ESS-M-A2)
10. Illustrate the movement of convection currents (ESS-M-A2)
11. Illustrate the movements of lithospheric plates as stated in the plate tectonics theory (ESS-M-A2)
12. Identify the edges of plate boundaries as likely areas of earthquakes and volcanic action (ESS-M-A3)
13. Describe the processes responsible for earthquakes and volcanoes and identify the effects of these processes (e.g., faulting, folding) (ESS-M-A3)
14. Distinguish between chemical and mechanical (physical) weathering and identify the role of weathering agents (e.g., wind, water, ice, gravity) (ESS-M-A4)
15. Illustrate the role of organic processes in soil formation (ESS-M-A4)
16. Compare the physical characteristics of rock and mineral specimens to observe that a rock is a mixture of minerals (ESS-M-A5)
17. Describe the properties of minerals (e.g., color, luster, hardness, streak) (ESS-M-A5)
18. Describe how sedimentary, igneous, and metamorphic rocks form and change in the rock cycle (ESS-M-A6)
19. Determine the results of constructive and destructive forces upon landform development with the aid of geologic maps of Louisiana (ESS-M-A7)
20. Describe how humans' actions and natural processes have modified coastal regions in Louisiana and other locations (ESS-M-A8)
21. Read and interpret topographic maps (ESS-M-A9)
22. Compare ocean floor topography to continental topography by using topographic maps (ESS-M-A9)
23. Explain the processes of evaporation, condensation, precipitation, infiltration, transpiration, and sublimation as they relate to the water cycle (ESS-M-A10)
24. Investigate and explain how given factors affect the rate of water movement in the water cycle (e.g., climate, type of rock, ground cover) (ESS-M-A10)
25. Explain and give examples of how climatic conditions on Earth are affected by the proximity of water (ESS-M-A11)
26. Describe and illustrate the layers of Earth's atmosphere (ESS-M-A11)
27. Identify different air masses, jet streams, global wind patterns, and other atmospheric phenomena and describe how they relate to weather events, such as El Niño and La Niña (ESS-M-A12)
28. Use historical data to plot the movement of hurricanes and explain events or conditions that affected their paths (ESS-M-A12)
29. Make predictions about future weather conditions based on collected weather data (ESS-M-A12)

Earth History

30. Interpret a geologic timeline (ESS-M-B1)
31. Compare fossils from different geologic eras and areas of Earth to show that life changes over time (ESS-M-B1)
32. Interpret a timeline starting with the birth of the solar system to the present day (ESS-M-B2)
33. Use historical data to draw conclusions about the age of Earth (e.g., half-life, rock strata) (ESS-M-B2)
34. Apply geological principles to determine the relative ages of rock layers (e.g., original horizontality, superposition, cross-cutting relationships) (ESS-M-B3)
35. Describe how processes seen today are similar to those in the past (e.g., weathering, erosion, lithospheric plate movement) (ESS-M-B3)

Earth in the Solar System

36. Describe the life cycle of a star and predict the next likely stage of the Sun (ESS-M-C1)
37. Use a Hertzsprung-Russell diagram and other data to compare the approximate mass, size, luminosity, temperature, structure, and composition of the Sun to other stars (ESS-M-C1)
38. Use data to compare the planets in terms of orbit, size, composition, density, rotation, revolution, and atmosphere (ESS-M-C2)
39. Relate Newton's laws of gravity to the motions of celestial bodies and objects on Earth (ESS-M-C3)
40. Identify and illustrate the relative positions of Earth, the Moon, and the Sun during eclipses and phases of the Moon (ESS-M-C4)
41. Describe the effects of the Moon on tides (ESS-M-C4)
42. Interpret a scale model of the solar system (ESS-M-C5)
43. Identify the processes involved in the creation of land and sea breezes (ESS-M-C6)
44. Describe how unequal heating of Earth's surface affects movement of air masses and water in the atmosphere and hydrosphere (ESS-M-C6)
45. Explain how seasonal changes are caused by the tilt of Earth as it rotates on its axis and revolves around the Sun (ESS-M-C7)
46. Illustrate and explain how the angle at which sunlight strikes Earth produces changes in the seasons and length of daylight (ESS-M-C7)
47. Compare the relative distances from Earth to the Sun on the first day of summer and the first day of winter (ESS-M-C7)
48. Communicate ways that information from space exploration and technological research have advanced understanding about Earth, the solar system, and the universe (ESS-M-C8)
49. Identify practical applications of technological advances resulting from space exploration and scientific and technological research (ESS-M-C8)

Science and the Environment

50. Illustrate possible point and non-point source contributions to pollution and natural or human-induced pathways of a pollutant in an ecosystem (SE-M-A3)
51. Analyze the consequences of human activities on global Earth systems (SE-M-A4)
52. Describe the relationship between plant type and soil compatibility (SE-M-A9)
53. Distinguish among several examples of erosion (e.g., stream bank, topsoil, coastal) and describe common preventive measures (SE-M-A10)

Science
Grade-Level Expectations

High School
Grades 9–12

Science as Inquiry
The Abilities Necessary to Do Scientific Inquiry

1. Write a testable question or hypothesis when given a topic (SI-H-A1)
2. Describe how investigations can be observation, description, literature survey, classification, or experimentation (SI-H-A2)
3. Plan and record step-by-step procedures for a valid investigation, select equipment and materials, and identify variables and controls (SI-H-A2)
4. Conduct an investigation that includes multiple trials and record, organize, and display data appropriately (SI-H-A2)
5. Utilize mathematics, organizational tools, and graphing skills to solve problems (SI-H-A3)
6. Use technology when appropriate to enhance laboratory investigations and presentations of findings (SI-H-A3)
7. Choose appropriate models to explain scientific knowledge or experimental results (e.g., objects, mathematical relationships, plans, schemes, examples, role-playing, computer simulations) (SI-H-A4)
8. Give an example of how new scientific data can cause an existing scientific explanation to be supported, revised, or rejected (SI-H-A5)
9. Write and defend a conclusion based on logical analysis of experimental data (SI-H-A6) (SI-H-A2)
10. Given a description of an experiment, identify appropriate safety measures (SI-H-A7)

Understanding Scientific Inquiry

11. Evaluate selected theories based on supporting scientific evidence (SI-H-B1)
12. Cite evidence that scientific investigations are conducted for many different reasons (SI-H-B2)
13. Identify scientific evidence that has caused modifications in previously accepted theories (SI-H-B2)
14. Cite examples of scientific advances and emerging technologies and how they affect society (e.g., MRI, DNA in forensics) (SI-H-B3)
15. Analyze the conclusion from an investigation by using data to determine its validity (SI-H-B4)
16. Use the following rules of evidence to examine experimental results:
    (a) Can an expert's technique or theory be tested, has it been tested, or is it simply a subjective, conclusive approach that cannot be reasonably assessed for reliability?
    (b) Has the technique or theory been subjected to peer review and publication?
    (c) What is the known or potential rate of error of the technique or theory when applied?
    (d) Were standards and controls applied and maintained?
    (e) Has the technique or theory been generally accepted in the scientific community? (SI-H-B5) (SI-H-B1) (SI-H-B4)

Science
Grade-Level Expectations

Physical Science
(Recommended for Grade 9)

Physical Science
Measurement and Symbolic Representation

1. Measure the physical properties of different forms of matter in metric system units (e.g., length, mass, volume, temperature) (PS-H-A1)
2. Gather and organize data in charts, tables, and graphs (PS-H-A1)
3. Distinguish among symbols for atoms, ions, molecules, and equations for chemical reactions (PS-H-A2)
4. Name and write chemical formulas using symbols and subscripts (PS-H-A2)

Atomic Structure

5. Identify the three subatomic particles of an atom by location, charge, and relative mass (PS-H-B1)
6. Determine the number of protons, neutrons, and electrons of elements by using the atomic number and atomic mass from the periodic table (PS-H-B1)
7. Describe the results of loss/gain of electrons on charges of atoms (PS-H-B1) (PS-H-C5)
8. Evaluate the uses and effects of radioactivity in people's daily lives (PS-H-B2)
9. Compare nuclear fission to nuclear fusion (PS-H-B2)
10. Identify the number of valence electrons of the first 20 elements based on their positions in the periodic table (PS-H-B3)

The Structure and Properties of Matter

11. Investigate and classify common materials as *elements*, *compounds*, or *mixtures* (heterogeneous or homogeneous) based on their physical and chemical properties (PS-H-C1)
12. Classify elements as *metals* or *nonmetals* based on their positions in the periodic table (PS-H-C2)
13. Predict how factors such as particle size and temperature influence the rate of dissolving (PS-H-C3)
14. Investigate and compare methods for separating mixtures by using the physical properties of the components (PS-H-C4) (PS-H-C1)
15. Using selected elements from atomic numbers 1 to 20, draw Bohr models (PS-H-C5) (PS-H-B3)
16. Name and write the formulas for simple ionic and covalent compounds (PS-H-C5)
17. Name and predict the bond type formed between selected elements based on their locations in the periodic table (PS-H-C5)
18. Diagram or construct models of simple hydrocarbons (four or fewer carbons) with single, double, or triple bonds (PS-H-C6)
19. Analyze and interpret a graph that relates temperature and heat energy absorbed during phase changes of water (PS-H-C7)
20. Predict the particle motion as a substance changes phases (PS-H-C7) (PS-H-C3)

Chemical Reactions

21. Classify changes in matter as *physical* or *chemical* (PS-H-D1)
22. Identify evidence of chemical changes (PS-H-D1)
23. Classify unknowns as *acidic*, *basic*, or *neutral* using indicators (PS-H-D2)
24. Identify balanced equations as neutralization, combination, and decomposition reactions (PS-H-D3)

25. Determine the effect of various factors on reaction rate (e.g., temperature, surface area, concentration, agitation) (PS-H-D4)
26. Illustrate the laws of conservation of matter and energy through balancing simple chemical reactions (PS-H-D5) (PS-H-D3) (PS-H-D7)
27. Distinguish between endothermic and exothermic reactions (PS-H-D6)
28. Identify chemical reactions that commonly occur in the home and nature (PS-H-D7)

Forces and Motion

29. Differentiate between *mass* and *weight* (PS-H-E1)
30. Compare the characteristics and strengths of forces in nature (e.g., gravitational, electrical, magnetic, nuclear) (PS-H-E1)
31. Differentiate between speed and velocity (PS-H-E2)
32. Plot and compare line graphs of acceleration and velocity (PS-H-E2)
33. Calculate velocity and acceleration using equations (PS-H-E2)
34. Demonstrate Newton's three laws of motion (e.g., inertia, net force using F = ma, equal and opposite forces) (PS-H-E3)
35. Describe and demonstrate the motion of common objects in terms of the position of the observer (PS-H-E4)

Energy

36. Measure and calculate the relationships among energy, work, and power (PS-H-F1)
37. Model and explain how momentum is conserved during collisions (PS-H-F2)
38. Analyze diagrams to identify changes in kinetic and potential energy (PS-H-F2)
39. Distinguish among thermal, chemical, electromagnetic, mechanical, and nuclear energy (PS-H-F2)
40. Demonstrate energy transformation and conservation in everyday actions (PS-H-F2)

Interactions of Energy and Matter

41. Identify the parts and investigate the properties of transverse and compression waves (PS-H-G1)
42. Describe the relationship between wavelength and frequency (PS-H-G1)
43. Investigate and construct diagrams to illustrate the laws of reflection and refraction (PS-H-G1)
44. Illustrate the production of static electricity (PS-H-G2)
45. Evaluate diagrams of series and parallel circuits to determine the flow of electricity (PS-H-G2)
46. Diagram a magnetic field (PS-H-G2)
47. Explain how electricity and magnetism are related (PS-H-G2)
48. Compare properties of waves in the electromagnetic spectrum (PS-H-G3)
49. Describe the Doppler effect on sound (PS-H-G3)
50. Identify positive and negative effects of electromagnetic/mechanical waves on humans and human activities (e.g., sound, ultraviolet rays, X-rays, MRIs, fiber optics) (PS-H-G4) (PS-H-G3)

Biology

(Recommended for Grade 10)

Life Science
The Cell

1. Compare prokaryotic and eukaryotic cells (LS-H-A1)

2. Identify and describe structural and functional differences among organelles (LS-H-A1)
3. Investigate and describe the role of enzymes in the function of a cell (LS-H-A1)
4. Compare active and passive cellular transport (LS-H-A2)
5. Analyze the movement of water across a cell membrane in hypotonic, isotonic, and hypertonic solutions (LS-H-A2)
6. Analyze a diagram of a developing zygote to determine when cell differentiation occurs (LS-H-A3)

The Molecular Basis of Heredity

7. Identify the basic structure and function of nucleic acids (e.g., DNA, RNA) (LS-H-B1)
8. Describe the relationships among DNA, genes, chromosomes, and proteins (LS-H-B1)
9. Compare mitosis and meiosis (LS-H-B2)
10. Analyze pedigrees to identify patterns of inheritance for common genetic disorders (LS-H-B3)
11. Calculate the probability of genotypes and phenotypes of offspring given the parental genotypes (LS-H-B3)
12. Describe the processes used in modern biotechnology related to genetic engineering (LS-H-B4) (LS-H-B1)
13. Identify possible positive and negative effects of advances in biotechnology (LS-H-B4) (LS-H-B1)

Biological Evolution

14. Analyze evidence on biological evolution, utilizing descriptions of existing investigations, computer models, and fossil records (LS-H-C1)
15. Compare the embryological development of animals in different phyla (LS-H-C1) (LS-H-A3)
16. Explain how DNA evidence and fossil records support Darwin's theory of evolution (LS-H-C2)
17. Explain how factors affect gene frequency in a population over time (LS-H-C3)
18. Classify organisms from different kingdoms at several taxonomic levels, using a dichotomous key (LS-H-C4)
19. Compare characteristics of the major kingdoms (LS-H-C5)
20. Analyze differences in life cycles of selected organisms in each of the kingdoms (LS-H-C6)
21. Compare the structures, functions, and cycles of viruses to those of cells (LS-H-C7)
22. Describe the role of viruses in causing diseases and conditions (e.g., AIDS, common colds, smallpox, influenza, warts) (LS-H-C7) (LS-H-G2)

Interdependence of Organisms

23. Illustrate the flow of carbon, nitrogen, and water through an ecosystem (LS-H-D1) (SE-H-A6)
24. Analyze food webs by predicting the impact of the loss or gain of an organism (LS-H-D2)
25. Evaluate the efficiency of the flow of energy and matter through a food chain/pyramid (LS-H-D2)
26. Analyze the dynamics of a population with and without limiting factors (LS-H-D3)
27. Analyze positive and negative effects of human actions on ecosystems (LS-H-D4) (SE-H-A7)

Matter, Energy, and Organization of Living Systems

28. Explain why ecosystems require a continuous input of energy from the Sun (LS-H-E1)
29. Use balanced equations to analyze the relationship between photosynthesis and cellular respiration (LS-H-E1)
30. Explain the role of adenosine triphosphate (ATP) in a cell (LS-H-E2)
31. Compare the levels of organization in the biosphere (LS-H-E3)

Systems and the Behavior of Organisms

32. Analyze the interrelationships of organs in major systems (LS-H-F1) (LS-H-E3)
33. Compare structure to function of organs in a variety of organisms (LS-H-F1)
34. Explain how body systems maintain homeostasis (LS-H-F2)
35. Explain how selected organisms respond to a variety of stimuli (LS-H-F3)
36. Explain how behavior affects the survival of species (LS-H-F4)

Personal and Community Health

37. Explain how fitness and health maintenance can result in a longer human life span (LS-H-G1)
38. Discuss mechanisms of disease transmission and processes of infection (LS-H-G2) (LS-H-G4)
39. Compare the functions of the basic components of the human immune system (LS-H-G3)
40. Determine the relationship between vaccination and immunity (LS-H-G3)
41. Describe causes, symptoms, treatments, and preventions of major communicable and noncommunicable diseases (LS-H-G4)
42. Summarize the uses of selected technological developments related to the prevention, diagnosis, and treatment of diseases or disorders (LS-H-G5)

Earth Science

(Recommended for Grades 11/12)

Earth and Space Science
Energy in Earth's System

1. Describe what happens to the solar energy received by Earth every day (ESS-H-A1)
2. Trace the flow of heat energy through the processes in the water cycle (ESS-H-A1)
3. Describe the effect of natural insulation on energy transfer in a closed system (ESS-H-A1)
4. Describe the relationship between seasonal changes in the angle of incoming solar radiation and its consequences to Earth’s temperature (e.g., direct vs. slanted rays) (ESS-H-A2)
5. Explain how the process of fusion inside the Sun provides the external heat source for Earth (ESS-H-A3)
6. Discuss how heat energy is generated at the inner core-outer core boundary (ESS-H-A4)
7. Analyze how radiant heat from the Sun is absorbed and transmitted by several different earth materials (ESS-H-A5)
8. Explain why weather only occurs in the tropospheric layer of Earth's atmosphere (ESS-H-A5)
9. Compare the structure, composition, and function of the layers of Earth’s atmosphere (ESS-H-A6)
10. Analyze the mechanisms that drive weather and climate patterns and relate them to the three methods of heat transfer (ESS-H-A6)

11. Describe the processes that drive lithospheric plate movements (i.e., radioactive decay, friction, convection) (ESS-H-A7) (ESS-H-A3) (ESS-H-A4)
12. Relate lithospheric plate movements to the occurrences of earthquakes, volcanoes, mid-ocean ridge systems, and off-shore trenches found on Earth (ESS-H-A7)

Geochemical Cycles

13. Explain how stable elements and atoms are recycled during natural geologic processes (ESS-H-B1)
14. Compare the conditions of mineral formation with weathering resistance at Earth's surface (ESS-H-B1)
15. Identify the sun-driven processes that move substances at or near Earth's surface (ESS-H-B2)

The Origin and Evolution of the Earth System

16. Use the nebular hypothesis to explain the formation of a solar system (ESS-H-C1)
17. Determine the relative ages of rock layers in a geologic profile or cross section (ESS-H-C2)
18. Use data from radioactive dating techniques to estimate the age of earth materials (ESS-H-C2)
19. Interpret geological maps of Louisiana to describe the state's geologic history (ESS-H-C3)
20. Determine the chronological order of the five most recent major lobes of the Mississippi River delta in Louisiana (ESS-H-C3)
21. Use fossil records to explain changes in the concentration of atmospheric oxygen over time (ESS-H-C4)
22. Analyze data related to a variety of natural processes to determine the time frame of the changes involved (e.g., formation of sedimentary rock layers, deposition of ash layers, fossilization of plant or animal species) (ESS-H-C5)

The Origin and Evolution of the Universe

23. Identify the evidence that supports the big bang theory (ESS-H-D1)
24. Describe the organization of the known universe (ESS-H-D2)
25. Using the surface temperature and absolute magnitude data of a selected star, locate its placement on the Hertzsprung-Russell diagram and infer its color, size, and life stage (ESS-H-D3)
26. Identify the elements present in selected stars, given spectrograms of known elements and those of the selected stars (ESS-H-D4)
27. Trace the movement and behavior of hydrogen atoms during the process of fusion as it occurs in stars like the Sun (ESS-H-D5)
28. Identify the relationship between orbital velocity and orbital diameter (ESS-H-D6) (PS-H-E2)
29. Demonstrate the elliptical shape of Earth's orbit and describe how the point of orbital focus changes during the year (ESS-H-D6)
30. Summarize how current technology has directly affected our knowledge of the universe (ESS-H-D7)

Science
Grade-Level Expectations

Environmental Science
(Recommended for Grades 11/12)

Science and the Environment
Ecological Systems and Interactions

1. Describe the abiotic and biotic factors that distinguish Earth's major ecological systems (SE-H-A1)
2. Describe the characteristics of major biomes on Earth (SE-H-A1)
3. Use the 10% rule and data analysis to measure the flow of energy as represented by biomass in a system (SE-H-A2)
4. Determine the effects of limiting factors on a population and describe the concept of carrying capacity (SE-H-A3)
5. Examine and discuss the major stages of succession, describing the generalized sequential order of the types of plant species (SE-H-A4)
6. Analyze the consequences of changes in selected divisions of the biosphere (e.g., ozone depletion, global warming, acid rain) (SE-H-A5) (SE-H-A7)
7. Illustrate the flow of carbon, water, oxygen, nitrogen, and phosphorus through an ecosystem (SE-H-A6) (LS-H-D1)
8. Explain how species in an ecosystem interact and link in a complex web (SE-H-A7) (SE-H-A10)
9. Cite and explain examples of organisms' adaptations to environmental pressures over time (SE-H-A8)
10. Analyze the effect of an invasive species on the biodiversity within ecosystems (SE-H-A9)
11. Explain why biodiversity is essential to the survival of organisms (SE-H-A9)
12. Give examples and describe the effect of pollutants on selected populations (SE-H-A11)

Resources and Resource Management

13. Evaluate whether a resource is renewable by analyzing its relative regeneration time (SE-H-B1)
14. Analyze data to determine the effect of preservation practices compared to conservation practices for a sample species (SE-H-B2)
15. Identify the factors that cause the inequitable distribution of Earth's resources (e.g., politics, economics, climate) (SE-H-B3)
16. Evaluate the effectiveness of natural resource management in Louisiana (SE-H-B4) (SE-H-B5)
17. Analyze data to determine when reuse, recycling, and recovery are applicable (SE-H-B5)
18. Identify the factors that affect sustainable development (SE-H-B6)

Environmental Awareness and Protection

19. Determine the interrelationships of clean water, land, and air to the success of organisms in a given population (SE-H-C1)
20. Relate environmental quality to quality of life (SE-H-C2)
21. Analyze the effect of common social, economic, technological, and political considerations on environmental policy (SE-H-C3)
22. Analyze the risk-benefit ratio for selected environmental situations (SE-H-C4)
23. Describe the relationship between public support and the enforcement of environmental policies (SE-H-C5)

Personal Choices and Responsible Actions

24. Identify the advantages and disadvantages of using disposable items versus reusable items (SE-H-D1)
25. Discuss how education and collaboration can affect the prevention and control of a selected pollutant (SE-H-D2) (SE-H-D3)
26. Determine local actions that can affect the global environment (SE-H-D4)
27. Describe how accountability toward the environment affects sustainability (SE-H-D5)
28. Discuss the reduction of combustible engines needed to significantly decrease CO_2 in the troposphere (SE-H-D6)

Chemistry

(Recommended for Grades 11/12)

Physical Science

Measurement and Symbolic Representation

1. Convert metric system units involving length, mass, volume, and time using dimensional analysis (i.e., factor-label method) (PS-H-A1)
2. Differentiate between accuracy and precision and evaluate percent error (PS-H-A1)
3. Determine the significant figures based on precision of measurement for stated quantities (PS-H-A1)
4. Use scientific notation to express large and small numbers (PS-H-A1)
5. Write and name formulas for ionic and covalent compounds (PS-H-A2)
6. Write and name the chemical formula for the products that form from the reaction of selected reactants (PS-H-A2)
7. Write a balanced symbolic equation from a word equation (PS-H-A2)

Atomic Structure

8. Analyze the development of the modern atomic theory from a historical perspective (PS-H-B1)
9. Draw accurate valence electron configurations and Lewis dot structures for selected molecules, ionic and covalent compounds, and chemical equations (PS-H-B1)
10. Differentiate among *alpha, beta*, and *gamma* emissions (PS-H-B2)
11. Calculate the amount of radioactive substance remaining after a given number of half-lives has passed (PS-H-B2)
12. Describe the uses of radioactive isotopes and radiation in such areas as plant and animal research, health care, and food preservation (PS-H-B2)
13. Identify the number of bonds an atom can form given the number of valence electrons (PS-H-B3)

The Structure and Properties of Matter

14. Identify unknowns as elements, compounds, or mixtures based on physical properties (e.g., density, melting point, boiling point, solubility) (PS-H-C1)
15. Predict the physical and chemical properties of an element based only on its location in the periodic table (PS-H-C2)
16. Predict the stable ion(s) an element is likely to form when it reacts with other specified elements (PS-H-C2)
17. Use the periodic table to compare electronegativities and ionization energies of elements to explain periodic properties, such as atomic size (PS-H-C2)
18. Given the concentration of a solution, calculate the predicted change in its boiling and freezing points (PS-H-C3)
19. Predict the conductivity of a solution (PS-H-C3)

20. Express concentration in terms of molarity, molality, and normality (PS-H-C3)
21. Design and conduct a laboratory investigation in which physical properties are used to separate the substances in a mixture (PS-H-C4)
22. Predict the kind of bond that will form between two elements based on electronic structure and electronegativity of the elements (e.g., ionic, polar, nonpolar) (PS-H-C5)
23. Model chemical bond formation by using Lewis dot diagrams for ionic, polar, and nonpolar compounds (PS-H-C5)
24. Describe the influence of intermolecular forces on the physical and chemical properties of covalent compounds (PS-H-C5)
25. Name selected structural formulas of organic compounds (PS-H-C6)
26. Differentiate common biological molecules, such as carbohydrates, lipids, proteins, and nucleic acids by using structural formulas (PS-H-C6)
27. Investigate and model hybridization in carbon compounds (PS-H-C6)
28. Name, classify, and diagram *alkanes*, *alkenes*, and *alkynes* (PS-H-C6)
29. Predict the properties of a gas based on gas laws (e.g., temperature, pressure, volume) (PS-H-C7)
30. Solve problems involving heat flow and temperature changes by using known values of specific heat and latent heat of phase change (PS-H-C7)

Chemical Reactions

31. Describe chemical changes and reactions using diagrams and descriptions of the reactants, products, and energy changes (PS-H-D1)
32. Determine the concentration of an unknown acid or base by using data from a titration with a standard solution and an indicator (PS-H-D2)
33. Calculate pH of acids, bases, and salt solutions based on the concentration of hydronium and hydroxide ions (PS-H-D2)
34. Describe chemical changes by developing word equations, balanced formula equations, and net ionic equations (PS-H-D3)
35. Predict products (with phase notations) of simple reactions, including acid/base, oxidation/reduction, and formation of precipitates (PS-H-D3)
36. Identify the substances gaining and losing electrons in simple oxidation-reduction reactions (PS-H-D3)
37. Predict the direction of a shift in equilibrium in a system as a result of stress by using LeChatalier's principle (PS-H-D4)
38. Relate the law of conservation of matter to the rearrangement of atoms in a balanced chemical equation (PS-H-D5)
39. Conduct an investigation in which the masses of the reactants and products from a chemical reaction are calculated (PS-H-D5)
40. Compute percent composition, empirical formulas, and molecular formulas of selected compounds in chemical reactions (PS-H-D5)
41. Apply knowledge of stoichiometry to solve mass/mass, mass/volume, volume/volume, and mole/mole problems (PS-H-D5)
42. Differentiate between activation energy in endothermic reactions and exothermic reactions (PS-H-D6)
43. Graph and compute the energy changes that occur when a substance, such as water, goes from a solid to a liquid state, and then to a gaseous state (PS-H-D6)
44. Measure and graph energy changes during chemical reactions observed in the laboratory (PS-H-D6)
45. Give examples of common chemical reactions, including those found in biological systems (PS-H-D7)

Forces and Motion

46. Identify and compare intermolecular forces and their effects on physical and chemical properties (PS-H-E1)

Interactions of Energy and Matter

47. Assess environmental issues related to the storage, containment, and disposal of wastes associated with energy production and use (PS-H-G4)

Physics

(Recommended for Grades 11/12)

Physical Science

Measurement and Symbolic Representation

1. Measure and determine the physical quantities of an object or unknown sample using correct prefixes and metric system units (e.g., mass, charge, pressure, volume, temperature, density) (PS-H-A1)
2. Determine and record measurements correctly using significant digits and scientific notation (PS-H-A1)
3. Determine accuracy and precision of measured data (PS-H-A1)
4. Perform dimensional analysis to verify problem set-up (PS-H-A1)
5. Use trigonometric functions to make indirect measurements (PS-H-A1)

Forces and Motion

6. Explain the role of strong nuclear forces and why they are the strongest of all forces (PS-H-E1)
7. Relate gravitational force to mass and distance (PS-H-E1)
8. Compare and calculate electrostatic forces acting within and between atoms to the gravitational forces acting between atoms (PS-H-E1)
9. Describe and measure motion in terms of position, displacement time, and the derived quantities of velocity and acceleration (PS-H-E2)
10. Determine constant velocity and uniform acceleration mathematically and graphically (PS-H-E2)
11. Plot and interpret displacement-time and velocity-time graphs and explain how these two types of graphs are interrelated (PS-H-E2)
12. Model scalar and vector quantities (PS-H-E2)
13. Solve for missing variables in kinematic equations relating to actual situations (PS-H-E2)
14. Add and resolve vectors graphically and mathematically to determine resultant/equilibrant of concurrent force vectors (PS-H-E3)
15. Calculate centripetal force and acceleration in circular motion (PS-H-E3)
16. Analyze circular motion to solve problems relating to angular velocity, acceleration, momentum, and torque (PS-H-E3)
17. Analyze simple harmonic motion (PS-H-E3)
18. Demonstrate the independence of perpendicular components in projectile motion and predict the optimum angles and velocities of projectiles (PS-H-E3)

Energy

19. Explain quantitatively the conversion between kinetic and potential energy for objects in motion (e.g., roller coaster, pendulum) (PS-H-F1)

20. Calculate the mechanical advantage and efficiency of simple machines and explain the loss of efficiency using the dynamics of the machines (PS-H-F1)
21. Explain and calculate the conversion of one form of energy to another (e.g., chemical to thermal, thermal to mechanical, magnetic to electrical) (PS-H-F1)
22. Analyze energy transformations using the law of conservation of energy (PS-H-F2)
23. Apply the law of conservation of momentum to collisions in one and two dimensions, including angular momentum (PS-H-F2)
24. Apply the concept of momentum to actual situations with different masses and velocities (PS-H-F2)

Interactions of Energy and Matter

25. Determine the relationships among amplitude, wavelength, frequency, period, and velocity in different media (PS-H-G1)
26. Evaluate how different media affect the properties of reflection, refraction, diffraction, polarization, and interference (PS-H-G1)
27. Investigate and construct diagrams to illustrate the laws of reflection and refraction (PS-H-G1)
28. Draw constructive and destructive interference patterns and explain how the principle of superposition applies to wave propagation (PS-H-G1)
29. Describe observed electrostatic phenomena, calculate Coulomb's law, and test charge pole, electric field, and magnetic field (PS-H-G2)
30. Construct basic electric circuits and solve problems involving voltage, current, resistance, power, and energy (PS-H-G2)
31. Describe the relationship of electricity, magnetism, and inductance as aspects of a single electromagnetic force (PS-H-G2)
32. Compare properties of electromagnetic and mechanical waves (PS-H-G3)
33. Solve problems related to sound and light in different media (PS-H-G3)
34. Compare the properties of the electromagnetic spectrum as a wave and as a particle (PS-H-G3)
35. Analyze the Doppler effect of a moving wave source (PS-H-G3)