Strands, Benchmarks, and Grade-Level Expectations (GLEs)

The Louisiana science content standards are broad statements of expectations for student learning. To further define the knowledge and skills students are expected to know at the end of each grade, not just at the end of a grade span, Louisiana educators developed grade-level expectations (GLEs).

BIOLOGY LIFE SCIENCE	
BENCHMARKS – THE CELL	**GRADE-LEVEL EXPECTATIONS**
LS-H-A1: observing cells, identifying organelles, relating structure to function, and differentiating among cell types **LS-H-A2**: demonstrating a knowledge of cellular transport **LS-H-A3**: investigating cell differentiation and describing stages of embryological development in representative organisms	1. Compare prokaryotic and eukaryotic cells 2. Identify and describe structural and functional differences among organelles 3. Investigate and describe the role of enzymes in the function of the cell 4. Compare active and passive cellular transport 5. Analyze the movement of water across a cell membrane in hypotonic, isotonic, and hypertonic solutions 6. Analyze a diagram of a developing zygote to determine when cell differentiation occurs

BENCHMARKS – THE MOLECULAR BASIS OF HEREDITY	GRADE-LEVEL EXPECTATIONS
LS-H-B1: explaining the relationship among chromosomes, DNA, genes, RNA, and proteins **LS-H-B2**: comparing and contrasting mitosis and meiosis **LS-H-B3**: describing the transmission of traits from parent to offspring and the influence of environmental factors on gene expression **LS-H-B4**: exploring advances in biotechnology and identifying possible positive and negative effects	7. Identify the basic structure and function of nucleic acids (e.g., DNA, RNA) 8. Describe the relationship among DNA, genes, chromosomes and proteins 9. Compare mitosis and meiosis 10. Analyze pedigrees to identify patterns of inheritance for common genetic disorders 11. Calculate the probability of genotypes and phenotypes of offspring given the parental genotype 12. Describe the processes used in modern biotechnology related to genetic engineering 13. Identify possible positive and negative effects of advances in biotechnology

BENCHMARKS – BIOLOGICAL EVOLUTION	GRADE-LEVEL EXPECTATIONS
LS-H-C1: exploring experimental evidence that supports the theory of the origin of life **LS-H-C2**: recognizing the evidence for evolution **LS-H-C3**: discussing the patterns, mechanisms, and rate of evolution **LS-H-C4**: classifying organisms **LS-H-C5**: distinguishing among the kingdoms **LS-H-C6**: comparing and contrasting life cycles of organisms **LS-H-C7**: comparing viruses to cells	14. Analyze evidence on biological evolution, utilizing descriptions of existing investigations, computer models, and fossil records 15. Compare the embryological development of animals in different phyla 16. Explain how DNA evidence and fossil records support Darwin's theory of evolution 17. Explain how factors affect gene frequency in a population over time 18. Classify organisms from different kingdoms at several taxonomic levels, using a dichotomous key 19. Compare characteristics of the major kingdoms 20. Analyze differences in life cycles of selected organisms in each of the kingdoms 21. Compare the structures, functions, and cycles of viruses to those of cells 22. Describe the role of viruses in causing diseases and conditions (e.g., AIDS, common colds, smallpox, influenza, warts)
BENCHMARKS – INTERDEPENDENCE OF ORGANISMS	**GRADE-LEVEL EXPECTATIONS**
LS-H-D1: illustrating the biogeochemical cycles and explaining their importance **LS-H-D2**: describing trophic levels and energy flows **LS-H-D3**: investigating population dynamics **LS-H-D4**: exploring how humans have impacted ecosystems and the need for societies to plan for the future	23. Illustrate the flow of carbon, nitrogen, and water through an ecosystem 24. Analyze food webs by predicting the impact of the loss or gain of an organism 25. Evaluate the efficiency of the flow of energy and matter through a food chain/pyramid 26. Analyze the dynamics of a population with and without limiting factors 27. Analyze positive and negative effects of human actions on ecosystems

BENCHMARKS – MATTER, ENERGY, AND ORGANIZATION OF LIVING SYSTEMS	GRADE-LEVEL EXPECTATIONS
LS-H-E1: comparing and contrasting photosynthesis and cellular respiration; emphasizing their relationships **LS-H-E2**: recognizing the importance of the ATP cycle in energy usage within the cell **LS-H-E3**: differentiating among levels of biological organization	28. Explain why ecosystems require a continuous input of energy from the Sun 29. Use balanced equations to analyze the relationship between photosynthesis and cellular respiration 30. Explain the role of adenosine triphosphate (ATP) in a cell 31. Compare the levels of organization in the biosphere
BENCHMARKS – SYSTEMS AND THE BEHAVIOR OF ORGANISMS	**GRADE-LEVEL EXPECTATIONS**
LS-H-F1: identifying the structure and functions of organ systems **LS-H-F2:** identifying mechanisms involved in homeostasis **LS-H-F3:** recognizing that behavior is the response of an organism to internal changes and/or external stimuli **LS-H-F4:** recognizing that behavior patterns have adaptive value	32. Analyze the interrelationship of organs in major system 33. Compare structure to function of organs in a variety of organisms 34. Explain how body systems maintain homeostasis 35. Explain how selected organisms respond to a variety of stimuli 36. Explain how behavior affects the survival of species
BENCHMARKS – PERSONAL AND COMMUNITY HEALTH	**GRADE-LEVEL EXPECTATIONS**
LS-H-G1: relating fitness and health to longevity **LS-H-G2:** contrasting how organisms cause disease **LS-H-G3:** explaining the role of the immune system in fighting disease **LS-H-G4:** exploring current research on the major diseases with regard to cause, symptoms, treatment, prevention, and cure **LS-H-G5:** researching technology used in prevention, diagnosis, and treatment of disease/disorders	37. Explain how fitness and health maintenance can result in a longer human life span 38. Discuss mechanisms of disease transmission and processes of infection 39. Compare the functions of the basic components of the human immune system 40. Determine the relationship between vaccination and immunity 41. Describe causes, symptoms, treatments, and preventions of major communicable and noncommunicable diseases 42. Summarize the uses of selected technological developments related to the prevention, diagnosis, and treatment of diseases or

EARTH AND SPACE SCIENCE	
BENCHMARKS – ENERGY IN EARTH'S SYSTEM	**GRADE-LEVEL EXPECTATIONS**
ESS-H-A1: investigating the methods of energy transfer and identifying the sun as the major source of energy for most of the earth's systems	1. Describe what happens to the solar energy received by earth everyday 2. Trace the flow of heat energy through the processes in the water cycle **3.** Describe the effect of natural insulation on energy transfer in a closed system
BENCHMARKS – GEOCHEMICAL CYCLES	**GRADE-LEVEL EXPECTATIONS**
ESS-H-B1: illustrating how stable chemical atoms or elements are recycled through the solid earth, oceans, atmosphere, and organisms **ESS-H-B2:** demonstrating earth's internal and external energy sources as forces in moving chemical atoms or elements	13. Explain how stable elements and atoms are recycled during natural geologic process 15. Identify the sun-driven processes that move substances at or near earth's surface
BENCHMARKS – THE ORIGIN AND EVOLUTION OF THE EARTH SYSTEM	**GRADE-LEVEL EXPECTATIONS**
ESS-H-C2: estimating the age of the earth by using dating techniques **ESS-H-C5:** explaining that natural processes and changes in the earth system may take place in a matter of seconds or develop over billions of years	17. Determine the relative ages of rock layers in a geologic profile or cross section 18. Use data from radioactive dating techniques to estimate the age of earth materials 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)

SCIENCE AS INQUIRY	
BENCHMARKS – THE ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY	**GRADE-LEVEL EXPECTATIONS**
SI-H-A1: identifying questions and concepts that guide scientific investigations **SI-H-A2:** designing and conducting scientific investigations **SI-H-A3:** using technology and mathematics to improve investigations and communications **SI-H-A4:** formulating and revising scientific explanations and models using logic and evidence **SI-H-A5:** recognizing and analyzing alternative explanations and models **SI-H-A6:** communicating and defending a scientific argument **SI-H-A7:** utilizing science safety procedures during scientific investigations	1. Write a testable question or hypothesis when given a topic 3. Plan and record step-by-step procedures for a valid investigation, select equipment and materials, and identify variables and controls. 4. Conduct an investigation that includes multiple trials and record, organize, and display data properly 5. Utilize mathematics, organizational tools, and graphing skills to solve problems 7. Choose appropriate models to explain scientific knowledge or experimental results (e.g., objects, mathematical relationships, plans, schemes, examples, role-playing, computer simulations) 8. Give an example of how new scientific data can cause an existing scientific explanation to be supported, revised, or rejected 9. Write and defend a conclusion based on logical analysis of experimental data 10. Given a description of an experiment, identify appropriate safety measures

BENCHMARKS – UNDERSTANDING SCIENTIFIC INQUIRY	GRADE-LEVEL EXPECTATIONS
SI-H-B1: communicating that scientists usually base their investigations on existing models, explanations, and theories **SI-H-B2:** communicating that scientists conduct investigations for a variety of reasons, such as exploration of new areas, discovery of new aspects of the natural world, confirmation of prior investigations, evaluation of current theories, and comparison of models and theories **SI-H-B3:** communicating that scientists rely on technology to enhance the gathering and manipulation of data **SI-H-B4:** analyzing a proposed explanation of scientific evidence according to the following criteria: follow a logical structure, follow rules of evidence, allow for questions and modifications, and is based on historical and current scientific knowledge **SI-H-B5:** communicating that the results of scientific inquiry, new knowledge, and methods emerge from different types of investigations and public communication among scientists	11. Evaluate selected theories based on supporting scientific evidence 13. Identify scientific evidence that has caused modifications in previously accepted theories 14. Cite examples of scientific advances and emerging technologies and how they affect society (e.g., MRI, DNA in forensics) 15. Analyze the conclusion from an investigation by using data to determine its validity 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?