CAISL
Carlucci American International School of Lisbon

GRADE 8 SCIENCE FRAMEWORK

Contents

THEMES AND CONTENT

- Chemical Reactions: Identify, Represent and Balance Chemical Reactions
- Structure and Function: Cell Theory; Plant and Animal Cells; Cell Organelles; Levels of Organization of an Organism
- Organization for Matter and Energy Flow in Organisms: Photosynthesis and Cellular Respiration
- Ecosystems: Biotic and Abiotic factors; Autotrophs and Heterotrophs; Types of Heterotrophs; Trophic Levels; Food Chains and Food Webs; Energy Flow in an Ecosystem; Carbon Cycle; Types of Interactions between Organisms
- Reproduction: Sexual and Asexual Reproduction; Successful Reproduction
- Inheritance and Variation of Traits: Genetic Terms; Mutations (beneficial, neutral and harmful); Traits; Genotype and Phenotype; Alleles (dominant and recessive)
- Natural Selection and Adaptation: Evolution; Natural Selection; Adaptation
- Evidence of Common Ancestry and Diversity

SCIENCE AND ENGINEERING PRACTICES (DEVELOPED IN CONJUNCTION WITH THE PERFORMANCE INDICATORS)

Asking Questions and Defining Problems

Asking questions and defining problems in 6–8 builds on K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.

- Ask questions
  - that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.
  - to identify and/or clarify evidence and/or the premise(s) of an argument.
  - to determine relationships between independent and dependent variables and relationships in models.
  - to clarify and/or refine a model, an explanation, or an engineering problem.
  - that require sufficient and appropriate empirical evidence to answer.
  - that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.
  - that challenge the premise(s) of an argument or the interpretation of a data set.
- Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Evaluate limitations of a model for a proposed object or tool.
- Develop or modify a model—based on evidence – to match what happens if a variable or component of a system is changed.
- Use and/or develop a model of simple systems with uncertain and less predictable factors.
- Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.
- Develop and/or use a model to predict and/or describe phenomena.
- Develop a model to describe unobservable mechanisms.
- Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales.

Planning and Carrying Out Investigations

Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.

- Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.
- Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.
- Evaluate the accuracy of various methods for collecting data.
- Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.
- Collect data about the performance of a proposed object, tool, process or system under a range of conditions.

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.
- Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships.
- Distinguish between causal and correlational relationships in data.
- Analyze and interpret data to provide evidence for phenomena.
- Apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error), and/or seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials).
- Analyze and interpret data to determine similarities and differences in findings.
- Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success.

Using Mathematics and Computational Thinking

Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.

- Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends.
- Use mathematical representations to describe and/or support scientific conclusions and design solutions.
- Create algorithms (a series of ordered steps) to solve a problem.
- Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems.
- Use digital tools and/or mathematical concepts and arguments to test and compare proposed solutions to an engineering design problem.

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.
- Construct an explanation using models or representations.
- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events.
- Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion.

- Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system.
- Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.
- Optimize performance of a design by prioritizing criteria, making tradeoffs, testing.

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts.
- Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail.
- Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
- Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system based on empirical evidence concerning whether or not the technology meets relevant criteria and constraints.
- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.

Obtaining, Evaluating, and Communicating Information
Obtaining, evaluating, and communicating information in 6–8 builds on K–5 experiences and progresses to evaluating the merit and validity of ideas and methods.

- Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s).
- Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings.
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.
- Evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts.
- Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations.

SCIENCE NOTEBOOK EXPECTATIONS

- Inquiry is the focus of science notebooks.
- Science notebooks are independently organized with minimal support and guidance from the teacher.

- Teacher may suggest that science notebooks include but are not limited to investigations, focus questions, unit vocabulary, note-taking, diagrams and models, scientific articles and readings, and any other handouts.

SCIENTIFIC WRITING EXPECTATIONS

- Students independently write formal Investigation Reports which include:
    - A testable question
    - Variables (independent, dependent and controlled)
    - A hypothesis
    - Procedures (step-by-step instructions)
    - Data recorded in an appropriate format (quantitative and qualitative)
    - A graph using Excel (showing the results of the investigation)
    - Complete analysis of the results:
        - Analyze experimental data (data table and graph)
        - Scientific explanation for the data
        - Suggested sources of error and improvements
- Students continue to use the CER writing format to explain their Claim, Evidence, and Reasoning (See Grade 6 Framework). In Grade 8, a CER becomes more embedded in their investigation report.

SCIENCE LABORATORY SAFETY EXPECTATIONS

Students will be expected to learn and to follow the expectations for safe and appropriate practices during laboratory activity, as shown on the "Science Laboratory Safety" document.

See link below:
https://www.caislisbon.org/uploaded/Curriculum_links/Science/Science_lab_safety_Middle_School.pdf

INFORMATION TECHNOLOGY EXPECTATIONS

Students will be expected to use a variety of digital tools according to grade level expectations stated in CAISL's Research and Information Technology Integration Scope and Sequence.
See link below:
https://www.caislisbon.org/uploaded/Curriculum_links/2019-2020/IT_Skills_Scope_and_Sequence_by_Grade.pdf

PERFOMANCE INDICATORS (ASSESSED ON REPORT CARDS)

PHYSICAL SCIENCE

Chemical Reactions: Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. DOK 4

Structures and Properties of Matter: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. DOK 3

LIFE SCIENCE

Structure and Function: Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. DOK 3
Structure and Function: Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. DOK 2
Structure and Function: Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. DOK 3
Growth and Development of Organisms: Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. DOK 3
Growth and Development of Organisms: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. DOK 3
Organization for Matter and Energy Flow in Organisms: Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. DOK 3
Organization for Matter and Energy Flow in Organisms: Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. DOK 2
Interdependent Relationships in Ecosystems: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. DOK 3
Interdependent Relationships in Ecosystems: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. DOK 3
Cycle of Matter and Energy Transfer in Ecosystems: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. DOK 3
Ecosystem Dynamics, Functioning, and Resilience: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. DOK 3
Ecosystem Dynamics, Functioning, and Resilience: Evaluate competing design solutions for maintaining biodiversity and ecosystem services. DOK 4
Inheritance & Variation of Traits: Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. DOK 3
Inheritance & Variation of Traits: Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. DOK 3
Evidence of Common Ancestry and Diversity: Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. DOK 4
Evidence of Common Ancestry and Diversity: Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. DOK 3
Evidence of Common Ancestry and Diversity: Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. DOK 4

Natural Selection: Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. DOK 3
Natural Selection: Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. DOK 4
Adaptation: Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. DOK 3

SCIENCE AND ENGINEERING PRACTICES
Engineering Design: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. DOK 3
Engineering Design: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. DOK 1
Engineering Design: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. DOK 3
Engineering Design: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. DOK 3