CAISL
Carlucci American International School of Lisbon

GRADE 7 SCIENCE FRAMEWORK

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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 more independently organized with support and guidance from the teacher.
- Science notebooks include but are not limited to investigations, focus questions, unit vocabulary, note-taking, diagrams and models, scientific articles and readings, and all other handouts.

SCIENTIFIC WRITING EXPECTATIONS

- In Grade 7 students are introduced to independently writing a formal Investigation Report 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 7, 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

PERFORMANCE INDICATORS (ASSESSED ON REPORT CARDS)

PHYSICAL SCIENCE

Forces and Motion: Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. DOK 4
Forces and Motion: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. DOK 3
Types of Interactions: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. DOK 3
Types of Interactions: Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. DOK 3
Types of Interactions: Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. DOK 3
Relationship between Energy and Forces: Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. DOK 3

Wave Properties: Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. DOK 3
Wave Properties: Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. DOK 2

EARTH SCIENCE

The Universe and Its Stars: Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. DOK 2
The Universe and Its Stars: Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. DOK 3
Earth and the Solar System: Analyze and interpret data to determine scale properties of objects in the solar system. DOK 4
The Roles of Water in Earth's Surface Processes: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. DOK 2
Weather and Climate: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. DOK 2
Weather and Climate: Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. 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