CAISL
Carlucci American International School of Lisbon

GRADE 12 ADVANCED ENVIRONMENTAL SCIENCE - IB ENVIRONMENTAL SYSTEMS AND SOCIETIES YEAR 2 FRAMEWORK

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SKILLS AND EXPECTATIONS

By the end of grade 12 students taking Environmental Science/Environmental Systems and Societies are expected to:

- Develop a testable hypothesis/research question, design and conduct an investigation identifying ethical and safety implication of the research.
- Identify variables, organize and present quantitative and qualitative results, looking for trends and discrepancies.
- Apply error measurements and calculation as well as basic statistical analysis and mathematical correlations.
- Discuss date from multiple perspectives, critically concluding and evaluating the results and future applications of experimental results.
- Explore the use of technology in order to reduce uncertainty and infer about validity of data.

OTHER SKILLS AND EXPECTATIONS

MATH SKILLS

- Students are required to identify different types of variables (dependent, independent and controlled) and describe how they will be measured, identifying units and uncertainties associated with data collection equipment.
- Students are expected to process collected data by calculating indices, averages, standard deviations. Other statistical techniques can be also applied (Chi squared, regressions, t-test) but are not specifically required.
- Students must present data considering accuracy of raw data, precision of the equipment's used, scientific notation and significant figures.

SCIENCE NOTEBOOK

- Notebooks are an independent responsibility of the student.
- Students are expected to keep an organized notebook with notes from class, work done at home and data collected during labs.

SCIENTIFIC WRITING

- Students will write Laboratory Reports about experiments conducted in class, related to the subject content, which will include but is not limited to the following requirements:
  - Conduct independent background research to sustain their findings.
  - Include in-text citations for research.
  - Use reliable sources, correctly cited in MLA format.
  - Provide a bibliography created with NoodleTools.
  - Submit personal investigation/Internal Assessment via Turnitin.
    (Additional information about research parameters is available on the CAISL website).

INFORMATION TECHNOLOGY

- Students are expected to use digital measurement tools (probes) in order to collect data, and make appropriate use of data collection software (Logger Pro).
- Students are expected to master the use of Excel to manipulate and interpret collected data.

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.

ASSESSMENTS

For students to receive a credit towards their High School Diploma, they must demonstrate proficiency on:

- Summative assessments set by the class teacher which may take the form of:
    - Quizzes which assess both knowledge and skill acquisition in the subjects' subtopics.
    - Tests which assess both knowledge and skill acquisition in the subjects' topics.
    - Lab reports.
    - Last steps of their personal investigation by collecting data using the procedure proposed during the first year; analyzing, interpreting and discuss that data; evaluating their findings and propose possible applications of their research.
    - An exam at the end of the 2nd year which covers all content and skill acquisition to that point.

Students who are pursuing the IB Diploma in addition to the High School Diploma must complete both years of the program. During the second year they must demonstrate proficiency on:

- Summative assessments set by the class teacher which may take the form of:
    - Quizzes which assess both knowledge and skill acquisition in the subjects' subtopics.
    - Tests which assess both knowledge and skill acquisition in the subjects' topics.
    - In-class projects.
    - Lab reports.
    - A draft of their internal assessment by collecting data using the procedure proposed during the first year; analyzing, interpreting and discuss that data; evaluating their findings and propose possible applications of their research.

In addition, students who are pursuing the IB Diploma will submit the following items to the IBO which will assess them and determine the IB score awarded to the students for the IB Environmental Systems and Societies course:

- Paper 01 – Case study
- Paper 02 – Section A: short answer questions and Section B: two essay questions from a choice of four
- Internal Assessment

PERFORMANCE INDICATORS

Soil systems and terrestrial food production systems and societies

Introduction to soil systems

Understand that the soil system is a dynamic ecosystem that has inputs, outputs, storages and flows.

Discuss how the quality of soil influences the primary productivity of an area.

Compare and contrast the structure and properties of sand, clay and loam soils, with reference to a soil texture diagram, including their effect on primary productivity.

Terrestrial Food Production Systems

Identify how the sustainability of terrestrial food production systems is influenced by socio-political, economic and ecological factors.

Recognize that consumers have a role to play through their support of different terrestrial food production systems.

Comprehend that the supply of food is inequitably available and land suitable for food production is unevenly distributed among societies, and this can lead to conflict and concerns.

Analyze tables and graphs that illustrate the differences in inputs and outputs associated with food production systems.

Compare and contrast the inputs, outputs and system characteristics for two given food production systems and evaluate its relative environmental impacts.

Discuss the links that exist between socio-cultural systems and food production systems.

Evaluate strategies to increase sustainability in terrestrial food production systems.

Soil Degradation and Conservation

Recognize that fertile soils require significant time to develop through the process of succession and human activities may reduce soil fertility and increase soil erosion.

Understand that soil conservation strategies exist and may be used to preserve soil fertility and reduce soil erosion.

Atmospheric systems and societies

Introduction to the Atmosphere

Recognize the atmosphere as a dynamic system that is essential to life on Earth and that its behavior, structure and composition influence variations in all ecosystems.

Discuss the role of the albedo effect from clouds in regulating global average temperature.

Outline the role of the greenhouse effect in regulating temperature on Earth.

Stratospheric Ozone

Identify stratospheric ozone as a key component of the atmospheric system because it protects living systems from the negative effects of ultraviolet radiation from the Sun.

Recognize that human activities have disturbed the dynamic equilibrium of stratospheric ozone formation and pollution management strategies are being employed to conserve stratospheric ozone.

Evaluate the role of national and international organizations in reducing the emissions of ozone-depleting substances.

Photochemical Smog

Understand that the combustion of fossil fuels produces primary pollutants that may generate secondary pollutants and lead to photochemical smog, the levels of which can vary by topography, population density and climate.

Understand that photochemical smog has significant impacts on societies and living systems, but it can be reduced by decreasing human reliance on fossil fuels.

Evaluate pollution management strategies for reducing photochemical smog.

Acid Deposition

Understand how acid deposition can impact living systems and the built environment.

Discuss how the pollution management of acid deposition often involves cross-border issues.

Evaluate pollution management strategies for acid deposition.

Climate change and energy production

Energy choices and security

Recognize that there is a range of different energy sources available to societies that vary in their sustainability, availability, cost and socio-political implications.

Understand that the choice of energy sources is controversial and complex and energy security is an important factor in making energy choices.

Evaluate the advantages and disadvantages of different energy sources.

Discuss the factors that affect the choice of energy sources adopted by different societies and evaluate the energy strategy of a given one.

Climate Change: Causes and Impacts

Understand that climate change has been a normal feature of the Earth's history, but human activity has contributed to recent changes.

Recognize that there has been significant debate about the causes of climate change, which are widespread and with significant impacts on a global scale.

Discuss the feedback mechanisms that would be associated with a change in mean global temperature

Evaluate contrasting viewpoints on the issue of climate change.

Climate Change: Mitigation and Adaptation

Understand that mitigation attempts to reduce the causes of climate change and adaptation attempts to manage the impacts of climate change.

Discuss mitigation and adaptation strategies to deal with impacts of climate change.

Evaluate the effectiveness of international climate change talks and initiatives.

Human systems and resource use

Human Population Dynamics

Recognize that a variety of models and indicators are employed to quantify human population dynamics;

Discuss how human population growth rates are impacted by a complex range of changing factors.

Calculate values of CBR, CDR, TFR, DT and NIR, explaining its relative values.

Analyze age–gender pyramids and diagrams showing demographic transition models.

Discuss the use of models in predicting the growth of human populations and explain the nature and implications of that growth.

Analyze the impact that national and international development policies can have on human population dynamics and growth.

Discuss the cultural, historical, religious, social, political and economic factors that influence human population dynamics.

Resource Use in Society

Understand that the renewability of natural capital has implications for its sustainable use and that the status and economic value of natural capital is dynamic.

Outline an example of how renewable and non-renewable natural capital has been mismanaged.

Explain the dynamic nature of the concept of natural capital.

Solid Domestic Waste

Recognize that solid domestic waste (SDW) is increasing as a result of growing human populations and consumption.

Understand that both the production and management of SDW can have significant influence on sustainability.

Evaluate SDW disposal options.

Compare and contrast pollution management strategies for SDW and evaluate recycling, incineration, composting and landfills in this context.

Carrying Capacity and Ecological Footprints

Understand that human carrying capacity is difficult to quantify and that the concept of environmental footprint (EF) is a model that makes it possible to determine whether human populations are living within carrying capacity.

Evaluate the application of the concept of carrying capacity to local and global human populations.

Compare and contrast the differences in the EF of two countries.

Evaluate how EVSs impact the EFs of individuals or populations.