The New Senior Secondary Curriculum for Sierra Leone

Subject Syllabus for Environmental Science
Subject stream: Science & Technologies

This subject syllabus is based on the National Curriculum Framework for Senior Secondary Education. It was prepared by national curriculum specialists and subject experts.

SSSC
Senior Secondary School Curriculum

Curriculum Elements for Environmental Science – an applied subject

Subject Description

This is an interdisciplinary subject that studies the interaction of the physical, chemical, and biological components of the environment, and also the relationships and effects of these components with the organisms in the environment.

General learning outcomes/broad goals

At the end of the course, student will be able to:

- Stimulate interest in the environment
- To develop an understanding of the interdisciplinary and holistic nature of the environment
- To develop knowledge and understanding of environmental issue and principles and the ability to apply these to environmental management particularly in the Sierra Leonean context.
- To develop the ability to collect, collate, analyze, and interpret environmental data
- To provide an understanding of the interactions between people and the environment.
- To recognize and evaluate the socio-economic, political, and ethical issues in Environmental science
- To develop an understanding of how natural resources and the environment affect quality of life and the question for sustainable development in Sierra Leone.

Rationale for the inclusion of Environmental Science in the Senior Secondary School Curriculum:

Environmental Science is a vision for the future and an essential part of every pupil learning process. It helps to encourage an awareness of the environment leading to informed concern for active participation in resolving environmental issues.

- The environment and natural resource base are critical for Sierra Leoneans to make meaningful contributions.
- Natural resource base, environmental management and conservation are prerequisites for sustainable development in the country.

Subject Content Outline by Broad themes and Specific topics.

Introduction to Environmental of Science

- The Chemical and Biological foundations of life
- Biological Organization
- Environment and Environmental Science
- The Scientific method

- Sustainability and Sustainable development
- The IPAT Equation
- The Precautionary Principle
- The Benefits of the environment
- Global Perspective

Habitats Ecosystem and its evolution

- Definition of habitats
- Classification of habitats
- Definition of Ecosystem
- Evolution of Ecosystems
- Examples of Ecosystems
- Structure of Ecosystems
- Biodiversity and Conservation of Ecosystems
- Case study of Ecosystems.

Meteorology and the environment

- Definition of Meteorology
- Case studies of
    - Precipitation (Rain, Snow)
    - Thunderstorms
    - Tornadoes
    - Hurricanes
    - Typhoons
- Radiation, Condensation temperature and wind condition in the atmosphere
- Air masses and fronts
- Low- and high-Pressure Systems
- Tropical Meteorology
- Meteorological standard Instruments and their accuracy.
- Cloud Classification.
- Climatology

Geology and the environment

- Introduction to topographic maps

- Streams and flooding
- Coastal zones and processes
- Mass movements
- Water and water pollution
- Energy resources- Fossil fuels and alternative sources
- Waste Disposal
- Air Pollution

Renewable and Non-renewable resources

- *Renewable Resources*
  - Introduction to Conventional and Renew able energy sources.
  - Environmental Impact Challenges and future trends
  - Solar Energy
  - Wind Energy
  - Hydropower
  - Biomass Geothermal Energy
  - Ocean Energy

- *Non-Renewable Resources*
  - Definition of Energy
    Fossil Fuel: Types of formation and consumption patterns, fossil fuels and greenhouse gases
  - Coal: Mining, processing, electricity generation. Impact of coal mining, burning, reducing the impact of coal use
  - Oil: Extraction, processing, refining fracking and environmental impact of oil.
  - Natural Gas: Fracking.
  - Nuclear Energy
    Sources: Nuclear fuel processing, Nuclear Power Plant, Benefits of nuclear energy, Drawbacks of nuclear energy

Structure of the Syllabus Over the Three Year Senior Secondary Cycle

	SSS 1	SSS 2	SSS 3
Term 1	Introduction to Environmental Science • The chemical and biological foundation of life • Biological organization • Environment and Environmental science • The scientific method • Sustainability and sustainable development	• Meteorology and the environment • Definition of meteorology. Case studies of ○ Thunderstorms ○ Tornadoes ○ Hurricanes ○ Typhoons • Radiation, condensation, temperature, and wind condition in the atmosphere. • Air masses and fronts. • Low- and high-pressure systems. • Tropical meteorology • Meteorological standard instrument and their accuracy • Cloud classification • Climatology	Nuclear Energy Sources: • Nuclear fuel processing • Nuclear power plant • Benefits of Nuclear energy. • Draw backs of nuclear energy.
Term 2	Introduction to Environmental Science • The IPAT Equation • The precautionary Principle • The benefits of the environment • Global Perspective Habitats; ecosystem and its evolution • Definition of habitats • Classification of habitats • Definition of Ecosystem • Evolution of Ecosystem • Example of Ecosystem	Geology and the environment • Introduction to topographic maps • Streams and flooding • Coastal zones and processes • Mass movement • Water and water Pollution • Waste disposal	Revision of the entire syllabus and preparation for WASSCE exams

Term 3	Biodiversity and Conservation of Ecosystems	Renewable and Non-renewable resources Renewable Resources: • Introduction to convention and renewable energy sources • Environmental Impact challenges and future trends • Solar energy • Wind energy • Hydropower • Biomass • Geothermal energy • Ocean energy Non-Renewable resources • Definition of energy • Fossil fuel types, formation, and consumption patterns. Fossil fuels and greenhouse gases. • Coal: Mining processing electing generation. Impact of coal mining, burning, reducing the impact of coal use. • Oil: Extraction, processing, refining, fracking, and environmental impact of oil • Natural's gas: Fracking	

Teaching Syllabus

Topic/Theme/Unit	Expected learning outcomes	Recommended teaching methods	Suggested resources	Assessment of learning outcomes
Introduction to Environmental Science Chemical and Biological foundations of life • Structure of the atom • Molecules • Isotopes • Carbon • Hydrocarbons • Biological molecules • Biological organisation	By the end of the topic, students will be able to describe, at an introductory level the basic chemical and biological foundation of life on earth	• Direct instruction • Brainstorming • Videos, films, and slides. • Websites/internet	• Blackboard and chalk • Whiteboard and pens • Textbooks • Videos, films, and slides • Websites/internet	• Question and answers. • Comprising of oral, short answer structure question • Long essay questions • Multiple choice questions • Formative and Summative assessment
Environment and Environmental Science	By the end of the topic, students will understand and can define Environment, Ecosystem and Environmental Science	• Direct Instruction • Brainstorming • Videos, films and slides • Websites/internet • Field trips, Inquiry	• Blackboard and chalk • Whiteboard and pens • Textbooks • Videos, films, and slides • Websites/internet	• Questions and answers • Oral • Short answer • Structure questions • Long essay questions • Open ended questions • Multiple choice • Formative and summative questions
The Scientific method	By the end of the topic student will be able to apply scientific method to study phenomena in environmental Science.	• Brainstorm • Direct instruction • Use of website and internet • Application of knowledge and understanding	• Blackboard and chalk • White board and pens • Videoclips, films and slides • Textbooks	• Question and answer • Oral • Short answer • Structured questions • Long essay questions • Multiple choice question • Formative assessment

		• Problem solving approach		• Summative assessment
Sustainability and sustainable development	By the end of the topic. Student would be able to discuss sustainability and sustainable development	• Direct instruction • Brainstorming • Use of website and internet • Application knowledge and understanding • Problem solving approach	• Blackboard and chalk • White board and pens • Videoclips. Films and slides • Textbooks	• Question and answer • Oral • Short answer • Structured questions • Long essay questions • Multiple choice question • Formative assessment • Summative assessment
The IPAT equation The Precautionary Principle The benefit of the environment The Global Perspective	By the end of the unit students will be able to describe measures and tools available for natural resources and environmental risk management such as IPAT equation the precautionary Principle, the benefits of the environment and Global Perspective	• Brainstorming • Use of website and internet • Application knowledge and understanding • Problem solving approaches	• Blackboard and chalk • White board and pens • Videoclips. Films and slides • Textbooks	• Question and answer • Oral • Short answer • Structured questions • Long essay questions • Multiple choice question • Formative assessment • Summative assessment
Habitats ecosystem and its evolution • Definition of habitats • Classification of habitats • Definition of ecosystems • Evolution of Ecosystem • Example of Ecosystem	By the end of the topic, students will understand basic ecological concepts e.g., Ecology, Species. Population, Community, ecosystem, biosphere, atmosphere, lithosphere, habitat, niche Understand the process that govern interactions of organism with the biotic and	• Direct instruction • Brainstorming • Use of website and internet • Application knowledge and understanding • Problem solving approaches	• Blackboard and chalk • White board and pens • Videoclips. Films and slides Textbooks	• Question and answer • Oral • Short answer • Structured questions • Long essay questions • Multiple choice question • Formative assessment Summative assessment

	abiotic factors that affect the distribution of population and their activities.			
Biodiversity and conservation of Ecosystems • Biodiversity definition • Biogeographical classification of Sierra Leone • Value of biodiversity • Global biodiversity • Biological, regional Hotspots and threats to biodiversity • Conservation of Biodiversity Insitu and Exsitu conservation	By the end of the topic the student will be able to: • Underhand the importance of maintaining ecological balance and biodiversity • Evaluate some measures for consolation on environmental protection	• Direct instruction • Brainstorming • Use of website and internet • Application knowledge and understanding • Problem solving approaches	• Blackboard and chalk • White board and pens • Videoclips. Films and slides Textbooks	• Question and answer • Oral • Short answer • Structured questions • Long essay questions • Multiple choice question • Formative assessment Summative assessment
Meteorology and the environment • Definition of Meteorology • Case studies of ○ Thunderstorms ○ Tornadoes ○ Hurricanes ○ Typhoons ○ Radiation temperature and wind condition in the atmosphere • Air masses and fronts	By the end of the topic student will be able to: • Analyse, visualise, and interpreted meteorological information • Develop a sound understanding of climate and climate change • Develop skills in weather forecasting	• Brainstorming • Use of website and internet • Application knowledge and understanding • Problem solving approaches • Video, films, and slides • Field trips	• Blackboard and chalk • White board and pens • Videoclips, films and slides • Textbooks • Website and internet • Micro kits	• Question and answer • Oral • Short answer • Structured questions • Long essay questions • Multiple choice question • Formative assessment • Summative assessment

• Low- and high-pressure systems • Tropical meteorology • Meteorological standard instrument and their accuracy • Cloud classification • Climatology				
Geology and the environment • Introduction to topographic maps • Streams and flooding • Coastal zones and processes • Mass movement • Water and water pollution • Waste disposal	By the end of the topic student will be able to: • Construct and interpret topographic maps cross sections and profiles • Describe common earth materials and their relationship to natural hazards • Describe and explain the most common methods used to mitigate and prepare for each type of hazardous natural process	• Brainstorming • Use of website and internet • Application knowledge and understanding • Problem solving approaches • Video, films, and slides • Field trips	• Blackboard and chalk • White board and pens • Videoclips. Films and slides • Textbooks • Website and internet • Micro kits	• Question and answer • Oral • Short answer • Structured questions • Long essay questions • Multiple choice question • Formative assessment • Summative assessment
Renewable and Non-Renewable resources Renewable resources: • Introduction to Conventional and renewable energy sources.	By the end of the topic, student should be able to: • Describe arguments for renewable energy • Explain aspects of solar energy such as the working of solar energy, solar panels, examples, and use. The limitation	• Brainstorming • Use of website and internet • Application knowledge and understanding • Problem solving approaches	• Blackboard and chalk • White board and pens • Videoclips. Films and slides • Textbooks • Website and internet • Micro kits	• Question and answer • Oral • Short answer • Structured questions • Long essay questions • Multiple choice question • Formative assessment • Summative assessment

• Environmental Impact challenge and future trends • Solar energy • Wind energy • Hydro power • Biomass • Geothermal energy • Ocean energy	and environmental costs associated with solar energy • Describe wind energy and explain its advantages • Describe hydroelectric energy and explain its advantages • Describe geothermal energy and explain the advantages and disadvantages • Explain aspects of biofuels / biomass energy such as the term carbon neutral and biomass energy concept, current achievement in biofuels and growth potential. • Describe Ocean energy sources	• Video, films, and slides • Field trips		
Non-renewable sources: • Definition of energy • Fossil, fuel types, formation, and consumption patterns. Fossil fuels and greenhouse gates. • Coal: Mining processing electric generation. Impact of coal mining. Burning,	By the end of the unit students will be able to: • List specific example of non-renewable sources • Explain what makes an energy source no renewable • Describe the main types of fossil fuels and how they are formed • Explain the environmental impacts associated with	• Brainstorming • Use of website and internet • Application knowledge and understanding • Problem solving approaches • Video, films, and slides • Field trips	• Blackboard and chalk • White board and pens • Videoclips. Films and slides • Textbooks • Website and internet • Micro kits	• Question and answer • Oral • Short answer • Structured questions • Long essay questions • Multiple choice question • Formative assessment • Summative assessment

reducing the impact of coal use. • Oil: Extraction processing, refining, fracking, and environmental impact of Gas. Fracking.	exploration, extraction, and the use of the different types of fossil fuels.			
• Nuclear Energy • Sources of Nuclear Energy • Nuclear fuel processing • Nuclear power plants • Drawback of nuclear energy	• By the end of the unit students will be able to explain nuclear energy, how it works, its benefits and risk • Explain the sources of nuclear energy • Describe nuclear fuel processing • Discuss the nuclear power plants • Describe the draw backs of nuclear energy	• Brainstorming sessions using video films and slides • Direct instruction	• Websites/internet • Blackboard and chalk • Whiteboard and board, pens, video. Films and slides • Power Point presentation	• Question and answer • Formative Assessment and Summative Assessment