11th Grade American Online School

SCIENCE CURRICULUM

Advanced Scientific Inquiry and Practical Applications

Version Mar/2025

1. Introduction

The Role of Science Education in 11th Grade

Science in 11th grade emphasizes advanced problem-solving, experimentation, and real-world applications. This curriculum strengthens students' understanding of biological sciences, chemistry, physics, natural sciences, and agriculture, preparing them for higher education and careers in STEM-related fields.

By the end of this course, students will:

✓ **Develop advanced analytical and experimental skills through hands-on scientific investigations**.

✓ **Apply biology, chemistry, and physical science concepts to real-world problems**.

✓ **Understand the role of science in sustainability, agriculture, and environmental conservation**.

✓ **Use scientific reasoning to evaluate evidence, solve problems, and make informed decisions**.

---

2. Core Competence Areas

SCI.1 Biology and Life Sciences

Learning Outcomes

By the end of this unit, students will be able to:

✓ **Understand the structures and functions of living organisms**.

✓ **Analyze genetic inheritance, biotechnology, and evolutionary theory**.

✓ **Explore the impact of human activity on ecosystems and biodiversity**.

Competencies

SCI.1.A.1 – Advanced study of cell biology and genetics.

- Investigate cell structures, organelles, and biochemical processes.
- Explore DNA replication, protein synthesis, and gene expression.
- Understand inheritance patterns and genetic engineering.

SCI.1.A.2 – Ecology, biodiversity, and environmental impact.

- Analyze food chains, energy flow, and population dynamics.
- Study human impacts on climate change, pollution, and conservation efforts.
- Examine bioremediation and ecosystem restoration strategies.

SCI.2 Chemistry and Chemical Reactions

Learning Outcomes

By the end of this unit, students will be able to:

✓ **Understand the atomic and molecular structure of matter**.

✓ **Analyze chemical reactions, stoichiometry, and thermodynamics**.

✓ **Apply chemistry concepts in environmental and industrial contexts**.

Competencies

SCI.2.A.1 – Exploring chemical reactions and molecular interactions.

- Understand periodic trends and chemical bonding.
- Analyze reaction rates, equilibrium, and thermodynamics.
- Explore acid-base chemistry, pH, and buffer systems.

SCI.2.A.2 – Real-world applications of chemistry.

- Study chemical principles in medicine, agriculture, and environmental science.
- Analyze the role of polymers, nanotechnology, and materials science.
- Explore chemical sustainability and green chemistry.

SCI.3 Physical Sciences and Physics

Learning Outcomes

By the end of this unit, students will be able to:

✓ **Apply Newtonian mechanics and motion concepts to real-world systems**.

✓ **Understand energy conservation, thermodynamics, and electricity**.

✓ **Explore the applications of physics in engineering and technology**.

Competencies

SCI.3.A.1 – Understanding motion, forces, and energy.

- Apply Newton's Laws of Motion to real-world mechanics.
- Explore momentum, work, power, and energy transformation.
- Investigate simple and complex machines in physics.

SCI.3.A.2 – Exploring waves, electromagnetism, and modern physics.

- Understand wave behavior, sound, and light optics.
- Study electromagnetism and its applications in motors and power generation.
- Analyze modern physics concepts, including relativity and quantum mechanics.

SCI.4 Natural Sciences and Environmental Systems

Learning Outcomes

By the end of this unit, students will be able to:

✓ **Study Earth's systems, including climate, geology, and ecosystems**.

✓ **Understand the impact of human activities on the environment**.

✓ **Apply scientific models to predict environmental changes**.

Competencies

SCI.4.A.1 – Understanding Earth's dynamic systems.

- Explore plate tectonics, earthquakes, and geological formations.
- Study atmospheric science, weather patterns, and climate change.
- Investigate water cycles, ocean currents, and natural disasters.

SCI.4.A.2 – Sustainable solutions for environmental challenges.

- Analyze renewable and nonrenewable energy sources.
- Study waste management, pollution control, and conservation strategies.
- Explore the role of scientists in addressing global environmental issues.

SCI.4 Agriculture and Applied Sciences

Learning Outcomes

By the end of this unit, students will be able to:

✓ **Understand the role of agriculture in food production and sustainability**.

✓ **Apply biology and chemistry concepts to improve agricultural practices**.

✓ **Analyze the impact of agricultural technologies on food security and the environment**.

Competencies

SCI.4.A.1 – Understanding agricultural science and sustainability.

- Study soil composition, nutrient cycles, and plant biology.
- Explore sustainable farming techniques and irrigation systems.
- Analyze the environmental impact of pesticides and fertilizers.

SCI.5.A.2 – Agricultural biotechnology and food production.

- Examine aquaculture and selective breeding.
- Study hydroponics, aquaponics, and vertical farming innovations.
- Investigate the role of AI and automation in modern agriculture.

---

3. Assessment and Evaluation

Formative Assessments – Checking Progress Through Interactive Learning

✓ **Scientific journal entries and lab reports**.
✓ **Quizzes and worksheets covering key science concepts**.
✓ **Discussions on case studies related to scientific advancements**.

Summative Assessments – Final Projects and Exams

✓ **Cumulative exams covering biology, chemistry, physics, and agriculture**.
✓ **Projects applying scientific principles to real-world problems**.
✓ **Oral presentations on scientific innovations and discoveries**.

Authentic Assessment – Real-World Applications

✓ **Students analyze environmental policies and propose solutions**.
✓ **Engineering and agricultural innovations case studies**.

---

4. Instructional Strategies for Online Learning

Inquiry-Based and Problem-Based Learning

✓ **Case studies on real-world scientific discoveries and challenges**.
✓ **Research projects on sustainability and technological innovation**.

Project-Based Learning (PBL)

✓ **Students design experiments and collect data in virtual or physical labs**.
✓ **Projects on space exploration, energy, and environmental science**.

Technology-Integrated Learning

✓ **Use of AI-powered scientific simulations and virtual labs**.
✓ **Online data analysis tools for climate, genetics, and chemistry research**.