

# 10th Grade American Online School

## SCIENCE CURRICULUM

### Everyday Science to Understand the World

Version Mar/2025

## 1. Introduction

### The Role of Science Education in 10th Grade

Science is a fundamental discipline that fosters critical thinking, problem-solving, and inquiry-based learning. At the 10th-grade level, students advance their understanding of the physical and biological world by:

- Exploring scientific principles.
- Conducting experiments.
- Applying knowledge to real-world contexts.

This curriculum is designed to bridge foundational science education with advanced scientific exploration, equipping students with:

- ✓ Analytical skills to critically evaluate scientific information.
- ✓ Research capabilities to conduct investigations and interpret data.
- ✓ Technological fluency to engage with modern scientific tools and digital applications.
- ✓ Interdisciplinary knowledge to understand the connections between different scientific fields.
- ✓ An appreciation for the natural world, sustainability, and ethical considerations in science.

## 2. Core Competence Areas

### SCI.1 Biology – Life and Environmental Sciences

#### Learning Outcomes

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

- ✓ Use the scientific method to ask questions, make predictions, and test ideas through simple experiments.
- ✓ Understand cell structures and their functions, including how cells grow, divide, and produce energy.
- ✓ Learn the basics of genetics, including how traits are passed from parents to offspring and how DNA works.
- ✓ Explore ecosystems and the environment, studying food chains, climate, and how human actions affect nature.
- ✓ Discover biotechnology, such as how scientists use biology to improve medicine, farming, and the environment.
- ✓ Develop basic skills in analyzing data and scientific information to better understand biological research.
- ✓ Think about ethical issues in science, such as genetic modification, cloning, and protecting the environment.

#### Competencies

##### SCI.1.A.1 – Using the scientific method to explore biology.

- Ask scientific questions and make simple predictions.
- Plan and carry out basic experiments.
- Record observations and draw conclusions from results.

##### SCI.1.A.2 – Understanding cells and how they work.

- Identify major cell parts and their functions.
- Learn how plants and animals use energy through photosynthesis and respiration.
- Understand how cells stay balanced and healthy.

##### SCI.1.A.3 – Learning about genetics and how traits are inherited.

- Understand how parents pass traits to their children.
- Explore DNA and how it controls traits.
- Learn how small changes in DNA can affect living things.

**SCI.1.A.4 – Studying ecosystems and the environment.**

- Understand how plants, animals, and humans interact in nature.
- Learn about climate, pollution, and protecting nature.
- Explore ways to take care of the environment.

**SCI.1.A.5 – Discovering biotechnology and its uses.**

- Learn how science helps improve medicine, farming, and the environment.
- Explore basic ideas about genetically modified foods and medical research.
- Discuss how biotechnology can help solve real-world problems.

**SCI.1.A.6 – Looking at scientific data and research.**

- Read and understand simple graphs, charts, and research data.
- Learn how scientists collect and organize information.
- Use basic tools to analyze biological data.

**SCI.1.A.7 – Thinking about ethics in science.**

- Discuss the benefits and risks of new scientific discoveries.
- Learn about ethical questions in genetic modification and cloning.
- Understand why protecting the environment is important.

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**SCI.2 Chemistry – Chemical Structures and Interactions****Learning Outcomes**

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

- ✓ Conduct simple chemistry experiments to explore how substances react and change.
- ✓ Understand the structure of atoms and elements, including how they are arranged in the periodic table.
- ✓ Learn how different types of chemical bonds form and why some materials are stronger or more reactive than others.
- ✓ Explore acids and bases, how they interact, and why pH balance is important in nature and industry.
- ✓ Discover how chemistry is used in daily life, including in food, medicine, and the environment.
- ✓ Understand chemical reactions, how substances combine and break apart, and what factors affect reaction speed.

✓ Learn about sustainability in chemistry, including ways to reduce pollution and make materials more eco-friendly.

## Competencies

### SCI.2.A.1 – Understanding atoms and the periodic table.

- Learn what atoms are and how they combine to make everything around us.
- Understand how the periodic table organizes elements based on their properties.
- Explore how different elements react with each other.

### SCI.2.A.2 – Learning about chemical bonding and molecular structures.

- Identify the different types of chemical bonds (ionic, covalent, and metallic).
- Understand how molecules form different shapes and why that matters.
- Learn about forces that hold molecules together, like hydrogen bonds.

### SCI.2.A.3 – Exploring chemical reactions and what affects them.

- Investigate what makes reactions happen faster or slower, like temperature and concentration.
- Learn about equilibrium, when reactions balance out.
- Discover why some reactions release energy while others absorb it.

### SCI.2.A.4 – Understanding acids, bases, and pH balance.

- Learn the difference between acids and bases and how they react with each other.
- Explore how pH levels affect the environment and everyday life.
- Conduct simple experiments with acids and bases, like testing household items.

### SCI.2.A.5 – Discovering chemistry in everyday life.

- Understand how chemistry is used in medicine, food, and technology.
- Learn about plastics, fuels, and materials made using chemistry.
- Explore how chemistry helps in storing energy (like in batteries).

### SCI.2.A.6 – Using simple tools to analyze chemicals.

- Learn how scientists identify unknown substances using tests and instruments.
- Explore basic techniques like chromatography and spectroscopy.
- Understand how computers help scientists predict chemical reactions.

### **SCI.2.A.7 – Learning about chemistry and the environment.**

- Explore how chemistry can help reduce pollution and make cleaner energy.
  - Understand the importance of recycling and sustainable materials.
  - Learn about how chemicals affect air, water, and soil and what can be done to protect nature.
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## **SCI.3 Physics – Physical Principles and Technological Applications**

### **Learning Outcomes**

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

- ✓ Understand how objects move by applying Newton's Laws of Motion to everyday activities, such as driving a car or riding a bike.
- ✓ Explore forces, energy, and power, learning how they affect movement and machines.
- ✓ Learn about sound, light, and waves, and how they are used in technologies like medical imaging, fiber optics, and communication systems.
- ✓ Discover key ideas in modern physics, such as relativity, quantum mechanics, and nuclear energy, and their role in new technologies like space travel and quantum computers.
- ✓ See how physics helps develop new technologies, including clean energy, robots, and nanotechnology.
- ✓ Use simple computer models and simulations to study how objects move and interact.
- ✓ Develop problem-solving skills to understand real-world physics challenges in areas like engineering, climate science, and medicine.

### **Competencies**

#### **SCI.3.A.1 – Understanding motion and forces.**

- Learn how forces like gravity, friction, and acceleration affect movement.
- Apply Newton's Laws to everyday situations like driving, sports, and construction.
- Understand how speed and motion can be measured and predicted.

### **SCI.3.A.2 – Learning about energy and how it is used.**

- Discover how energy is transferred and transformed in machines and engines.
- Learn how heat and energy efficiency affect our environment.
- Explore how renewable energy sources like wind and solar power work.

### **SCI.3.A.3 – Exploring sound, light, and waves.**

- Understand how waves travel and why they are important in technology.
- Learn how light reflects, bends, and interacts with materials.
- Explore how sound and acoustics are used in music, medicine, and communication.

### **SCI.3.A.4 – Understanding electricity and magnetism.**

- Learn about electricity and magnetic fields and how they power motors and generators.
- Explore how electromagnetic waves are used in wireless communication.
- Discover how batteries, circuits, and electrical systems work in daily life.

### **SCI.3.A.5 – Discovering modern physics concepts.**

- Learn about atoms, nuclear energy, and radiation.
- Explore how scientists use quantum physics in computers and space exploration.
- Understand how new technologies use physics principles to solve big challenges.

### **SCI.3.A.6 – Using computers to model physics.**

- Use simple computer programs to predict how objects move.
- Explore how scientists use simulations to study weather, space, and technology.
- Learn how AI and machine learning help in physics research.

### **SCI.3.A.7 – Seeing how physics connects to other sciences.**

- Explore how physics helps in medicine, engineering, and climate science.
- Learn how scientists use physics to study the environment.
- Understand how physics, chemistry, and biology work together in real-world applications.

## **SCI.4 Natural Sciences – Earth Science and Systems Thinking**

### **Learning Outcomes**

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

- ✓ **Explore Earth's natural processes, including how volcanoes, earthquakes, and erosion shape the planet.**
- ✓ **Understand weather and climate patterns, including how they affect ecosystems and human life.**
- ✓ **Learn about environmental changes, how human activities impact nature, and ways to protect the environment.**
- ✓ **Study space science, including how planets move and how gravity affects celestial bodies.**
- ✓ **Use simple models and data to make predictions about weather, climate, and planetary motion.**

### **Competencies**

#### **SCI.4.A.1 – Understanding Earth's structure and natural processes.**

- Learn about Earth's layers and how they interact.
- Explore how earthquakes, volcanoes, and erosion change the landscape.
- Understand how natural disasters affect people and the environment.

#### **SCI.4.A.2 – Learning about climate and weather.**

- Study how air, water, and the sun work together to create weather.
- Understand different climate zones and why they exist.
- Explore how human activities affect the climate and ways to reduce their impact.

#### **SCI.4.A.3 – Discovering space and planetary motion.**

- Learn about gravity and how it affects planets, moons, and stars.
- Understand how Earth orbits the Sun and how that creates seasons.
- Explore how scientists observe and track objects in space.

#### **SCI.4.A.4 – Using models to study Earth and space.**

- Use simple tools to study environmental changes.
- Learn how scientists predict weather and climate using data.
- Explore solutions for sustainability and protecting natural resources.

## **SCI.4 Agriculture – Sustainability and Resource Management**

### **Learning Outcomes**

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

- ✓ Understand how farming works, including different methods used to grow food.
- ✓ Learn about the challenges of modern agriculture, such as feeding a growing population while protecting the environment.
- ✓ Explore how science and technology help improve farming, including better plant growth and pest control.
- ✓ Discover how soil, water, and climate affect farming and food production.
- ✓ Understand the environmental impact of farming, including ways to reduce pollution and protect biodiversity.
- ✓ Learn about new and sustainable farming techniques, such as hydroponics and organic farming.
- ✓ Think about solutions for producing food efficiently while keeping the environment healthy.

### **Competencies**

#### **SCI.4.A.1 – Understanding different types of farming and their impact.**

- Compare traditional and modern farming methods.
- Learn how organic farming and sustainable agriculture help protect the environment.
- Explore how reducing food waste can improve food security.

#### **SCI.5.A.2 – Learning about plants and how they grow.**

- Understand how plants get nutrients and grow.
- Learn how scientists modify crops to make them stronger and more resistant to drought or pests.
- Think about the pros and cons of genetically modified foods (GMOs).

#### **SCI.5.A.3 – Exploring the connection between farming and the environment.**

- Learn how farming affects ecosystems, soil, and biodiversity.
- Understand the role of bees, insects, and microorganisms in healthy farming.
- Explore how climate change affects food production.



### **SCI.5.A.4 – Discovering new farming technologies and methods.**

- Learn about hydroponics, aquaponics, and vertical farming as new ways to grow food.
  - Explore how AI, robotics, and smart technology are used in modern farming.
  - Discover sustainable ways to raise animals and produce food.
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## **3. Assessment and Evaluation**

**Formative Assessments – Ongoing assessments that help students track their progress and improve their understanding.**

- ✓ Interactive simulations – Hands-on digital activities that make learning more engaging.
- ✓ Virtual labs – Online experiments where students can collect data and test ideas.
- ✓ Quizzes and adaptive learning tools – Short tests and personalized learning resources to reinforce key concepts.

**Summative Assessments – Final evaluations to measure what students have learned.**

- ✓ Standardized tests – Multiple-choice or written exams to assess understanding of key science topics.
- ✓ Lab reports – Written summaries of experiments, including steps, results, and conclusions.
- ✓ Digital portfolios – A collection of projects, experiments, and reflections that showcase student learning.

**Authentic Assessment – Real-world learning experiences that encourage problem-solving and creativity.**

- ✓ Research projects – In-depth investigations on scientific topics that promote curiosity and inquiry.
  - ✓ Case studies – Real-world examples where students analyze scientific and technological challenges.
  - ✓ AI-driven assessments – Personalized evaluations that adapt to students' learning styles and provide feedback.
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## 4. Instructional Strategies for Online Learning

**Inquiry-Based and Problem-Based Learning – Encouraging students to ask questions, explore ideas, and solve real-world problems.**

- ✓ Virtual experiments and simulations – Allow students to test ideas and analyze results in an interactive way.
- ✓ Case-based scenarios – Present students with real-world science problems to solve.
- ✓ Collaborative discussions – Encourage teamwork, discussion, and critical thinking.

**Project-Based Learning (PBL) – Helping students connect science to real-life applications through hands-on projects.**

- ✓ Student-led research projects – Encourage students to investigate scientific questions.
- ✓ Group work and collaboration – Allow students to work together to solve problems.
- ✓ Digital portfolios and multimedia presentations – Help students document and share their work.

**Technology-Integrated Learning – Using digital tools to improve engagement and understanding.**

- ✓ Virtual labs – Give students an interactive way to perform experiments.
- ✓ AI-powered tutoring – Provide personalized feedback and support for each student.
- ✓ Data analysis tools – Help students interpret scientific information and conduct simulations.