# 9th Grade American Online School

# SCIENCE CURRICULUM

# Exploring the Living World, Physical Forces, and Earth's Systems Through Inquiry and Evidence

Version Apr/2025

## 1. Introduction

### The Role of Science Education in 9th Grade

The 9th Grade Science curriculum empowers students to understand biological systems, chemical processes, physical phenomena, and environmental dynamics through hands-on investigation, conceptual modeling, and data analysis. Rooted in interdisciplinary inquiry, the curriculum fosters scientific reasoning, ethical responsibility, and critical thinking. Students will apply the scientific method across real-world contexts, developing a solid foundation for advanced STEM learning.

By the end of this course, students will:

✓ **Describe and model structures and functions in living systems.**

✓ **Understand atomic structure, chemical reactions, and material science.**

✓ **Apply physics principles to motion, energy, and wave behavior.**

✓ **Analyze Earth and space systems and evaluate environmental issues.**

✓ **Design scientific investigations, interpret data, and communicate conclusions.**

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# 2. Core Competence Areas

## SCI.1 Biology

### Learning Outcomes

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

✓ **Describe cell components and their roles.**

✓ **Explain genetic inheritance and evolution.**

✓ **Investigate biodiversity and ecosystem dynamics.**

✓ **Analyze bioelectric phenomena in living organisms.**

### Competencies

#### SCI.1.A.1 – Describing Cell Structures.

- Identify organelles and explain their functions in plant and animal cells.

#### SCI.1.A.2 – Explaining Genetic Principles.

- Use Punnett squares and DNA models to describe inheritance patterns.

#### SCI.1.A.3 – Analyzing Evolution and Selection.

- Interpret examples of natural selection and explain taxonomy.

#### SCI.1.A.4 – Modeling Ecosystem Interactions.

- Map food chains, assess biodiversity, and explore energy flow.

#### SCI.1.A.5 – Understanding Bioelectric Systems.

- Relate electrical impulses to neural signaling and bio-sensors.

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# SCI.2 Chemistry

## Learning Outcomes

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

✓ **Model atomic structure and chemical bonding.**

✓ **Use the periodic table to predict element behavior.**

✓ **Describe chemical changes and material states.**

✓ **Apply chemistry to sustainability and recycling.**

## Competencies

### SCI.2.A.1 – Model Atomic Structure.

- Draw Bohr models and classify subatomic particles.

### SCI.2.A.2 – Using the Periodic Table.

- Identify element families and predict reactivity

### SCI.2.A.3 – Balancing Chemical Equations.

- Write and balance reactions following conservation laws..

### SCI.2.A.4 – Describing States of Matter.

- Explain changes of state using particle motion models.

### SCI.2.A.5 – Evaluating Recycling Chemistry.

- Analyze material properties and propose recycling solutions.

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# SCI.3 Physics

## Learning Outcomes

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

✓ **Analyze forces and motion with mathematical models.**

✓ **Calculate energy and describe transformations.**

✓ **Describe wave behavior and properties.**

✓ **Conduct scientific investigations using proper methodology.**

## Competencies

### SCI.3.A.1 – Analyzing Motion and Forces.

- Use position-time graphs, apply Newton's Laws, and solve kinematics problems.

### SCI.3.A.2 – Calculating Energy and Work.

- Solve for kinetic and potential energy and calculate work and power..

### SCI.3.A.3 – Understanding Waves and Sound.

- Compare wave types and apply concepts of frequency, amplitude, and speed.

### SCI.3.A.4 – Conducting Scientific Investigations.

- Design experiments, measure data, and graph results for interpretation.

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# SCI.4 Earth and Environmental Science

## Learning Outcomes

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

✓ **Explain basic economic principles and systems.**

✓ **Analyze international trade and its impact on nations.**

✓ **Assess economic inequality and development goals.**

## Competencies

### SCI.4.A.1 – Understanding Earth's Structure.

- Describe internal layers, plate tectonics, and geological activity.

### SCI.4.A.2 – Analyzing Climate and Weather.

- Interpret climate graphs and explain greenhouse effects.

### SCI.4.A.3 – Evaluating Resources and Human Impact.

- Differentiate renewable/non-renewable resources and assess human influence.

### SCI.4.A.4 – Exploring the Solar System.

- Describe planetary motion, orbits, and lunar phenomena.

## SCI.5 Scientific Method and Research Skills

### Learning Outcomes

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

✓ **Design valid scientific experiments.**

✓ **Collect and analyze data using multiple methods.**

✓ **Evaluate evidence and communicate conclusions.**

✓ **Apply scientific reasoning to societal issues.**

### Competencies

#### SCI.5.A.1 – Designing Scientific Investigations.

- Form hypotheses, identify variables, and structure procedures.

#### SCI.5.A.2 – Interpreting Data.

- Organize data in tables and graphs and identify trends.

#### SCI.5.A.3 – Communicating Conclusions.

- Write lab reports, explain findings, and evaluate experimental errors.

#### SCI.5.A.4 – Applying Science to Real-World Problems.

- Use inquiry to solve environmental or technological challenges.

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# 3. Assessment and Evaluation

### Formative Assessments – Checking Progress Through Interactive Learning

✓ **Quizzes, exit tickets, and class reflections.**

✓ **Lab skill practice and observation checklists.**

✓ **Group feedback and scientific dialogue sessions.**

### Summative Assessments – Final Projects and Exams

✓ **Cumulative unit tests and portfolio submissions.**
✓ **Formal lab reports and content-based essays.**
✓ **Performance rubrics for experimental procedures and analysis.**

### Authentic Assessment – Real-World Applications

✓ **Independent or group research projects.**
✓ **Field-based investigations and eco-footprint assessments.**
✓ **Simulation-based problem-solving scenarios.**

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## 4. Instructional Strategies for Online Learning

### Inquiry-Based and Problem-Based Learning

✓ **Emphasize questioning, discovery, and interdisciplinary challenges.**

### Project-Based Learning (PBL)

✓ **Use student-led investigations and collaborative experiments.**

### Technology-Integrated Learning

✓ **Use PhET simulations, virtual labs, and data apps.**
✓ **Integrate video analysis and digital graphing tools.**
✓ **Use microscopes, sensors, or spreadsheet modeling.**