Next Generation Science Standards:
Physical Science
9th Grade

SCI 300 Physical Science (Introduction to Physics and Chemistry)

1 credit
5 days per week; 1 year
Taught in English

This is a required course for all 9th grade students in the Mexican and/or U.S. diploma program. The course emphasizes Physics and Chemistry. The Physics content will include a look at the fundamentals of science (measuring, calculating, and recording), the relationships of force, motion and speed, the relationships of energy, work, and electricity, the movement of waves, and the workings of mirrors and lenses. The Chemistry content will include the nature of matter (states, types, and behaviors), understanding and using the Periodic table, the properties of elements, solutions, and their interactions, acids and bases. Students will perform various labs emphasizing course material, will develop and show an ability to follow instructions and complete lab reports, and will develop and show ability to present data/results in an organized manner.

Textbook: McLaughlin, William, et.al. Physical Science. Glencoe/McGraw/Hill, (2012 Edition)
Prerequisite: SCI 200

Strand 1: Structure and Properties of Matter
Strand 2: Chemical Reactions
Strand 3: Forces and Interactions
Strand 4: Energy
Strand 5: Waves and Electromagnetic Radiation
Strand 7: Engineering Design

Strand 1: Structure and Properties of Matter

Standard 1: Structure and Property of Matter	
Benchmark Code	Benchmark
HS-PS1-1 Repeat	The student will use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-PS1-3 Repeat	The student will plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
Standard 2: Nuclear Processes	
Benchmark Code	Benchmark
HS-PS1-8	The student will develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
Standard 3: Types of Interactions	
Benchmark Code	Benchmark

HS-PS2-6	The student will communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Strand 2: Chemical Reactions

Standard 1: Structure and Property of Matter

Benchmark Code	Benchmark
HS-PS1-2 Repeat	The student will construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. (also in Strand 2, Standard 2)
HS-PS1-4 Repeat	The student will develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

Standard 2: Chemical Reactions

Benchmark Code	Benchmark
HS-PS1-2 Repeat	The student will construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. (also in Strand 2, Standard 1)
HS-PS1-5	The student will apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
HS-PS1-6	The student will refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. (also in Strand 2, Standard 3)
HS-PS1-7	The student will use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Strand 3: Forces and Interactions

Standard 1: Forces in Motion

Benchmark Code	Benchmark
HS-PS2-1	The student will analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
HS-PS2-2	The student will use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is net force on the system.
HS-PS2-3	The student will apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

Standard 2: Types of Interactions

Benchmark Code	Benchmark
HS-PS2-4	The student will use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

HS-PS2-5 Repeat	The student will plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current

Strand 4: Energy

Standard 1: Definitions of Energy	
Benchmark Code	Benchmark
HS-PS3-2	The student will develop and use models to illustrate that energy at the macroscopic scale can be accounted for as either motions of particles or energy stored in fields.
HS-PS3-3	The student will design, build and refine a device that works within given constraints to convert one form of energy into another form of energy. (also in Strand 3, Standard 4)
Standard 2: Conservation of Energy and Energy Transfer	
Benchmark Code	Benchmark
HS-PS3-1	The student will create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
HS-PS3-4 Repeat	The student will plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). (also in Strand 4, Standard 4)
Standard 3: Relationship Between Energy and Forces	
Benchmark Code	Benchmark
HS-PS3-5	The student will develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
Standard 4: Energy in Chemical Reactions	
Benchmark Code	Benchmark
HS-PS3-3	The student will design, build and refine a device that works within given constraints to convert one form of energy into another form of energy. (also in Strand 3, Standard 1)
HS-PS3-4 Repeat	The student will plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). (also in Strand 4, Standard 2)

Strand 5: Waves and Electromagnetic Radiation

Standard 1: Wave Properties	
Benchmark Code	Benchmark
HS-PS4-1	The student will use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
HS-PS4-2	The student will evaluate questions about the advantages of using a digital transmission and storage of information.

HS-PS4-3 Repeat	The student will evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. (also in Strand 5 Standard 2)
HS-PS4-5 Repeat	The student will communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. (also in Strand 5 Standard 2)) (also in Strand 5 Standard 3)
Standard 2: Electromagnetic Radiation	
Benchmark Code	Benchmark
HS-PS4-3 Repeat	The student will evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. (also in Strand 5 Standard 1)
HS-PS4-4	The student will evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.
HS-PS4-5 Repeat	The student will communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. (also in Strand 5 Standard 1)) (also in Strand 5 Standard 3)
Standard 3: Information Technologies and Instrumentation	
Benchmark Code	Benchmark
HS-PS4-5 Repeat	The student will communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

Strand 7: Engineering Design

Standard 1: The student asks and defines a problem, develops and uses models, plans, and carries out investigations, analyzes and interprets data, uses mathematics and computer technology, constructs explanations, and designs solution, engages in argument from evidence and obtains, evaluates, and communicates information.	
Benchmark Code	Benchmark
HS-ETS1-1	The student will analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. (Use ETS1-C Optimizing the Design Solution to connect to PS1-6: Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others may be needed.)
HS-ETS1-2	The student will design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3	The student will evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

HS-ETS1-4	The student will use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.