DREYFOUS

Course Overview

Physical Science

TABLE OF CONTENTS

Description of courses 7-9

EduSystem's 7-9 Science courses were developed and updated based on the curricular designs, content standards and grade-level expectations of the Department of Education of Puerto Rico (*Puerto Rico Core Standards*) and the Curriculum Framework. Furthermore, the content has been enriched by the study of curricular programs designed by other educational institutions and private schools.

The courses introduce their content in a dynamic, innovative and recreational way. Additionally, they allow the students to build on their own knowledge through the cognitive development of scientific concepts, principles, and laws. They also encourage the study of this discipline by presenting scientific research, skills, and science processes within accessible content.

Basic Concepts and Conceptual Support Elements

EduSystem's 7-9 Science courses are supported in their design and conceptualization by several basic principles.

1. 1. Emphasis on the need to:
    - Stimulate in the student the use of logical and analytical thinking for reasoning, interpreting, and solving problems, as well as reflection and decision-making throughout the process.
    - Learn Science while "doing Science" by carrying out various activities, experimentation, and scientific research.
    - Promote curriculum integration and the application of scientific concepts in real-life situations.
    - Structure the teaching process systematically (in sequence, and from the concrete to the abstract).
    - Stimulate the development of multiple talents and the opportunity to express them in different ways.

- Promote the development of science concepts, principles, laws, processes, and skills in an articulated way.
- Provide strategies to address the individual differences of the students that make up the school population.

2. The development of the activities integrates a constructivist focus which provides and promotes an environment for the students to play a bigger role in the construction of their knowledge and the development of their skills.

General Objectives

- Promote learning through concrete experiences.
- Encourage the use of information technology as a learning scenario.
- Raise awareness in the students regarding the protection and conservation of the environment.
- Encourage reflection and self-assessment during the learning process.
- Promote experiences that develop the values of the sciences and our surrounding environment.
- Integrate scientific disciplines (Chemistry, Physics, Biology, among others) with other fields.
- Encourage participation in scientific research and in the development of science concepts, skills, and processes.
- Integrate science standards and expectations.
- Facilitate situations, activities, and exercises to actively build knowledge and apply it to different situations.
- Work with concrete and abstract concepts.
- Contribute to the development of language as a means of individual and collective communication and incorporate scientific vocabulary.
- Enrich the lessons with texts, exercises, and activities that are appropriate for the level.
- Highlight the scientific environment according to the level.

Course Structure

Physical Sciences is composed of twenty-seven units plus an introductory unit. Within each unit, you will find the lessons that make up the unit. Each lesson consists of a presentation divided into sections that develop the topic of study. Each lesson includes work documents, and as a general rule, contains videos or web links.

We invite you to familiarize yourself with the sections of the presentations and the documents generally found in the lessons of the EduSystem Physical Sciences course.

Units are made up of the following elements:

Lesson 0

This lesson consists of unit documents, a series of diagnostic, formative and cumulative assessment documents that will be used before, during and after the study of each unit. Other documents found on L00 are:

- **Activity** Various fun activities are carried out to verify what has been learned.
- **Ecological commitment** Topics related to the ecological point of view and how the student can contribute to the conservation of the environment are introduced.
- **Assessment exercises** Activities that verify the knowledge acquired in each unit.
- **Laboratory** Research activities are carried out by applying the scientific method. Subjects studied in class are applied during laboratory practice.

Lessons

Each unit consists of several lessons divided according to the topics to be studied. Likewise, each lesson consists of a presentation and the following documents:

- **Evaluate my Progress** Reflective exercise regarding the subject studied in the lesson.
- **Fact Sheet** The lesson plan. This includes the specific objectives of the lesson, standards, and expectations, teaching strategies and resources, keywords, web links, references, among others.
- **Let's do Science!** A research activity is developed in which the students can learn science by "doing science", through the execution of varied activities and scientific research.
- **Did you know...?** Very interesting topics and scientific curiosities that will stimulate student's imagination are presented.
- **Supplementary projects** A variety of activities, exercises, games, and manipulatives related to the topics presented in the lesson.
- **Vocabulary** New terms are defined.
- **Knowledge Check** Various activities that check the knowledge acquired in each subject.

Unit Breakdown

Below you will find the units divided into individual lessons with detailed objectives and concepts for each of them.

Unit 1. How Do We Study Matter?

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. How Do We Study Matter?

Code: C428G0SU01L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Physical Sciences

Code: C428G0SU01L01

Objective

- Explain what Physical Sciences are and how they have developed.

Key Terms

- medical ultrasound
- energy
- physicists
- insulin
- matter
- technology

Lesson 2. Science and You

Code: C428G0SU01L02

Objective

- Describe how science and scientific reasoning are present in all the activities we do.

Key Terms

- entomologist
- deductive reasoning
- inductive reasoning

Lesson 3. The Scientific Method

Code: C428G0SU01L03

Objective

- Explain the scientific method and how we apply it to our daily life.

Key Terms

- control group
- experimental group
- hypothesis
- qualitative observation
- quantitative observation
- dependent or responding variable
- independent or manipulated variable

Lesson 4. Science and Technology

Code: C428G0SU01L04

Objective

- Establish relations between science and technology.

Key Terms

- biotechnology
- sedentism

Unit 2. Measuring Matter

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Measuring Matter

Code: C428G0SU02L00

Unit documents: Activity, Laboratory, Ecological Commitment, Assessment Exercises, and Lesson Keys

Lesson 1. Measurements, Units and Prefixes

Code: C428G0SU02L01

Objectives

- Understand the different methods of measuring.
- Learn the history of the creation of the International System of Units (SI).
- Define the International System of Units.
- Learn the concepts of mass, weight, volume, time, and temperature.

Key Terms

- density
- liter
- length
- mass
- newton
- weight
- SI
- unit
- volume

Lesson 2. Conversions

Code: C428G0SU02L02

Objectives

- Understand the concept of conversion.
- Define concepts such as mass, weight, length, time, temperature, volume, and density.
- Solve problems involving conversions of measurements given in a particular unit into other units.

Key Terms

- significant figures
- precision

Lesson 3. Graphs

Code: C428G0SU02L03

Objectives

- Solve problems involving conversions of measurements given in a particular unit into other units.
- Build graphs to represent the relation between variables in an accurate manner.

Key Terms

- dependent or responding variable
- independent or manipulated variable

Unit 3. Matter

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Matter

Code: C428G0SU03L00

Unit documents: Activity, Project, Assessment Exercises and Lesson Keys

Lesson 1. Classification of Matter

Code: C428G0SU03L01

Objective

- Classify matter in terms of its purity, as pure substances (elements and compounds) and mixtures.

Key Terms

- compound
- element
- diatomic elements
- monatomic elements
- matter
- mixture
- heterogeneous mixture
- homogeneous mixture
- solution
- pure substances

Lesson 2. Matter and Its States

Code: C428G0SU03L02

Objective

- Identify and describe the states of matter.

Key Terms

- gases
- liquids
- plasma
- solids
- surface tension
- viscosity
- volume

Lesson 3. Properties and Changes in Matter

Code: C428G0SU03L03

Objectives

- Explain the changes in the states of matter.
- Explain and compare the physical and chemical changes that matter goes through.

Key Terms

- chemical changes
- physical changes
- freezing
- evaporation
- fusion
- physical properties
- extensive physical properties
- intensive physical properties
- sublimation
- volatile

Unit 4. Particles of Matter

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Particles of Matter

Code: C428G0SU04L00

Unit documents: Activity, Subatomic Particles Project, Laboratory, Assessment Exercises, and Lesson Keys

Lesson 1. The Atomic Theory

Code: C428G0SU04L01

Objectives

- Describe the contribution of different scientists to the study of the composition of matter until getting to the Atomic Theory.
- Explain the principles of the Atomic Theory and describe the atomic model and its subatomic particles.

Key Terms

- alchemy
- alchemist
- atom
- Law of Conservation of Mass
- Law of definite proportions
- Law of multiple proportions
- electron cloud
- pseudoscientists
- Atomic Theory

Lesson 2. Mass Number and Isotopes

Code: C428G0SU04L02

Objective

- Explain how to differentiate the atoms of the elements from each other based on their atomic number and their mass number.

Key Terms

- compound
- element
- isotopes
- atomic mass
- molecule
- neutron
- atomic number
- symbol

Lesson 3. Molecules and Ions

Code: C428G0SU04L03

Objective

- Explain the difference between elements and compounds in terms of their composition.

Key Terms

- allotropy
- allotropes
- anion
- diatomic elements
- ion
- monatomic ions
- polyatomic ions
- molecule
- polyatomic molecule
- diatomic molecule
- oxidation number

Unit 5. Atoms and Elements

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Atoms and Elements

Code: C428G0SU05L00

Unit documents: Activity, Laboratory, Assessment Exercises, and Lesson Keys

Lesson 1. The Periodic Table

Code: C428G0SU05L01

Objectives

- Describe the contribution of different scientists to the organization and classification of the elements, according to their characteristics, up until the periodic table.
- Explain that the periodic table is based on the principle that the physical and chemical properties of the elements are a periodic function of their atomic number.

Key Terms

- transition elements
- representative elements
- atomic structure
- Periodic Law
- Modern Periodic Law
- atomic mass
- atomic number
- Arabic numerals
- atomic weight
- periodic table
- valency

Lesson 2. Classification of Elements

Code: C428G0SU05L02

Objectives

- Classify and describe the element, according to the groups in the periodic table, as metals, nonmetals, and metalloids.
- Describe the characteristics and properties of the different groups of elements that make up the periodic table.

Key Terms

- cation
- transition elements
- actinide series
- lanthanide series
- alkaline-earth metals (group IIA)
- boron family (group IIIA)
- carbon family (group IVA)
- hydrogen family
- nitrogen family (group VA)
- oxygen family (group VIA)
- hydrogen family
- nitrogen family (group VA)
- oxygen family (group VIA)
- noble gases (group VIIIA)

- halogens (group VIIA)
- metals
- alkali metals
- metalloids
- nonmetals
- atomic number

Unit 6. Chemical Bonds and Compounds

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Chemical Bonds and Compounds

Code: C428G0SU06L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Why are chemical bonds formed?

Code: C428G0SU06L01

Objective

- Explain how chemical bonds are formed to produce compounds.

Key Terms

- energy layers
- energy levels
- valence electron
- chemical bond
- Lewis structures
- line
- electron cloud
- period
- octet rule
- valency

Lesson 2. Types of Bonds and Compounds

Code: C428G0SU06L02

Objective

- Describe the types of bonds formed by the elements to produce compounds.

Key Terms

- electron affinity
- anion
- cation
- crystals
- ionization energy
- covalent bond
- non-polar covalent bond
- polar covalent bond
- ionic bond
- metallic bond

Lesson 3. Oxidation number

Code: C428G0SU06L03

Objective

- Explain what the oxidation number is and how it is involved in the formation of the compounds.

Key Terms

- oxidation state
- oxidation number

Unit 7. Nomenclature of Inorganic Compounds

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Nomenclature of Inorganic Compounds

Code: C428G0SU07L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Nomenclature

Code: C428G0SU07L01

Objective

- Describe what organic compounds and inorganic compounds are.

Key Terms

- compound
- inorganic compounds
- organic compounds
- nomenclature
- symbol

Lesson 2. Ionic Compounds

Code: C428G0SU07L02

Objectives

- Explain how a chemical formula expresses the exact composition of a compound.
- Write chemical formulas using monatomic and polyatomic ions.
- Accurately name compounds by their chemical formula.

Key Terms

- coefficients
- ternary compound
- binary compound
- empirical formula
- chemical formula
- monatomic ions
- polyatomic ions
- subscripts

Unit 8. States of Matter

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. States of Matter

Code: C428G0SU08L00

Unit documents: Activity, Assessment Exercises, Ecological Commitment, and Lesson Keys

Lesson 1. Solids and Liquids

Code: C428G0SU08L01

Objective

- Identify and describe the characteristics of the states of matter.

Key Terms

- capillary action
- crystals
- intermolecular forces
- liquid
- matter
- bipolar molecule
- crystal lattice
- atomic solid
- molecular solid
- ionic solids
- metallic solids
- surface tension
- viscosity

Lesson 2. Gases and Plasma

Code: C428G0SU08L02

Objective

- Explain the laws that govern the behavior of gases.

Key Terms

- Amedeo Avogadro
- barometer
- Blaise Pascal
- diffusion
- Evangelista Torricelli
- gas
- Jacques Charles
- Joseph Louis Gay-Lussac
- Boyle's law
- gas laws
- pascal
- plasma
- pressure
- atmospheric pressure
- Robert Boyle
- Rudolf Clausius
- Kinetic Molecular Theory

Lesson 3. Changes of State

Code: C428G0SU08L03

Objectives

- Describe the effect of pressure, temperature and volume on the states of matter.
- Explain the energy changes that occur when matter changes state.

Key Terms

- condensation
- evaporation
- fusion
- gas
- liquefaction
- boiling point
- melting point
- solidification
- solid
- sublimation
- thermochemistry
- vaporization

Unit 9. Rectilinear motion

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Rectilinear motion

Code: C428G0SU09L00

Unit documents: Activity, Assessment Exercises, Laboratory, Ecological Commitment, and Lesson Keys

Lesson 1. Motion

Code: C428G0SU09L01

Objective

- Describe the different ways in which an object may move.

Key Terms

- simple harmonic motion
- kinetics
- kinematics
- horizontal component
- vertical component
- statics
- friction
- inertia
- frames of reference
- mechanics
- relative motion
- trajectory

Lesson 2. Velocity and Distance

Code: C428G0SU09L02

Objectives

- Define and explain the difference between concepts such as speed, velocity, distance, and displacement.
- Describe the rectilinear motion of an object using the graphical method.

Key Terms

- conversion
- distance
- x-axis
- y-axis
- position-time graph
- interval
- speed
- constant speed
- instantaneous speed
- average speed
- time
- units
- dependent variable
- independent variable
- velocity
- constant velocity
- instantaneous velocity
- average velocity

Lesson 3. Acceleration

Code: C428G0SU09L03

Objectives

- Define and explain the difference between concepts such as speed, velocity, distance, displacement, and acceleration.
- Mathematically determine the speed of an object, the distance it travels, the time it takes to travel a given distance and its acceleration.

Key Terms

- acceleration
- negative acceleration
- free falling objects
- deceleration
- meter per second squared
- time
- velocity
- final velocity
- initial velocity

Unit 10. Forces

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Forces

Code: C428G0SU10L00

Unit documents: Activity, Assessment Exercises, and Lesson Keys

Lesson 1. Types of Forces and their Effects

Code: C428G0SU10L01

Objective

- Describe and explain what a force is, the different types of forces that exist and their effects on objects.

Key Terms

- electromagnetism
- friction
- force
- centripetal force
- force of gravity
- magnetic force
- weak nuclear force
- strong nuclear force
- force of attraction
- force of repulsion
- inertia
- magnetism
- magnetic poles

Lesson 2. Measuring Force

Code: C428G0SU10L02

Objectives

- Explain what a spring is and apply Hooke's law to determine its elongation when a force is applied.
- Explain Newton's law of universal gravitation and apply it to determine the force of attraction between two bodies.

Key Terms

- ultimate elongation
- initial elongation
- dynamometer
- elasticity
- final force
- initial force
- Hooke's law
- Law of Universal Gravitation
- Newton

Lesson 3. Newton's Laws

Code: C428G0SU10L03

Objective

- Explain Newton's Laws of Motion and apply the second law to determine the force, mass, and acceleration of an object.

Key Terms

- magnitude
- Newton's First Law of Motion
- Newton's Second Law of Motion
- Newton's third Law of Motion

Unit 11. Work and Energy

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Work and Energy

Code: C428G0SU11L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Work and Power

Code: C428G0SU11L01

Objective

- Explain what work and power are and mathematically determine them using the corresponding equations and units.

Key Terms

- force
- joule
- newton
- power
- work
- watt

Lesson 2. Types of Energy

Code: C428G0SU11L02

Objectives

- Identify and describe the different known types of energy and the uses given to each of them.
- Explain the law of conservation of energy.

Key Terms

- tidal energy
- wind energy
- geothermal energy
- hydroelectric energy
- luminous energy
- nuclear energy
- chemical energy
- solar energy
- thermal energy
- electromagnetic spectrum
- geysers
- Law of conservation of energy
- nuclear reactor

Lesson 3. Let's Calculate Energy

Code: C428G0SU11L03

Objectives

- Explain the concepts of kinetic and potential energy and how they relate.
- Mathematically determine the kinetic energy and potential energy of an object.

Key Terms

- kinetic energy
- potential energy

Unit 12. Waves

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Waves

Code: C428G0SU12L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Characteristics, Frequency, and Wavelength

Code: C428G0SU12L01

Objectives

- Mention and explain the characteristics of waves.
- Mathematically determine the frequency and period of a wave.

Key Terms

- amplitude
- angle of incidence
- angle of reflection
- crest
- frequency
- interference
- constructive interference or reinforcement
- destructive interference or cancellation
- wavelength
- Law of reflection
- medium
- surface wave
- longitudinal wave
- transverse wave
- electromagnetic waves
- mechanical waves
- period
- perpendicular
- superposition principle
- wave pulse
- reflection
- refraction
- wave train
- trough

Lesson 2. Energy of Waves

Code: C428G0SU12L02

Objective

- Explain the relationship between the waves and the energy they carry.

Key Terms

- absorption
- kinetic energy
- radiant energy
- elastic property
- inertial property
- wave
- radiation
- terrestrial radiation
- resistance

Lesson 3. Electromagnetic Spectrum

Code: C428G0SU12L03

Objective

- Explain what the electromagnetic spectrum is and the types of radiation that constitute it.

Key Terms

- aleatory
- collisions
- electromagnetic spectrum
- photon
- beams
- ionosphere
- infrared radiation
- broadcasting
- gamma rays
- X-rays
- ultraviolet

Unit 13. Color

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Color

Code: C428G0SU13L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Evolution of the Color Theory and the Color Spectrum

Code: C428G0SU13L01

Objective

- Describe the evolution of the color theory, explain what the color spectrum is and our ability to see.

Key Terms

- concentric layers
- beams
- transparent medium

Lesson 2. Mixing Colored Light

Code: C428G0SU13L02

Objectives

- Explain how secondary colors of light and secondary pigments are formed and the differences between them.
- Describe and explain the color of objects when they are illuminated by lights of different colors.

Key Terms

- hues
- pigments
- suspensions

Lesson 3. Atomic Spectra

Code: C428G0SU13L03

Objective

- Explain what the spectrum of the elements is and how it helps identify them.

Key Terms

- continuous spectrum
- line spectrum
- spectroscope

Unit 14. Light

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Light

Code: C428G0SU14L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Nature and Behavior of Light

Code: C428G0SU14L01

Objective

- Explain the theories about the nature of light and describe its behavior.

Key Terms

- illuminated objects
- artificial luminous objects
- natural luminous objects
- opaque objects
- prism
- corpuscular theory
- wave theory
- translucent objects
- transparent objects

Lesson 2. Lenses

Code: C428G0SU14L02

Objective

- Describe the types of lenses, the images they form, and their uses in different devices.

Key Terms

- chromatic aberration
- spherical aberration
- aberrations
- real image
- virtual image
- concave lens
- convex lens
- compound microscopes
- projector
- telescope
- virtually
- viewfinder

Lesson 3. Laser Beam

Code: C428G0SU14L03

Objective

- Describe what a laser is and its uses.

Key Terms

- spectroscopy
- hologram
- laser

Lesson 4. Photographic Cameras

Code: C428G0SU14L04

Objective

- Describe the parts of a camera, explain how it works and compare it with the human eye.

Key Terms

- photoelectric cell
- diaphragm
- objectives

Unit 15. Sound

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Sound

Code: C428G0SU15L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Speed of Sound

Code: C428G0SU15L01

Objectives

- Explain what sound is, describe the characteristics of sound waves, and mathematically determine the wave speed, frequency, and wavelength.
- Describe the behavior of sound in the ocean, how dolphins use their sonar and echolocation abilities.

Key Terms

- aerodynamic
- echolocation
- hypersonic
- protuberance
- sonar
- sounds
- subsonic
- supersonic

Lesson 2. Doppler Effect

Code: C428G0SU15L02

Objective

- Explain the Doppler effect and its uses and applications.

Key Terms

- Doppler ultrasound
- Doppler Effect
- sender
- receiver
- probe
- ultrasound

Lesson 3. Acoustics

Code: C428G0SU15L03

Objective

- Describe what acoustics is, mention the parts of the ear and explain how they work so we can listen.

Key Terms

- acoustics
- decibels
- outer ear
- inner ear
- middle ear
- grooves
- threshold of audibility

Unit 16. Solutions

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Solutions

Code: C428G0SU16L00

Unit documents: Activity and Lesson Keys

Lesson 1. Solutions, its parts and types

Code: C428G0SU16L01

Objective

- Describe what solutions are, their parts and the types of solutions that can be formed.

Key Terms

- alloys
- solvent
- universal solvent
- dissolve
- electrode
- filtration
- humidity
- mixture
- solution
- aqueous solution
- gaseous solution
- liquid solution
- solid solution
- solute

Lesson 2. Solubility and the Dissolution Process

Code: C428G0SU16L02

Objective

- Explain the concept of solubility, the dissolution process, and the changes in temperature and energy that occur.

Key Terms

- insoluble
- unsaturated
- saturated
- supersaturated
- solubility
- soluble

Lesson 3. Factors that Affect Solubility

Code: C428G0SU16L03

Objective

- Mention and explain the factors that affect the solubility of different types of substances.

Key Terms

- hydrophobic compound
- hydration
- hydrophilic
- hydrogen bond
- immiscible
- miscible

Lesson 4. Concentration of Solutions

Code: C428G0SU16L04

Objective

- Mathematically determine the concentration of a solution and express it in different ways.

Key Terms

- concentration
- concentrate
- diluted
- weight percent

Unit 17. Chemical Reactions

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Chemical Reactions

Code: C428G0SU17L00

Unit documents: Activity and Lesson Keys

Lesson 1. Chemical Equations

Code: C428G0SU17L01

Objective

- Express simple chemical reactions using a word equation and using a chemical equation.

Key Terms

- distillation column
- condensation
- crystallization
- distillation
- word equation
- chemical equation
- physical state
- miscible
- precipitate
- produce
- products
- chemical reaction
- reagents

Lesson 2. Law of Conservation of Mass

Code: C428G0SU17L02

Objective

- Apply the law of conservation of mass to balance simple chemical equations.

Key Terms

- coefficient
- balanced equation
- Law of Conservation of Mass

Lesson 3. Types of Chemical Reactions

Code: C428G0SU17L03

Objective

- Identify and explain the different types of chemical reactions such as synthesis, decomposition, single displacement, and double displacement.

Key Terms

- decomposition
- double displacement
- single displacement
- electrolysis
- synthesis

Lesson 4. Chemical Reactions and Energy

Code: C428G0SU17L04

Objective

- Explain what endothermic and exothermic chemical reactions are.

Key Terms

- ATP
- carbohydrates
- degradation
- activation energy
- lactic acid fermentation
- ATP hydrolysis
- endothermic reaction
- exothermic reaction
- cellular respiration

Unit 18. Acids, Bases, and Salts

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Acids, Bases, and Salts

Code: C428G0SU18L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Acids

Code: C428G0SU18L01

Objective

- Explain how acids are formed and describe their characteristics.

Key Terms

- acid
- self-ionization of water
- hydrogen ion
- hydronium ion
- reversible reaction

Lesson 2. Bases

Code: C428G0SU18L02

Objective

- Explain how bases are formed and describe their characteristics.

Key Terms

- amines
- ammonia
- antacid
- base
- coagulation
- electrolysis
- nitrogen fixation
- soap
- saponification
- alkaline solution

Lesson 3. Indicators and pH

Code: C428G0SU18L03

Objective

- Explain what the pH of a substance is and describe the use of the indicators and the pH meter to measure the pH of a solution.

Key Terms

- weak acid
- strong acid
- weak base
- strong base
- pH scale
- phenolphthalein
- indicator
- pH meter
- neutral
- litmus paper
- methyl violet

Lesson 4. Neutralization: Forming Salts

Code: C428G0SU18L04

Objective

- Explain the neutralization process, the formation of salts and their characteristics.

Key Terms

- burette
- titration curve
- neutralization
- equivalence point
- salt
- titration

Unit 19. Nonmetals

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Nonmetals

Code: C428G0SU19L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Properties of nonmetals

Code: C428G0SU19L01

Objectives

- Identify nonmetals in the periodic table and describe their properties.
- Explain what allotropes are and their characteristics.

Key Terms

- electron affinity
- allotropes
- carbon
- diamond
- electronegativity
- ionization energy
- covalent bond
- nitrogen family
- oxygen family
- white phosphorus
- red phosphorus
- gases
- graphite
- halogens
- Linus Pauling
- metals
- metalloids
- nonmetals
- ozone
- chemical properties
- periodic table of elements

Lesson 2. Reactions of nonmetals

Code: C428G0SU19L02

Objective

- Explain the different ways in which nonmetal elements chemically react.

Key Terms

- acids
- combustion
- interhalogens
- oxide
- covalent oxides
- phosphorus oxides
- peroxide
- superoxide

Lesson 3. Noble Gases

Code: C428G0SU19L03

Objective

- Explain what noble gases are and describe the characteristics that distinguish them.

Key Terms

- insulator
- argon
- density
- noble gases
- helium
- Henry Cavendish
- inert
- neon
- radioactive
- radiotherapy
- radon
- Rayleigh
- William Ramsay
- xenon

Unit 20. Metals

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Metals

Code: C428G0SU20L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Alkali and Alkaline Earth Metals

Code: C428G0SU20L01

Objectives

- Identify the alkali and alkaline earth metals in the periodic table.
- Explain the characteristics that distinguish the different groups of alkali metals and alkaline earth metals and their uses.

Key Terms

- mortar
- beryl
- lime
- chlorophyll
- excited electrons
- released energy
- ionic bonds
- magnesium
- alkali metals
- alkaline earth metals
- flame test
- X-rays
- reactivity

Lesson 2. Transition Elements

Code: C428G0SU20L02

Objective

- Identify the different groups of transition metals in the periodic table and explain their overall characteristics and their uses.

Key Terms

- actinides
- transition elements
- photosensitive
- lanthanides
- oxidation numbers
- rare-earth elements

Lesson 3. Reactions and Alloys of Metals

Code: C428G0SU20L03

Objective

- Describe some of the typical reactions of metals and the formation of alloys.

Key Terms

- steel
- alloy
- smelting
- metals

Unit 21. Organic and Biochemical Compounds

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Organic and Biochemical Compounds

Code: C428G0SU21L00

Unit documents: Activity, Assessment Exercises, Ecological Commitment, and Lesson Keys

Lesson 1. Carbon

Code: C428G0SU21L01

Objectives

- Explain what organic compounds are and how they are formed.
- Explain the difference between the molecular formula and the structural formula of some organic compounds and the bonds they form.

Key Terms

- carbon
- inorganic compound
- organic compound
- double bond
- single bond
- triple bond
- covalent compounds
- structural formula
- molecular formula
- isomer

Lesson 2. Hydrocarbons and Their Derivatives

Code: C428G0SU21L02

Objective

- Describe and explain what hydrocarbons are and the different types of hydrocarbons that are formed.

Key Terms

- carboxylic acid
- alkane
- alcohol
- alkene
- alkyne
- amine
- benzene
- cycloalkane
- ester
- functional group
- halocarbon
- hydrocarbon
- aromatic hydrocarbon
- cyclic hydrocarbon
- open chain hydrocarbon
- unsaturated hydrocarbon
- saturated hydrocarbon
- substituted hydrocarbon

Lesson 3. Biochemical Compounds

Code: C428G0SU21L03

Objective

- Describe what biochemical compounds are and explain their characteristics and functions in living organisms.

Key Terms

- oil
- deoxyribonucleic acid (DNA)
- nucleic acid
- ribonucleic acid (RNA)
- amino acids
- essential amino acids
- antibody
- carbohydrate
- cholesterol
- biochemical compound
- fructose
- glucose
- fat
- hemoglobin
- lactose
- lipids
- maltose
- proteins
- sucrose

Unit 22. Heat and Temperature

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Heat and Temperature

Code: C428G0SU22L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Heat and Temperature

Code: C428G0SU22L01

Objective

- Explain the difference between heat and temperature, and explain how heat produces the thermal expansion of the three states of matter.

Key Terms

- water
- Anders Celsius
- heat
- calories
- kinetic energy
- potential energy
- thermal energy
- thermal equilibrium
- Celsius scale
- temperature scale
- Fahrenheit scale
- Kelvin scale
- expansion
- thermal expansion
- Gabriel Fahrenheit
- joules
- Lord Kelvin
- mercury
- temperature
- Kinetic Molecular Theory
- Calorie Theory
- volume

Lesson 2. Specific Heat

Code: C428G0SU22L02

Objective

- Explain what specific heat is, the application of specific heat to determine the heat gained or lost by an object, and how to mathematically determine the heat gained or lost by an object when its temperature changes.

Key Terms

- specific heat
- absorbed energy
- internal energy
- temperature

Lesson 3. Calorimeter

Code: C428G0SU22L03

Objectives

- Explain what a calorimeter is, its operation and its uses, and mathematically determine the final temperature reached in an isolated system such as a calorimeter.
- Explain the relationship between chemical reactions and thermal energy and what the heat of reaction is.

Key Terms

- heat of reaction
- calorimeter
- combustion calorimeter
- chemical equation
- equation
- thermochemistry
- thermal energy
- endothermic reaction
- exothermic reaction
- chemical reactions
- system

Unit 23. Electricity

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Electricity

Code: C428G0SU23L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Electric Charges

Code: C428G0SU23L01

Objective

- Explain what electric charges are and apply Coulomb's Law to describe and mathematically determine the force of attraction between two charges and the magnitude of an electric charge.

Key Terms

- atom
- negative charge
- positive charge
- electricity
- electrons
- ion
- Coulomb's law
- neutrons
- protons

Lesson 2. Electrical Conduction

Code: C428G0SU23L02

Objective

- Describe electrical conduction in different materials and explain what to charge by induction and by conduction means.

Key Terms

- insulators
- conduction load
- conductors
- electric current
- electrically polarized
- electroscope
- friction
- induction
- semiconductors
- ionic solids
- superconductors

Lesson 3. Electric Currents

Code: C428G0SU23L03

Objective

- Describe an electrical circuit and its parts and mathematically determine the intensity of the current, the voltage, and the power consumed by an appliance.

Key Terms

- ammeter
- ampere

- charge
- solar cell
- voltaic cell
- circuit
- solid conductor
- coulomb
- potential difference
- potential energy
- generator
- voltage
- voltmeter
- volt

Lesson 4. Ohm's Law

Code: C428G0SU23L04

Objective

- Explain Ohm's Law and use it to determine the intensity of the current, resistance, and voltage in a circuit.

Key Terms

- parallel circuit
- series circuit
- George Ohm
- Ohm's Law
- resistance

Unit 24. Radioactivity and Nuclear Energy

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Radioactivity and Nuclear Energy

Code: C428G0SU24L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Radioactive Elements

Code: C428G0SU24L01

Objective

- Explain what radioactive elements are and describe the uses of radioactivity.

Key Terms

- diagnosis
- radioactive elements
- agricultural research
- isotopes
- radioactive isotopes
- weapons
- chemotherapy
- radiation
- radioactivity
- radiotherapy
- nuclear reactors
- depleted uranium

Lesson 2. Nuclides

Code: C428G0SU24L02

Objective

- Describe nuclides, ionizing radiation and the interaction between ionizing radiation and matter.

Key Terms

- ionization
- nuclides
- ionizing radiation

Lesson 3. Nuclear Radiation

Code: C428G0SU24L03

Objective

- Define the units for measuring nuclear radiation, describe the harmful effects of nuclear radiation, and explain nuclear fusion and fission.

Key Terms

- activity
- chromosomes
- nuclear fission
- genetic mutations
- neutrons
- alpha particles
- beta particles
- cosmic radiation
- nuclear radiation
- gamma rays
- X-rays
- chain reaction
- thermonuclear reactions
- rem
- immune system

Lesson 4. Disintegration and Half-Life

Code: C428G0SU24L04

Objective

- Explain the different types of radioactive decay, express a nuclear reaction through a nuclear equation, and explain what the half-life of radioactive elements is.

Key Terms

- radioactive decay
- strong nuclear force
- stable nuclei
- unstable nuclei
- nuclear reaction
- transmutation
- half-life

Unit 25. Earth's Environment

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Earth's Environment

Code: C428G0SU25L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Biogeochemical Cycles

Code: C428G0SU25L01

Objectives

- Explain what biogeochemical cycles are.
- Differentiate between the water, carbon and nitrogen cycles.

Key Terms

- ATP
- aerobic bacteria
- carnivores
- carbon cycle
- nitrogen cycle
- water cycle
- biogeochemical cycles
- condensation
- denitrification
- carbon dioxide
- evaporation
- extinction
- photosynthesis
- herbivores
- nitrification
- precipitation
- transpiration

Lesson 2. Climate and Biomes

Code: C428G0SU25L02

Objectives

- Explain the concept of climate and describe the factors that determine the climate.
- Explain what biomes are and describe some of them.

Key Terms

- adaptation
- biome
- tropical rainforest
- rainforests
- climate
- desert
- El Yunque
- radiant energy
- wet season
- fauna
- flora
- humidity
- meadow
- precipitation
- savanna
- temperature
- winds

Lesson 3. Agriculture and the Environment

Code: C428G0SU25L03

Objective

- Describe how different activities related to agriculture affect the environment.

Key Terms

- biomagnification
- DDT
- predator
- fertilizer
- phosphorus
- chlorinated hydrocarbons
- nitrogen
- pests
- pesticides
- biological transfer

Unit 26. The Aquatic Environment

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. The Aquatic Environment

Code: C428G0SU26L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. Chemical and Physical Properties of Water

Code: C428G0SU26L01

Objective

- Describe the chemical and physical properties of water.

Key Terms

- water
- heat of condensation
- heat of vaporization
- universal solvent
- cohesion force
- properties
- hydrogen bond
- surfactants
- surface tension

Lesson 2. Freshwater Pollution

Code: C428G0SU26L02

Objective

- Describe water pollutants and the sources that produce them, and explain how they pollute water.

Key Terms

- carcinogen
- thermal pollution
- pollutant
- non-persistent pollutant
- persistent pollutant
- DDT
- decomposers
- mining industry
- heavy metals
- salinity
- acidic substances
- toxics

Lesson 3. Water Quality Factors

Code: C428G0SU26L03

Objective

- Mention and explain the factors that determine water quality.

Key Terms

- alkalinity
- biodegradability
- chlorides
- organic compounds
- chemical oxygen demand
- fluorides
- ion exchange
- potable
- BOD test
- suspended solids
- turbidity
- turbidimeter

Lesson 4. Drinking Water Production

Code: C428G0SU26L04

Objective

- Explain the drinking water production process and wastewater treatment.

Key Terms

- raw water
- drinking water
- wastewater
- silt
- desalination
- filtration
- flocculators
- organic matter
- filtration plant
- Primary Treatment Plant
- polymer
- production
- sedimentation tanks
- suspended solids

Unit 27. The Atmospheric Environment

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. The Atmospheric Environment

Code: C428G0SU27L00

Unit documents: Activity, Assessment Exercises and Lesson Keys

Lesson 1. The Atmosphere

Code: C428G0SU27L01

Objectives

- Describe the characteristics of the atmosphere.
- Explain the composition of the different layers of the atmosphere.

Key Terms

- electromagnetic spectrum
- stratopause
- stratosphere
- exosphere
- ionosphere
- mesopause
- mesosphere
- ozone
- ultraviolet radiation
- ultraviolet region
- tropopause
- troposphere

Lesson 2. Atmospheric Pollution

Code: C428G0SU27L02

Objective

- Describe air pollutants and the sources that produce them, and explain how they pollute the atmosphere.

Key Terms

- atmospheric environment
- asbestos
- volatile organic compounds
- atmospheric pollution
- primary pollutants
- secondary pollutants
- industrialization
- photochemical smog
- particulate
- peroxyacetyl nitrate
- volatile

Lesson 3. Acid Rain

Code: C428G0SU27L03

Objective

- Explain how acids that pollute the atmosphere are formed, how they form acid rain, and the harmful effects of acid rain.

Key Terms

- acidify
- oxidizing agent
- sulfur dioxide
- acid rain
- nitrogen oxides