San Juan del Sur Day School

Grade 8 Science Learning Outcomes and Unit Guide

Unit	Learning Outcomes	✓	Performance Indicators
Who We Are	**Life Science – Cells, Tissues, Organs, and Systems (CS)**		
	Analyze the characteristics of cells, and compare structural and functional characteristics of plant and animal cells.		Explain that the cell is a living system that exhibits all the characteristics of life including growth, movement, reaction to stimulus, and reproduction.
			Categorize organisms as single-celled and multicellular.
			Observe and describe how single-celled organisms take in food and move.
			Explain how growth and reproduction of living organisms depends on cell division.
			Design and carry out an experiment to demonstrate the function of selectively permeable membranes in cells.
			Model the processes of diffusion and osmosis to demonstrate how gases and water move into and out of plant and animal cells.
			Observe and identify cell structures (e.g., cell wall, cell membrane, vacuole, nucleus, cytoplasm, mitochondria, and chloroplast) and identify which are found in plant cells and which are found in animal cells.
			Use a microscope to observe and draw the similarities and differences between the structure of plant and animal cells.
			Demonstrate how gases and water move into and out of cells by modelling the processes of diffusion and osmosis.
			Explain the function of cell structures (e.g., cell wall, cell membrane, vacuole, nucleus, cytoplasm, mitochondria, and chloroplast), including how each structure contributes to the health of plant and animal cells.
			Use appropriate scientific terminology to communicate plans, ideas, and results related to the study of plant and animal cells.
			Work cooperatively with team members to develop and carry out a plan to construct a representation (e.g., model, drawing, sculpture, or dance) of the structures and functions of plant and animal cells.
			Analyze the strengths and weaknesses of various representations of the structure and function of plant and animal cells.
	Distinguish structural and functional relationships among cells, tissues, organs, and organ systems in humans and how this knowledge is important to various careers.		Pose questions about the composition of the human body such as "What are humans made of?".
			Distinguish among cells, tissues, organs, and organ systems based on structure and function.
			Research various ideas and theories, past and present, used to explain the composition of the human body (e.g., living organisms were made of air, fire, and water; and body is animated by spirit).
			Analyze why cells and tissues are specialized in multicellular organisms.
			Describe the function and provide examples of the four major types of tissue found in humans (i.e., muscle, nerve, epithelial, and connective tissue).
			Construct a representation of the relationships among cells, tissues, organs, and organ systems in humans using examples from the respiratory, circulatory, digestive, excretory, and nervous systems.
			Relate the needs and functions of various cells and organs to the needs and functions of the human organism as a whole.
			Summarize the main points of modern cell theory and identify the contributions of men and women, past and present, to the development of the theory.
			Describe examples of science- and technology-based careers that require an understanding of cells and human body systems (e.g., lab and X-ray technicians, doctors, physiotherapists, nutritionists, and public health nurses).
			Identify and describe, in general terms, the main components and roles of the human organ systems (digestive, circulatory, respiratory, excretory, and nervous systems).
			Explain how organ systems work together to obtain and transport nutrients, remove wastes, and exchange gases.
	Analyze how the interdependence of organ systems contributes to the healthy functioning of the human body.		Show interest in science-related questions and issues by posing questions and defining practical problems related to the healthy functioning of the human body.
			Describe how various body systems work together to accomplish tasks (e.g. eating, running, and sleeping), and predict the impact of the failure or removal of one or more organs on the healthy functioning of the human body.
			Recognize that cells in multicellular organisms must reproduce to form and repair tissue.
			Describe how lifestyle choices (e.g., nutrition, exercise, smoking, drugs, and alcohol) and technologies (e.g., dialysis, pacemaker, organ transplant) can affect human health.
			Provide examples of how the body reacts to internal and external stimuli such as viruses, bacteria, alcohol, drugs, dust, and temperature changes.
			Select and synthesize information from various sources to illustrate examples of conflicting evidence regarding the ways in which we should maintain our body (e.g., energy drinks, dairy products, vaccinations, and vitamin supplements).
			Design and carry out an experiment, including identifying and controlling major variables, to compare and contrast the heart rate, breathing rate, and/or blood pressure of an individual during various levels of activity.
			Suggest explanations for discrepancies in data related to variations in the heart rate, breathing rate, and/or blood pressure of the same individual during various levels of activity when an experiment is repeated.

San Juan del Sur Day School

Grade 8 Science Learning Outcomes and Unit Guide

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Where We Are in Place and Time	**Earth and Space Science – Water Systems on Earth (WS)**		
	Analyze the global distribution of water and its impact on local environments.		Describe how water circulates between the land, the ocean, and the atmosphere (water cycle).
			Identify how water is used in Nicaragua (e.g., domestic, industrial, agricultural, fisheries, recreational).
			Compare and contrast the characteristics of salt and freshwater (e.g., density, freezing point), and physical characteristics of surface water features, such as lakes, rivers, streams, wetlands, and riparian areas.
			Identify factors that affect glaciers and polar ice caps, and describe their consequent effects on the environment.
			Interpret graphical information on the availability of drinking water.
			Research water availability in different regions around the world, and explain how it impacts the local environment, economy, and culture.
			Propose a plan of action to reduce personal water consumption to help address water sustainability issues.
	Use the design process to demonstrate how water movement shapes our landscape.		Explain how the processes of weathering, erosion, and deposition result from water movement and wave action, including how waves and tides are generated and how they interact with shorelines.
			Describe how the interactions of ocean currents, winds, and regional climates shape local, regional, national, and global environments.
			Examine how wind, water, and ice have shaped and continue to shape the Nicaraguan landscape, research the processes of erosion and deposition that result from wave action and water flow, and describe their impact on Nicaragua.
			Create a written, visual, physical, or dramatic representation of the processes that lead to the development of rivers, lakes, continental drainage systems, and ocean basins, including glaciation, continental drift, erosion, and volcanic action.
			Collaborate to plan and conduct a simulation that demonstrates how temperature differences cause water currents.
			Critique the design and function of technologies designed to minimize damage caused by waves and tides (e.g., piers, breakwaters, levees).
			Design, construct, evaluate, and present a prototype of a device or system to prevent erosion caused by water.

San Juan del Sur Day School

Grade 8 Science Learning Outcomes and Unit Guide

Unit	Learning Outcomes	✓	Performance Indicators
How We Express Ourselves	**Physical Science – Forces, Fluids, and Density (FD)**		
	Investigate and represent the density of solids, liquids, and gases based on the particle theory of matter.		Illustrate the relationship between mass, volume, and density of solids, liquids, and gases using the particle theory of matter.
			Explain, using the particle theory of matter, differences in the density of solids, liquids, and gases.
			Calculate and compare densities of materials; and explain differences in the density of solids, liquids and gases, using the particle model of matter.
			Measure the mass and volume of a variety of objects, record the data in tabular form, and display the data graphically.
			Interpolate or extrapolate from student-constructed graphs of density to determine the mass or volume of a substance.
			Calculate the density of various regularly shaped materials using the formula d=m/v and using units of g/mL or g/cm_3.
			Value accuracy, precision, and honesty when gathering data about the density of objects.
			Predict how temperature will affect the density of a substance.
			Conduct an experiment using the water displacement method to determine the density of various regular and irregular shaped objects.
			Describe practical applications that have developed over time that are based on differing densities (e.g., hot-air balloons, wooden boats, Galileo thermometer, oil/water separators).
	Investigate and describe physical properties of fluids (liquids and gases), including viscosity and compressibility.		Design and conduct an experiment to compare the viscosity of various fluids (e.g., water, syrup, oil, shampoo, glycerine, honey, ketchup, hand cream, and detergent) and identify variables relevant to the investigation.
			Use appropriate vocabulary related to the study of fluids, including fluid, viscosity, buoyancy, pressure, compressibility, hydraulic, pneumatic, and density.
			Investigate the relationship between the temperature and viscosity of a liquid, controlling the major variables.
			Use a temperature measuring technology, such as a temperature probe, effectively and accurately for collecting data to investigate the relationship between temperature and viscosity of a liquid.
			Identify products in which viscosity is an important property (e.g., paint, hand lotion, motor oil, salad dressing, and condiments) and evaluate different brands of those products using student-developed criteria.
			Predict and investigate the effect of applying external pressure to the behaviour of liquids and gases (e.g., squeezing a balloon, depressing a plunger in a syringe).
			Describe situations in which pressure can be increased or decreased by altering surface area (e.g., flat-heeled vs. high-heeled shoes, placing a thumb over the end of a garden hose).
			Use the particle theory of matter to explain the differences in compressibility between liquids and gases.
			Explore and explain qualitatively the relationship between pressure, volume, and temperature when liquids and gases are compressed or heated.
			Show concern for safety of self and others when planning, carrying out, and reviewing procedures involving heating and compressing liquids and gases.
	Identify and interpret the scientific principles underlying the functioning of natural and constructed fluid systems.		Describe how hydraulic or pneumatic pressure can be used to create a mechanical advantage in a simple mechanical device (e.g., hydraulic jack, air powered tools, hairstylist's chair, and water spraying toy)
			Compare natural (e.g., circulatory and respiratory system) and constructed (e.g., hydraulic and air brakes, oil and gas pipelines, swimming pool circulation system, bicycle and other pumps, Archimedes screw, and automobile lifts) hydraulic and pneumatic fluid systems and identify advantages and disadvantages of each, using student-identified criteria such as cost and impact on society and the environment.
			Use a technological problem-solving process to design, construct, and evaluate a prototype of a device that models the operation of a natural or constructed fluid system.
			Work collaboratively to identify and correct problems in the way a prototype of a natural or constructed fluid system functions.
			Apply given criteria for evaluating evidence and sources of information by testing a prototype of a natural or constructed fluid system in a variety of situations to ensure that the results were not due to chance.
			Describe and explain the role of collecting evidence, finding relationships, proposing explanations, and imagination in the development of scientific knowledge related to fluids and fluid systems (e.g., finding relationships between density or pressure and change in temperature provides insights into practical uses for fluids).
			Describe situations in daily life where we see evidence that the density of substances changes naturally (e.g., molten lava as it cools, water 'turning over' at 4°C in the fall, air when mirages form) or is intentionally altered (e.g., air in a hot-air balloon, cream when it is churned and cooled).

San Juan del Sur Day School

Grade 8 Science Learning Outcomes and Unit Guide

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How We Express Ourselves	**Physical Science – Forces, Fluids, and Density (FD)**		
	Examine the effects of forces in and on objects in fluids, including the buoyant force.		Identify questions to investigate arising from practical problems and issues involving floating, sinking, and buoyancy (e.g., "What factors affect the amount of cargo a barge can hold?", "Why do some objects float and some objects sink?", and "How can a ship made of steel float in the ocean?").
			Examine contributions of people from various cultures to understanding the principles of buoyancy, including Archimedes Principle, and the development of watercraft such as canoes and kayaks.
			Explain the concept of force and provide examples of different types of contact and non-contact forces.
			Illustrate, using force diagrams, the movement of objects in fluids in terms of balanced and unbalanced forces acting on the objects.
			Use a spring scale to determine the relationship between mass and weight for various substances.
			Express the quantitative relationship between pressure, force, and area in fluids.
			Conduct a fair test to identify which factors determine whether a given object will float or sink, and discuss reasons why scientists control some variables when conducting a fair test.
			Use a technological problem-solving process to design, construct, and evaluate a prototype of an object that floats and can carry the greatest amount of cargo.
			Explain how buoyancy is controlled in nature (e.g., fish, humans, and sharks) and in constructed devices (e.g., submarines, airplanes, airships, scuba gear, and hot air balloons).
			Compare different fluids to determine how they alter the buoyant force on a given object.
			Explain the operation of technologies whose development is based on scientific understanding of the properties of fluids (e.g., personal flotation devices, float planes, surfboards, gliders, antifreeze tester, and heart pumps).
			Analyze designs of traditional and contemporary watercraft (e.g., canoe, kayak, lake boat, catamaran, and jet-ski) with respect to the principles of buoyancy.
How the World Works	**Physical Science – Optics and Vision (OP)**		
	Identify and describe, through experimentation, sources and properties of visible light including rectilinear propagation, reflection, refraction.		Classify natural and artificial sources of light as incandescent or fluorescent (including phosphorescent, chemiluminescent, and bioluminescent).
			Demonstrate that light is a form of energy, that light can be separated into a visible spectrum, and that light travels in straight lines in a uniform transparent medium.
			Investigate the properties of shadows, including umbra and penumbra formation, and demonstrate how the existence of shadows provides evidence that light travels in straight lines.
			Select appropriate methods and tools to demonstrate rectilinear propagation and the visible spectrum (e.g., pinhole camera to demonstrate how light travels in a straight line, prism to demonstrate spectrum of color).
			Estimate and measure angles of incidence and angles of reflection of visible light and determine the quantitative relationship between the angle of incidence and the angle of reflection.
			Investigate characteristics and applications of specular and diffuse reflection, including the absorption of light by surfaces of different colour and made of different materials (e.g., coloured paper, white paper, aluminium foil, mirror, and water).
			Describe qualitatively how visible light is refracted when passing from one substance to a substance of a different refractive index.
			Determine how light interacts with transparent, translucent, and opaque materials.
			Identify how reflection is used in everyday life (e.g., plane mirrors, sun dogs, magician's tricks, the ability to see the moon and other non-luminous bodies).
			Predict how light will refract when passing into transparent media with different refractive indices (e.g., water, salt water, plastic, glass, and oil) and conduct an experiment to confirm or refute that prediction.
			State a conclusion, based on experimental data and evidence, on how light is refracted when passing from one medium to another (e.g., water, glass, plastic, oil).
	Analyze different types of electromagnetic radiation and its impact on their daily lives.		Describe and compare different types of electromagnetic radiation, including infrared, visible light, ultraviolet, X-rays, microwaves, and radio waves.
			Provide examples of technologies that use different types of electromagnetic radiation (e.g., cellular phones, X-ray machines, radios, microwave ovens, UV tanning beds, GPS, wireless computing devices, thermographic cameras) and how they relate to their daily lives.
			Defend a position on an issue or problem, identified through personal research, related to the impact of electromagnetic radiation-based technologies on self and community.

San Juan del Sur Day School

Grade 8 Science Learning Outcomes and Unit Guide

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How We Organize Ourselves			**Physical Science – Optics and Vision (OP)**
	Explain how human vision works, including ways of correcting or extending human vision.		Identify questions to investigate arising from practical problems and issues related to human vision (e.g., "How are contact lenses crafted?", "Do humans see colour the same way?", and "What are some problems associated with human vision?").
			Demonstrate an understanding of how light interacts with concave and convex lenses.
			Illustrate, using a geometrical ray diagram, how the human eye sees objects.
			Compare the functional operation of the human eye to that of a camera or other optical instruments in focusing an image.
			Compare human vision with that of other vertebrates and invertebrates, including the function and design of the eye.
			Research the technological development of microscopes, telescopes, and other optical devices; describe how these developments enabled scientific research.
			Explain how the human eye sees objects and detects colors, and demonstrate that the ability to perceive color may vary from person to person.
			Explain how colours are produced, using both the additive and subtractive models of colour, and identify applications of the additive and subtractive models of colour in daily life, including the use of traditional dyes.
			Describe the operation of optical technologies that enhance human vision (e.g., contact lenses, glasses, night vision scopes, and snow goggles).
Sharing the Planet			**Earth and Space Science – Water Systems on Earth (WS)**
	Analyze the impact of natural and human-induced changes to the characteristics and distribution of water in local, regional, and national ecosystems.		Describe factors that affect productivity and species distribution in marine and freshwater environments (e.g., temperature, nutrients, pollutants, salinity, turbidity).
			Provide examples of problems related to water systems that cannot be resolved using scientific and technological knowledge alone (e.g., pollution, overfishing, freshwater scarcity).
			Analyze the impact of natural and human-induced changes to the characteristics and distribution of water in local, regional, and national ecosystems.
			Research a specific human practice or technology that may pose a threat to surface and/or groundwater systems in Nicaragua and explain how different groups in society (e.g., landowner, consumer, business owner, recreational user, fisherman, government official, and farmer) may have conflicting needs and desires in relation to the practice or technology and how those decisions or actions of different stakeholders may or may not be addressed by scientific or technological knowledge.
			Evaluate individual and group processes used in planning, problem solving, decision making, and completing a task related to studying threats to water systems, such as accepting various roles in a group, sharing responsibility for carrying out decisions, and seeking consensus before making decisions.
			Analyze natural factors and human practices that affect productivity and species distribution in marine and freshwater environments.
			Provide examples of how individuals and institutions contribute to the sustainability of water systems.
			Apply the concept of systems to show how changes in one component of a body of water cause changes in other components in that system.