Aquaculture

OVERVIEW

In *Aquaculture*, students learn fish biology, care, and management by maintaining their own goldfish tank. After an introduction to the history of aquaculture, they conduct chemical tests of tank water, learn fish anatomy and metabolism, calculate fish growth and productivity, and maintain records of their activities. Along the way, they learn the processes involved in a large-scale aquaculture operation and consider environmental impacts of aquaculture.

STUDENT OBJECTIVES

- Use a spreadsheet to practice record-keeping for an aquaculture operation.
- Conduct tests of tank water and learn appropriate levels for each chemical.
- Identify internal and external structures of fish.
- Understand fish life cycles and measure fish length and weight.
- Analyze fish growth curves and calculate appropriate stocking rates.
- Explore fish metabolic rates and calculate nutritional needs and productivity.
- Explore environmental impacts of aquaculture.
- Graph and analyze data from the classroom aquaculture tank.

ACTIVITIES

Students complete three performance assessments: 1) Water Chemistry – conduct water chemistry tests, define and explain expected values, and understand tank filtration; 2) Fish Biology – identify fish structures and properly manipulate live fish, including taking length and volume measurements; and 3) Fish Productivity – measure gill-opening rates, understand metabolism, and complete productivity calculations.

Biotechnology

OVERVIEW

In *Biotechnology*, students explore the past, present, and future of biotechnology. Through hands-on activities, computer simulations, and laboratory experiments, they investigate the structure of the DNA molecule and learn how it can be changed through genetic engineering, including recombinant DNA, gene splicing, and transgenic biotechnology. They consider some implications of using biotechnology in medicine, agriculture, and other fields.

STUDENT OBJECTIVES

- Define terms relating to genetics and biotechnology.
- Identify important historical events in the development of biotechnology.
- Construct and explain a model of a DNA molecule.
- Use pop-bead models to illustrate the processes of gene splicing and recombinant DNA.
- Complete a DNA extraction.
- Complete an enzyme experiment and analyze data from the experiment.
- Use multimedia and simulations to understand transgenic biotechnology.
- Learn about important applications of biotechnology in medicine and agriculture.
- Consider ethical problems related to biotechnology.

ACTIVITIES

Students complete three performance assessments: 1) Biotechnology and DNA – define *biotechnology*, explain areas in which biotechnology is used, and explain the structure of DNA; 2) Gene Splicing – use models to demonstrate and explain the structure of DNA and the process of gene splicing; and 3) Data Analysis – document experimental data, explain differences between experimental and control groups, and explain why careful analysis of any type of genetic engineering is mandatory.

Body Systems

OVERVIEW

In *Body Systems*, students explore the structure and functions of the 11 body systems. They measure functions and characteristics of their own bodies including respiration rate, CO_2 production, binocular vision, length of the digestive tract, and pulse rate. Students learn the hierarchy of organization within their own bodies and how body systems work together to maintain homeostasis.

STUDENT OBJECTIVES

- Explore the importance of vital signs in emergency medical situations.
- Learn the anatomical position and explain how it is used to locate organs.
- Locate major body organs and systems on a human torso model.
- Explore the major structures and functions of the 11 body systems.
- Observe and identify specialized tissues making up each body system.
- Consider levels of organization and relate levels to the human body as a system.
- Define *homeostasis* and explain how body systems work together to maintain it.
- Do hands-on activities to illustrate important aspects and functions in body systems including the digestive, circulatory, and integumentary systems.

ACTIVITIES

Students complete three performance assessments: 1) Digestion – define components of the alimentary canal, explain the process of digestion, and explain how nutrients enter the bloodstream; 2) Respiration and Skin – name and define structures of the two systems and show how respiration affects carbon dioxide production; and 3) Movement – explain how muscles and bones work together to move the body and demonstrate the movement of three types of joints.

Carbon Footprint

OVERVIEW

Carbon Footprint introduces students to greenhouse gases and global warming. They learn about carbon as an element and as a part of compounds. They learn what fossil fuels are and where they came from. They also learn about the natural carbon cycle and the effects people have on it. Students learn factors that are included in a carbon footprint and how to measure their own carbon footprint. They learn the impact of their choices and activities on the environment, particularly the atmosphere. Students learn what they can do to lessen their negative impact on the environment.

STUDENT OBJECTIVES

- Define the term *carbon footprint* and explain its significance.
- Identify carbon as an element and a part of compounds.
- Explore Earth's carbon cycle including major carbon sources and sinks.
- Explain how greenhouse gases relate to an individual's carbon footprint.
- Explore fossil fuels, where they came from, and how they affect the carbon footprint.
- Analyze the transportation, agriculture, energy, and consumer sectors of the carbon footprint.
- Brainstorm ways to decrease an individual's carbon footprint without changing the quality of life.

This title content focuses on green education.

ACTIVITIES

Students complete three performance assessments: 1) The Carbon Cycle – list Earth's major carbon sources and sinks, define greenhouse gases, and explain how they relate to the carbon cycle; 2) Carbon Footprint – define what a carbon footprint is and give an example of something people do that affects it; and 3) Measuring Carbon Footprint – list major factors that contribute to the carbon footprint, use an equation to calculate the student's own carbon footprint, and discuss ways to decrease their carbon footprint.

Cell Structure

OVERVIEW

In *Cell Structure*, students discover the structure and function of the living cell by doing a variety of hands-on activities. They learn proper techniques of microscope use. They observe prepared slides of cells and tissues, make wet-mount slides of living cells, and compare plant and animal cells. They do a naked-egg experiment to demonstrate osmosis across a semipermeable membrane. They use cell models to identify plant and animal cell organelles.

STUDENT OBJECTIVES

- Distinguish between prokaryotic and eukaryotic cells and compare plant and animal cells.
- Use models to identify cell organelles and learn their structures and functions.
- Learn proper techniques for using a microscope, performing experiments, and writing lab reports.
- Make wet-mount slides of living cells and observe and identify slides of the four animal tissue types.
- Using slides and cell boards, learn the stages and importance of mitosis.
- Perform a naked-egg experiment to show osmosis across a semipermeable membrane.

ACTIVITIES

Students complete three performance assessments: 1) Eukaryotic Cells – demonstrate proper microscope technique, show differences between plant and animal cells, and define functions of cell organelles; 2) Mitosis – use cell boards to show stages of mitosis and explain the purpose of mitosis in organisms; and 3) Osmosis – show correct experimental procedures for the naked-egg experiment, explain the function of osmosis, and relate experimental results to living systems.

Genetics

OVERVIEW

In *Genetics*, students learn genetics terminology and simulate breeding experiments similar to Gregor Mendel's. They construct models of chromosomes and DNA. Students create Punnett squares and determine probabilities of offspring given specific parent genotypes. They complete a dihybrid cross and a natural selection experiment.

STUDENT OBJECTIVES

- Learn genetic terminology and history.
- Model the structure of DNA and the processes of mitosis and meiosis.
- Explore dominant and recessive genes, genotypes and phenotypes, and sex-linkage.
- Use Punnett squares to show monohybrid and dihybrid crosses and calculate probabilities.
- Discuss the risks and benefits of genetic research.
- Explore the effects of natural selection on a simulated population.

ACTIVITIES

Students complete three performance assessments: 1) Genotype Dominance – distinguish between dominant and recessive and between genotype and phenotype using correct gene notation; 2) Incomplete Dominance – explain incomplete dominance and show how a Punnett square predicts probabilities; and 3) Dihybrid Cross – define *dihybrid cross* and *sex-linked traits* and predict the offspring produced from a specific parent cross.

Gravity

OVERVIEW

In *Gravity*, students explore the velocity of falling objects using a picket fence and timer. Students use a photo gate and computer software to explore velocity and acceleration of falling objects; they gather, graph, analyze, interpret, and apply experimental data; and they determine the acceleration of gravity. Students use an air track to perform experiments related to potential and kinetic energy.

STUDENT OBJECTIVES

- Use a photo gate and computer software to gather data on falling objects.
- Explore coordinate graphing by creating velocity versus time graphs of a falling object.
- Determine the slope between points on a velocity versus time graph.
- Determine the acceleration due to gravity.
- Explore the difference between potential and kinetic energy.
- Use an air track and computer software to determine total energy of moving objects.
- Graph potential, kinetic, and total energy and analyze the relationships among them.

ACTIVITIES

Students complete three performance assessments: 1) Gravity Data Collection – use a photo gate, a plastic picket fence, a computer interface, and computer software to gather data about free-falling objects; 2) Coordinate Graphing – explore Cartesian coordinates by graphing the data they have gathered and calculated; and 3) Energy – use an air track, two photo gates, and computer software to explore kinetic and potential energy.

Heart Fitness

OVERVIEW

In *Heart Fitness*, students cover factors affecting heart fitness, particularly diet and exercise. They monitor and record blood pressure and heart rate, identify heart structures, and describe the path of blood through the circulatory system. They monitor their own diet and relate it to heart fitness. They study symptoms of cardiovascular disease and learn how diet, lack of physical activity, and smoking relate to the development of cardiovascular disease.

STUDENT OBJECTIVES

- Learn major factors affecting heart fitness.
- Using a model, identify heart structures and describe blood flow through the heart.
- Using a pulse rate monitor, measure resting, standing, and active pulse rates.
- Using a stethoscope, monitor and record resting heart rate.
- Using an electronic blood pressure monitor, record and evaluate blood pressure.
- Learn the components of a good diet; identify and evaluate personal dietary habits.
- Learn about cardiovascular disease and demonstrate arterial blockage.
- Relate obesity, physical inactivity, and smoking to cardiovascular disease.
- Evaluate the benefits of a healthy lifestyle and create a health plan.

ACTIVITIES

Students complete three performance assessments: 1) Exercise Heart Rate – utilize a pulse monitor to obtain heart rate, and identify advantages of an aerobic exercise program; 2) Blood Pressure – draw and explain a normal EKG, demonstrate how to take blood pressure and explain the reading; and 3) Diet Analysis – complete the Diet Analysis Log and explain the importance of establishing healthier eating habits based on the diet analysis.

Mission to Mars

OVERVIEW

Mission to Mars integrates the concepts of green living into the current research being conducted for a planned mission to the planet Mars. Using a Mars mission as microscale ecosystem, *Mission to Mars* explores the green topics of water conservation, food availability, energy needs, global warming, and ozone depletion, to name a few. Students will be given the opportunity to identify and solve many of the problems of a mission to Mars and see how those solutions can also apply to many of the environmental challenges that are faced here on Earth.

STUDENT OBJECTIVES

- Describe the origins and characteristics of the universe and objects in the universe.
- Identify the objects in our solar system and list their characteristics.
- Relate the need for radiation protection to the ozone layer.
- Identify ways to conserve water and how to apply those solutions to space exploration.
- Identify potential alternative power sources and how they can be utilized on Mars.
- Relate plants to the production of oxygen and food on Earth and possibly Mars.

This title content focuses on green education.

ACTIVITIES

Students complete three performance assessments: 1) Radiation Risk – identify the risks of radiation exposure at different locations and explain how to mitigate those risks; 2) Water Resources – identify possible water resources based on evidence and explain how to utilize those resources; and 3) Base Location – identify a location on Mars as a possible location for a base and explain how resources would be supplied at that location.

Plastics & Polymers

OVERVIEW

In *Plastics & Polymers*, students explore several types of polymers, including plastics. The students explore the basic concepts of atoms, molecules, and compounds. This enables students to better understand the properties of the plastics and polymers they create and manipulate. Students create, mold, recycle, and form various polymers. These activities provide a better understanding of the usefulness and limitations of the materials.

STUDENT OBJECTIVES

- Explore basic molecular structure including atoms, molecules, and compounds.
- Examine uses for various polymers.
- Gather, analyze, and interpret data from experiments related to polymers.
- Verify the conservation of mass laws in polymer experiments.
- Explore the various properties of plastics and polymers including strength, malleability, and flexibility.
- Use procedures based on the scientific method to explore the properties of polymers.
- Create, mold, recycle, and form various polymers.

ACTIVITIES

Students complete three performance assessments: 1) Atoms, Molecules, and Polymers – define basic terms related to polymers and explore a polymer's characteristics; 2) Polymer Analysis – compare and contrast student-created polymers and the methods for storing these polymers; and 3) Recycling Polymers – create injection-molded golf tees from different polymers and evaluate the properties of recycled polymers.

Reactions

OVERVIEW

In *Reactions*, students experience and perform chemical processes that contribute to their general understanding of basic chemical principles, the reasoning for classifying reactants and products into specific groups, and the methods involved for mathematically interpreting the results. Practical, familiar examples of chemical reactions are used throughout this title to enhance the student realizations of the importance of chemistry.

STUDENT OBJECTIVES

- Utilize the basic information found in the periodic table.
- Experiment with the differences between endothermic and exothermic reactions.
- Describe how chemical symbols, formulas, and balanced equations are used in reactions.
- Identify the reactants and products in a chemical reaction.
- Use electrolysis to demonstrate the separation of water into its elemental parts.
- Write balanced chemical equations.
- Determine how to alter conditions for combustion to extinguish or enhance a fire.

ACTIVITIES

Students complete three performance assessments: 1) Types of Reactions – identify the four binary types of chemical reactions and classify each of the various types; 2) Precipitation – identify the reactants and products in the electrolysis reaction and explain what precipitation reaction occurs; and 3) Combustion – explore the compounds required to create and sustain a combustion reaction.

Soils

OVERVIEW

In *Soils*, students explore the role soil plays in agriculture and in our survival as a species on this planet. Students learn about soil formation, soil chemistry, and sustainable agricultural practices used to conserve, as well as increase, the productivity of soil. They participate in experiments that determine the characteristics of an agriculturally productive soil and show the importance of the relationship among soil, water, air, and living organisms.

STUDENT OBJECTIVES

- Categorize the various soil-forming processes.
- Compare and contrast rocks and minerals.
- Use the scientific method to solve a problem.
- Identify the processes involved in the rock cycle.
- Identify the processes involved in the water cycle.
- Evaluate texture of soil and learn about essential soil nutrients.
- Evaluate prescribed soil conservation practices/amendments.
- Differentiate among various soil conservation practices.
- Determine the pH, nitrogen, potassium, and phosphorus levels in a soil sample.

ACTIVITIES

Students complete three performance assessments: 1) Soil Fertility – name the three nutrients that must be provided to plants and determine the levels of these nutrients in soil; 2) Soil Texture Triangle – demonstrate the ability to successfully interpret the soil texture triangle and justify your determination of the soil sample's texture; and 3) Soil Organisms – name five organisms found in soil, define *humus*, and create a decomposer food web.