Main Criteria: Next Generation Science Standards (NGSS)
Secondary Criteria: JoVE
Subject: Science
Grade: 9-12
Correlation Options: Show Correlated
Adopted: 2013

STRAND	NGSS.HS-PS.	PHYSICAL SCIENCE
TITLE	HS-PS1.	Matter and Its Interactions
		Students who demonstrate understanding can:
PERFORMANCE EXPECTATION	HS-PS1-1.	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. JoVE • Coordination Chemistry Complexes
PERFORMANCE EXPECTATION	HS-PS1-2.	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. JoVE • Assembly of a Reflux System for Heated Chemical Reactions • Conducting Reactions Below Room Temperature • Coordination Chemistry Complexes • Determining Rate Laws and the Order of Reaction • Determining the Empirical Formula • Determining the Solubility Rules of Ionic Compounds • Introduction to Catalysis • Introduction to Titration • Le Châtelier's Principle • Preparing Anhydrous Reagents and Equipment • Proton Exchange Membrane Fuel Cells • Solutions and Concentrations • Spectrophotometric Determination of an Equilibrium Constant • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy

PERFORMANCE EXPECTATION	**HS-PS1-4.**	**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.** **JoVE** **• Conducting Reactions Below Room Temperature** **• Determining Rate Laws and the Order of Reaction** **• Le Châtelier's Principle** **• Using Differential Scanning Calorimetry to Measure Changes in Enthalpy**
PERFORMANCE EXPECTATION	**HS-PS1-5.**	**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.** **JoVE** **• Conducting Reactions Below Room Temperature** **• Determining Rate Laws and the Order of Reaction** **• Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat** **• Enzyme Assays and Kinetics** **• Introduction to Catalysis**
PERFORMANCE EXPECTATION	**HS-PS1-6.**	**Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.** **JoVE** **• Assembly of a Reflux System for Heated Chemical Reactions** **• Le Châtelier's Principle** **• Separation of Mixtures via Precipitation** **• Spectrophotometric Determination of an Equilibrium Constant**
PERFORMANCE EXPECTATION	**HS-PS1-7.**	**Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.** **JoVE** **• Assembly of a Reflux System for Heated Chemical Reactions** **• Conducting Reactions Below Room Temperature** **• Coordination Chemistry Complexes** **• Determining Rate Laws and the Order of Reaction** **• Determining the Empirical Formula** **• Determining the Solubility Rules of Ionic Compounds** **• Introduction to Catalysis** **• Introduction to Titration** **• Preparing Anhydrous Reagents and Equipment** **• Proton Exchange Membrane Fuel Cells** **• Solutions and Concentrations**

		• Spectrophotometric Determination of an Equilibrium Constant • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
PERFORMANCE EXPECTATION	HS-PS1-8.	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. JoVE • Determining Rate Laws and the Order of Reaction
STRAND	NGSS.HS-PS.	PHYSICAL SCIENCE
TITLE	HS-PS2.	Motion and Stability: Forces and Interactions
		Students who demonstrate understanding can:
PERFORMANCE EXPECTATION	HS-PS2-3.	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. JoVE • Raman Spectroscopy for Chemical Analysis
PERFORMANCE EXPECTATION	HS-PS2-5.	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. JoVE • fMRI: Functional Magnetic Resonance Imaging
PERFORMANCE EXPECTATION	HS-PS2-6.	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. JoVE • Le Châtelier's Principle
STRAND	NGSS.HS-PS.	PHYSICAL SCIENCE
TITLE	HS-PS3.	Energy
		Students who demonstrate understanding can:
PERFORMANCE EXPECTATION	HS-PS3-1.	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. JoVE • Using Differential Scanning Calorimetry to Measure Changes in Enthalpy
PERFORMANCE EXPECTATION	HS-PS3-2.	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.

		JoVE • Abdominal Exam II: Percussion • Auscultation • Cyclic Voltammetry (CV) • Ear Exam • Electrochemical Measurements of Supported Catalysts Using a Potentiostat/Galvanostat • Percussion
PERFORMANCE EXPECTATION	HS-PS3-3.	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. JoVE • fMRI: Functional Magnetic Resonance Imaging
PERFORMANCE EXPECTATION	HS-PS3-5.	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. JoVE • Gas Chromatography (GC) with Flame-Ionization Detection • fMRI: Functional Magnetic Resonance Imaging
STRAND	NGSS.HS-PS.	PHYSICAL SCIENCE
TITLE	HS-PS4.	Waves and Their Applications in Technologies for Information Transfer
		Students who demonstrate understanding can:
PERFORMANCE EXPECTATION	HS-PS4-2.	Evaluate questions about the advantages of using a digital transmission and storage of information. JoVE • Using GIS to Investigate Urban Forestry
PERFORMANCE EXPECTATION	HS-PS4-4.	Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. JoVE • An Introduction to Drosophila melanogaster • An Introduction to the Zebrafish: Danio rerio • An Overview of Genetics and Disease • Color Afterimages • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Histological Sample Preparation for Light Microscopy • Introduction to Fluorescence Microscopy • Introduction to Light Microscopy • Introduction to the Spectrophotometer • Mouse Genotyping

		• Nutrients in Aquatic Ecosystems • Photometric Protein Determination • Spectrophotometric Determination of an Equilibrium Constant • Turbidity and Total Solids in Surface Water • Ultraviolet-Visible (UV-Vis) Spectroscopy
PERFORMANCE EXPECTATION	HS-PS4-5.	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. <u>JoVE</u> • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam IV: Acute Abdominal Pain Assessment • An Introduction to Behavioral Neuroscience • An Introduction to Cognition • An Introduction to Learning and Memory • An Introduction to Motor Control • An Introduction to Neuroanatomy • An Introduction to Neurophysiology • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Auscultation • Color Afterimages • Community DNA Extraction from Bacterial Colonies • Conducting Reactions Below Room Temperature • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Coordination Chemistry Complexes • Cranial Nerves Exam I (I-VI) • Decision-making and the Iowa Gambling Task • Decoding Auditory Imagery with Multivoxel Pattern Analysis • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Determining the Empirical Formula • Ear Exam • Electro-encephalography (EEG) • Emergent Lateral Canthotomy and Inferior Catholysis • Event-related Potentials and the Oddball Task • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Eye Exam • Eye Tracking in Cognitive Experiments • Fear Conditioning • Finding Your Blind Spot and Perceptual Filling-in • Förster Resonance Energy Transfer (FRET) • Gas Chromatography (GC) with Flame-Ionization

		Detection **• Growing Crystals for X-ray Diffraction Analysis** **• Histological Sample Preparation for Light Microscopy** **• Internal Standards** **• Introduction to Catalysis** **• Introduction to Fluorescence Microscopy** **• Introduction to Light Microscopy** **• Introduction to Mass Spectrometry** **• Introduction to the Spectrophotometer** **• Language: The N400 in Semantic Incongruity** **• Lead Analysis of Soil Using Atomic Absorption Spectroscopy** **• Learning and Memory: The Remember-Know Task** **• MALDI-TOF Mass Spectrometry** **• Measuring Grey Matter Differences with Voxel-based Morphometry: The Musical Brain** **• Metabolic Labeling** **• Method of Standard Addition** **• Motion-induced Blindness** **• Motor Maps** **• Nuclear Magnetic Resonance (NMR) Spectroscopy** **• Nutrients in Aquatic Ecosystems** **• Ophthalmoscopic Examination** **• Percussion** **• Pericardiocentesis** **• Peripheral Vascular Exam Using a Continuous Wave Doppler** **• Photometric Protein Determination** **• Physical Properties Of Minerals I: Crystals and Cleavage** **• Plasmid Purification** **• Protein Crystallization** **• Purifying Compounds by Recrystallization** **• Raman Spectroscopy for Chemical Analysis** **• Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry** **• Rodent Stereotaxic Surgery** **• Solid-Liquid Extraction** **• Sonication Extraction of Lipid Biomarkers from Sediment** **• Soxhlet Extraction of Lipid Biomarkers from Sediment** **• Spatial Cueing** **• Spectrophotometric Determination of an Equilibrium Constant** **• Surface Plasmon Resonance (SPR)** **• Tandem Mass Spectrometry** **• The Attentional Blink** **• The Rubber Hand Illusion** **• The Staircase Procedure for Finding a Perceptual Threshold** **• Turbidity and Total Solids in Surface Water** **• Ultraviolet-Visible (UV-Vis) Spectroscopy**

		• Using Diffusion Tensor Imaging in Traumatic Brain Injury • Using GIS to Investigate Urban Forestry • Using TMS to Measure Motor Excitability During Action Observation • Visual Attention: fMRI Investigation of Object-based Attentional Control • X-ray Fluorescence (XRF) • Yeast Maintenance • fMRI: Functional Magnetic Resonance Imaging
STRAND	NGSS.HS-LS.	LIFE SCIENCE
TITLE	HS-LS1.	From Molecules to Organisms: Structures and Processes
		Students who demonstrate understanding can:
PERFORMANCE EXPECTATION	HS-LS1-1.	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. JoVE • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Genetics • An Introduction to Molecular Developmental Biology • An Introduction to Saccharomyces cerevisiae • An Introduction to Transfection • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • Annexin V and Propidium Iodide Labeling • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Cell Cycle Analysis • Chromatin Immunoprecipitation • Community DNA Extraction from Bacterial Colonies • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Density Gradient Ultracentrifugation • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Detecting Reactive Oxygen Species • Development and Reproduction of the Laboratory Mouse • Drosophila melanogaster Embryo and Larva Harvesting and Preparation

		• Electrophoretic Mobility Shift Assay (EMSA) • Embryonic Stem Cell Culture and Differentiation • Enzyme Assays and Kinetics • Explant Culture for Developmental Studies • Expression Profiling with Microarrays • Förster Resonance Energy Transfer (FRET) • Gel Purification • Gene Silencing with Morpholinos • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis • Molecular Cloning • Mouse Genotyping • PCR: The Polymerase Chain Reaction • Photometric Protein Determination • Plasmid Purification • Protein Crystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • Recombineering and Gene Targeting • Restriction Enzyme Digests • SNP Genotyping • Testing For Genetically Modified Foods • The TUNEL Assay • Two-Dimensional Gel Electrophoresis • Whole-Mount In Situ Hybridization • Yeast Maintenance • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling
PERFORMANCE EXPECTATION	**HS-LS1-2.**	**Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** **JoVE** • An Introduction to Aging and Regeneration • An Introduction to Behavioral Neuroscience • An Introduction to Caenorhabditis elegans • An Introduction to Cell Motility and Migration • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Genetics • An Introduction to Developmental Neurobiology • An Introduction to Learning and Memory • An Introduction to Modeling Behavioral Disorders and Stress

		• An Introduction to Molecular Developmental Biology • An Introduction to Motor Control • An Introduction to Organogenesis • An Introduction to Reward and Addiction • An Introduction to Stem Cell Biology • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Zebrafish: Danio rerio • Anesthesia Induction and Maintenance • Anxiety Testing • Approximate Number Sense Test • Assessing Dexterity with Reaching Tasks • Balance and Coordination Testing • Basic Care Procedures • Binocular Rivalry • Blood Withdrawal I • Blood Withdrawal II • C. elegans Chemotaxis Assay • C. elegans Development and Reproduction • C. elegans Maintenance • Calcium Imaging in Neurons • Chick ex ovo Culture • Co-Immunoprecipitation and Pull-Down Assays • Color Afterimages • Compound Administration I • Compound Administration II • Compound Administration III • Compound Administration IV • Considerations for Rodent Surgery • Crowding • Detecting Reactive Oxygen Species • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Diagnostic Necropsy and Tissue Harvest • Dichotic Listening • Drosophila Development and Reproduction • Drosophila Larval IHC • Embryonic Stem Cell Culture and Differentiation • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Fate Mapping • Finding Your Blind Spot and Perceptual Filling-in • Fundamentals of Breeding and Weaning • Genetic Engineering of Model Organisms • Habituation: Studying Infants Before They Can Talk • Histological Sample Preparation for Light Microscopy • Histological Staining of Neural Tissue • In ovo Electroporation of Chicken Embryos • Inattentional Blindness • Incidental Encoding

		• Induced Pluripotency • Just-noticeable Differences • Measuring Reaction Time and Donders' Method of Subtraction • Measuring Verbal Working Memory Span • Mental Rotation • Modeling Social Stress • Motion-induced Blindness • Motor Learning in Mirror Drawing • Multiple Object Tracking • Murine In Utero Electroporation • Neuronal Transfection Methods • Object Substitution Masking • Patch Clamp Electrophysiology • Physiological Correlates of Emotion Recognition • Primary Neuronal Cultures • Prospect Theory • Rodent Stereotaxic Surgery • Self-administration Studies • Spatial Cueing • Sterile Tissue Harvest • The Ames Room • The Attentional Blink • The Inverted-face Effect • The McGurk Effect • The Precision of Visual Working Memory with Delayed Estimation • The Rubber Hand Illusion • The Staircase Procedure for Finding a Perceptual Threshold • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Verbal Priming • Visual Search for Features and Conjunctions • Visual Statistical Learning • Whole-Mount In Situ Hybridization • Zebrafish Reproduction and Development • fMRI: Functional Magnetic Resonance Imaging
PERFORMANCE EXPECTATION	HS-LS1-3.	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. <u>JoVE</u> • Abdominal Exam I: Inspection and Auscultation • Abdominal Exam II: Percussion • Abdominal Exam III: Palpation • Abdominal Exam IV: Acute Abdominal Pain Assessment • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cellular and Molecular Neuroscience

		• An Introduction to Cognition • An Introduction to Developmental Neurobiology • An Introduction to Endocytosis and Exocytosis • An Introduction to Learning and Memory • An Introduction to Molecular Developmental Biology • An Introduction to Reward and Addiction • An Introduction to Stem Cell Biology • Anesthesia Induction and Maintenance • Ankle Exam • Annexin V and Propidium Iodide Labeling • Arterial Line Placement • Assessing Dexterity with Reaching Tasks • Auscultation • Balance and Coordination Testing • Basic Care Procedures • Basic Life Support Part II: Airway/Breathing and Continued Cardiopulmonary Resuscitation • Basic Life Support: Cardiopulmonary Resuscitation and Defibrillation • Basic Mouse Care and Maintenance • Blood Pressure Measurement • Blood Withdrawal I • Blood Withdrawal II • C. elegans Development and Reproduction • Calcium Imaging in Neurons • Cardiac Exam I: Inspection and Palpation • Cardiac Exam II: Auscultation • Cardiac Exam III: Abnormal Heart Sounds • Cell-surface Biotinylation Assay • Central Venous Catheter Insertion: Femoral Vein with Ultrasound Guidance • Central Venous Catheter Insertion: Internal Jugular with Ultrasound Guidance • Central Venous Catheter Insertion: Subclavian Vein • Compound Administration I • Compound Administration II • Compound Administration III • Compound Administration IV • Comprehensive Breast Exam • Considerations for Rodent Surgery • Cranial Nerves Exam I (I-VI) • Cranial Nerves Exam II (VII-XII) • Detecting Reactive Oxygen Species • Diagnostic Necropsy and Tissue Harvest • Ear Exam • Elbow Exam • Electro-encephalography (EEG) • Embryonic Stem Cell Culture and Differentiation • Emergency Tube Thoracostomy (Chest Tube Placement) • Emergent Lateral Canthotomy and Inferior Catholysis

		• Explant Culture of Neural Tissue • Eye Exam • FM Dyes in Vesicle Recycling • Fear Conditioning • Foot Exam • General Approach to the Physical Exam • Hand and Wrist Exam • Hip Exam • Histological Staining of Neural Tissue • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Intra-articular Shoulder Injection for Reduction Following Anterior Shoulder Dislocation • Intraosseous Needle Placement • Isolating Nucleic Acids from Yeast • Knee Exam • Lower Back Exam • Lymph Node Exam • Male Rectal Exam • Measuring Vital Signs • Motor Exam I • Motor Exam II • Murine In Utero Electroporation • Neck Exam • Needle Thoracostomy (needle Decompression) for Temporizing Tension Pneumothorax Treatment • Nose, Sinuses, Oral Cavity and Pharynx Exam • Observation and Inspection • Ophthalmoscopic Examination • Palpation • Patch Clamp Electrophysiology • Pelvic Exam I: Assessment of the External Genitalia • Pelvic Exam II: Speculum Exam • Pelvic Exam III: Bimanual and Rectovaginal Exam • Percussion • Percutaneous Cricothyrotomy (Seldinger Technique) • Pericardiocentesis • Peripheral Vascular Exam • Peripheral Vascular Exam Using a Continuous Wave Doppler • Peripheral Venous Cannulation • Physiological Correlates of Emotion Recognition • Proper Adjustment of Patient Attire during the Physical Exam • Reconstitution of Membrane Proteins • Respiratory Exam I: Inspection and Palpation • Respiratory Exam II: Percussion and Auscultation • Self-administration Studies • Sensory Exam • Shoulder Exam I • Shoulder Exam II

		• Spatial Memory Testing Using Mazes • Sterile Tissue Harvest • Surgical Cricothyrotomy • The ATP Bioluminescence Assay • The TUNEL Assay • Thyroid Exam • Tissue Regeneration with Somatic Stem Cells • Tree Identification: How To Use a Dichotomous Key • Using a pH Meter • Yeast Maintenance • Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Maintenance and Husbandry
PERFORMANCE EXPECTATION	**HS-LS1-4.**	**Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.** **JoVE** • An Introduction to Aging and Regeneration • An Introduction to Caenorhabditis elegans • An Introduction to Cell Division • An Introduction to Cell Motility and Migration • An Introduction to Developmental Genetics • An Introduction to Developmental Neurobiology • An Introduction to Molecular Developmental Biology • An Introduction to Organogenesis • An Introduction to Saccharomyces cerevisiae • An Introduction to Stem Cell Biology • An Overview of Epigenetics • An Overview of Gene Expression • C. elegans Development and Reproduction • Cell Cycle Analysis • DNA Methylation Analysis • Development and Reproduction of the Laboratory Mouse • Development of the Chick • Drosophila Larval IHC • Embryonic Stem Cell Culture and Differentiation • Explant Culture for Developmental Studies • Explant Culture of Neural Tissue • Expression Profiling with Microarrays • Fate Mapping • Gene Silencing with Morpholinos • Genetic Engineering of Model Organisms • Induced Pluripotency • Live Cell Imaging of Mitosis • Murine In Utero Electroporation • RNA-Seq • Tissue Regeneration with Somatic Stem Cells • Transplantation Studies • Whole-Mount In Situ Hybridization

		• Yeast Reproduction • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Reproduction and Development
PERFORMANCE EXPECTATION	HS-LS1-5.	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. <u>JoVE</u> • An Introduction to Cell Metabolism • Reconstitution of Membrane Proteins
PERFORMANCE EXPECTATION	HS-LS1-6.	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. <u>JoVE</u> • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cell Metabolism • An Introduction to Cell Motility and Migration • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Genetics • An Introduction to Molecular Developmental Biology • An Introduction to Saccharomyces cerevisiae • An Introduction to Transfection • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Annexin V and Propidium Iodide Labeling • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Biofuels: Producing Ethanol from Cellulosic Material • C. elegans Maintenance • Carbon and Nitrogen Analysis of Environmental Samples • Cell Cycle Analysis • Cell-surface Biotinylation Assay • Chromatin Immunoprecipitation • Chromatography-Based Biomolecule Purification Methods • Co-Immunoprecipitation and Pull-Down Assays • Column Chromatography • Community DNA Extraction from Bacterial Colonies • Conversion of Fatty Acid Methyl Esters by

		Saponification for Uk'37 Paleothermometry **• Cytogenetics** **• DNA Gel Electrophoresis** **• DNA Ligation Reactions** **• DNA Methylation Analysis** **• Density Gradient Ultracentrifugation** **• Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis** **• Detecting Reactive Oxygen Species** **• Development and Reproduction of the Laboratory Mouse** **• Development of the Chick** **• Dialysis: Diffusion Based Separation** **• Drosophila Development and Reproduction** **• Drosophila Larval IHC** **• Drosophila melanogaster Embryo and Larva Harvesting and Preparation** **• Electrophoretic Mobility Shift Assay (EMSA)** **• Embryonic Stem Cell Culture and Differentiation** **• Enzyme Assays and Kinetics** **• Explant Culture for Developmental Studies** **• Expression Profiling with Microarrays** **• Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction** **• FM Dyes in Vesicle Recycling** **• Förster Resonance Energy Transfer (FRET)** **• Gel Purification** **• Gene Silencing with Morpholinos** **• Genetic Crosses** **• Genetic Engineering of Model Organisms** **• Genetic Screens** **• Genome Editing** **• In ovo Electroporation of Chicken Embryos** **• Induced Pluripotency** **• Introduction to Catalysis** **• Introduction to Mass Spectrometry** **• Invasion Assay Using 3D Matrices** **• Invertebrate Lifespan Quantification** **• Ion-Exchange Chromatography** **• Isolating Nucleic Acids from Yeast** **• Live Cell Imaging of Mitosis** **• MALDI-TOF Mass Spectrometry** **• Metabolic Labeling** **• Method of Standard Addition** **• Molecular Cloning** **• Mouse Genotyping** **• Nutrients in Aquatic Ecosystems** **• PCR: The Polymerase Chain Reaction** **• Photometric Protein Determination** **• Plasmid Purification** **• Protein Crystallization**

		• Purification of a Total Lipid Extract with Column Chromatography • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • RNAi in C. elegans • Recombineering and Gene Targeting • Reconstitution of Membrane Proteins • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Restriction Enzyme Digests • Rodent Stereotaxic Surgery • SNP Genotyping • Separating Protein with SDS-PAGE • Separation of Mixtures via Precipitation • Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Spectrophotometric Determination of an Equilibrium Constant • Surface Plasmon Resonance (SPR) • Tandem Mass Spectrometry • Testing For Genetically Modified Foods • The ATP Bioluminescence Assay • The ELISA Method • The TUNEL Assay • The Transwell Migration Assay • The Western Blot • Two-Dimensional Gel Electrophoresis • Ultraviolet-Visible (UV-Vis) Spectroscopy • Whole-Mount In Situ Hybridization • Yeast Maintenance • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling • Zebrafish Microinjection Techniques • Zebrafish Reproduction and Development
PERFORMANCE EXPECTATION	HS-LS1-7.	Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. JoVE • An Introduction to Cell Metabolism • Biofuels: Producing Ethanol from Cellulosic Material • Detecting Reactive Oxygen Species • The ATP Bioluminescence Assay
STRAND	NGSS.HS-LS.	LIFE SCIENCE

TITLE	HS-LS2.	Ecosystems: Interactions, Energy, and Dynamics
		Students who demonstrate understanding can:
PERFORMANCE EXPECTATION	HS-LS2-2.	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. JoVE • Algae Enumeration via Culturable Methodology • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • Analysis of Earthworm Populations in Soil • Aseptic Technique in Environmental Science • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Basic Mouse Care and Maintenance • C. elegans Maintenance • Culturing and Enumerating Bacteria from Soil Samples • Detection of Bacteriophages in Environmental Samples • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Filamentous Fungi • Introduction to Mass Spectrometry • Isolation of Fecal Bacteria from Water Samples by Filtration • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Measuring Tropospheric Ozone • Nutrients in Aquatic Ecosystems • Passaging Cells • Plasmid Purification • Quantifying Environmental Microorganisms and Viruses Using qPCR • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms • Yeast Maintenance • Yeast Reproduction
PERFORMANCE EXPECTATION	HS-LS2-3.	Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

		JoVE **• Algae Enumeration via Culturable Methodology** **• Analysis of Earthworm Populations in Soil** **• Bacterial Growth Curve Analysis and its Environmental Applications** **• Carbon and Nitrogen Analysis of Environmental Samples** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Dissolved Oxygen in Surface Water** **• Filamentous Fungi** **• Fundamentals of Breeding and Weaning** **• Nutrients in Aquatic Ecosystems** **• Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium** **• Using GIS to Investigate Urban Forestry**
PERFORMANCE EXPECTATION	**HS-LS2-4.**	**Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.** **JoVE** **• Algae Enumeration via Culturable Methodology** **• An Overview of Alkenone Biomarker Analysis for Paleothermometry** **• An Overview of bGDGT Biomarker Analysis for Paleoclimatology** **• Analysis of Earthworm Populations in Soil** **• Bacterial Growth Curve Analysis and its Environmental Applications** **• Carbon and Nitrogen Analysis of Environmental Samples** **• Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry** **• Culturing and Enumerating Bacteria from Soil Samples** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Dissolved Oxygen in Surface Water** **• Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction** **• Filamentous Fungi** **• Fundamentals of Breeding and Weaning** **• Metabolic Labeling** **• Nutrients in Aquatic Ecosystems** **• Purification of a Total Lipid Extract with Column Chromatography** **• Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry** **• Soil Nutrient Analysis: Nitrogen, Phosphorus, and Potassium** **• Sonication Extraction of Lipid Biomarkers from Sediment**

		• Soxhlet Extraction of Lipid Biomarkers from Sediment • Using GIS to Investigate Urban Forestry
PERFORMANCE EXPECTATION	HS-LS2-5.	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. JoVE • An Introduction to Cell Metabolism • Biofuels: Producing Ethanol from Cellulosic Material • Detecting Reactive Oxygen Species • The ATP Bioluminescence Assay
PERFORMANCE EXPECTATION	HS-LS2-7.	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Measuring Tropospheric Ozone • Proton Exchange Membrane Fuel Cells • Self-report vs. Behavioral Measures of Recycling • Using GIS to Investigate Urban Forestry
STRAND	NGSS.HS-LS.	LIFE SCIENCE
TITLE	HS-LS3.	Heredity: Inheritance and Variation of Traits
		Students who demonstrate understanding can:
PERFORMANCE EXPECTATION	HS-LS3-1.	Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. JoVE • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Cellular and Molecular Neuroscience • An Introduction to Developmental Genetics • An Introduction to Drosophila melanogaster • An Introduction to Molecular Developmental Biology • An Introduction to Saccharomyces cerevisiae • An Introduction to Transfection • An Introduction to the Zebrafish: Danio rerio • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetic Engineering • An Overview of Genetics and Disease • Annexin V and Propidium Iodide Labeling • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • C. elegans Development and Reproduction

		• Cell Cycle Analysis • Chromatin Immunoprecipitation • Community DNA Extraction from Bacterial Colonies • Cytogenetics • DNA Gel Electrophoresis • DNA Ligation Reactions • DNA Methylation Analysis • Density Gradient Ultracentrifugation • Detecting Environmental Microorganisms with the Polymerase Chain Reaction and Gel Electrophoresis • Development and Reproduction of the Laboratory Mouse • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Electrophoretic Mobility Shift Assay (EMSA) • Embryonic Stem Cell Culture and Differentiation • Enzyme Assays and Kinetics • Explant Culture for Developmental Studies • Expression Profiling with Microarrays • Förster Resonance Energy Transfer (FRET) • Gel Purification • Gene Silencing with Morpholinos • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Genome Editing • In ovo Electroporation of Chicken Embryos • Induced Pluripotency • Isolating Nucleic Acids from Yeast • Live Cell Imaging of Mitosis • Molecular Cloning • Mouse Genotyping • PCR: The Polymerase Chain Reaction • Photometric Protein Determination • Plasmid Purification • Protein Crystallization • Quantifying Environmental Microorganisms and Viruses Using qPCR • RNA Analysis of Environmental Samples Using RT-PCR • RNA-Seq • Recombineering and Gene Targeting • Restriction Enzyme Digests • SNP Genotyping • Testing For Genetically Modified Foods • The TUNEL Assay • Two-Dimensional Gel Electrophoresis • Whole-Mount In Situ Hybridization • Yeast Maintenance • Yeast Transformation and Cloning • Zebrafish Breeding and Embryo Handling

PERFORMANCE EXPECTATION	HS-LS3-2.	Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. JoVE • An Introduction to Aging and Regeneration • An Introduction to Caenorhabditis elegans • An Introduction to Cell Death • An Introduction to Cell Division • An Introduction to Developmental Genetics • An Introduction to Drosophila melanogaster • An Introduction to Modeling Behavioral Disorders and Stress • An Introduction to Saccharomyces cerevisiae • An Introduction to Transfection • An Introduction to the Zebrafish: Danio rerio • An Overview of Epigenetics • An Overview of Gene Expression • An Overview of Genetic Analysis • An Overview of Genetics and Disease • C. elegans Development and Reproduction • Drosophila Development and Reproduction • Genetic Crosses • Genetic Engineering of Model Organisms • Genetic Screens • Isolating Nucleic Acids from Yeast • Passaging Cells • Recombineering and Gene Targeting • SNP Genotyping • The ELISA Method • The TUNEL Assay • Yeast Reproduction • Zebrafish Maintenance and Husbandry
PERFORMANCE EXPECTATION	HS-LS3-3.	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. JoVE • An Introduction to Developmental Genetics • An Overview of Epigenetics • An Overview of Genetic Analysis • An Overview of Genetics and Disease • DNA Methylation Analysis • Fundamentals of Breeding and Weaning • Genetic Crosses • The ELISA Method
STRAND	NGSS.HS-LS.	LIFE SCIENCE
TITLE	HS-LS4.	Biological Evolution: Unity and Diversity

		Students who demonstrate understanding can:
PERFORMANCE EXPECTATION	HS-LS4-1.	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. JoVE • An Introduction to Caenorhabditis elegans • An Introduction to Drosophila melanogaster • An Introduction to the Chick: Gallus gallus domesticus • An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • An Overview of Genetic Analysis • Drosophila Development and Reproduction • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • High-Performance Liquid Chromatography (HPLC)
PERFORMANCE EXPECTATION	HS-LS4-2.	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. JoVE • An Introduction to the Chick: Gallus gallus domesticus • An Overview of Genetic Analysis
PERFORMANCE EXPECTATION	HS-LS4-3.	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. JoVE • An Overview of Genetic Analysis
PERFORMANCE EXPECTATION	HS-LS4-4.	Construct an explanation based on evidence for how natural selection leads to adaptation of populations. JoVE • An Overview of Genetic Analysis
PERFORMANCE EXPECTATION	HS-LS4-5.	Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. JoVE • Algae Enumeration via Culturable Methodology • An Introduction to the Chick: Gallus gallus domesticus

		• An Introduction to the Laboratory Mouse: Mus musculus • An Introduction to the Zebrafish: Danio rerio • Analysis of Earthworm Populations in Soil • Aseptic Technique in Environmental Science • Bacterial Growth Curve Analysis and its Environmental Applications • Bacterial Transformation: Electroporation • Bacterial Transformation: The Heat Shock Method • Basic Mouse Care and Maintenance • C. elegans Maintenance • Culturing and Enumerating Bacteria from Soil Samples • Detection of Bacteriophages in Environmental Samples • Dissolved Oxygen in Surface Water • Drosophila Maintenance • Drosophila melanogaster Embryo and Larva Harvesting and Preparation • Filamentous Fungi • Isolation of Fecal Bacteria from Water Samples by Filtration • Passaging Cells • Plasmid Purification • Quantifying Environmental Microorganisms and Viruses Using qPCR • Yeast Maintenance • Yeast Reproduction
PERFORMANCE EXPECTATION	HS-LS4-6.	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. JoVE • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Self-report vs. Behavioral Measures of Recycling
STRAND	NGSS.HS-ESS.	EARTH AND SPACE SCIENCE
TITLE	HS-ESS1.	Earth's Place in the Universe
		Students who demonstrate understanding can:
PERFORMANCE EXPECTATION	HS-ESS1-1.	Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation. JoVE • Turbidity and Total Solids in Surface Water
PERFORMANCE EXPECTATION	HS-ESS1-5.	Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.

		JoVE • Determining Spatial Orientation of Rock Layers with the Brunton Compass • Igneous Intrusive Rock • Igneous Volcanic Rock • Making a Geologic Cross Section • Using Topographic Maps to Generate Topographic Profiles
STRAND	NGSS.HS-ESS.	EARTH AND SPACE SCIENCE
TITLE	HS-ESS2.	Earth's Systems
		Students who demonstrate understanding can:
PERFORMANCE EXPECTATION	HS-ESS2-1.	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. JoVE • Igneous Intrusive Rock • Igneous Volcanic Rock • Making a Geologic Cross Section • Turbidity and Total Solids in Surface Water • Using Topographic Maps to Generate Topographic Profiles
PERFORMANCE EXPECTATION	HS-ESS2-2.	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth's systems. JoVE • Algae Enumeration via Culturable Methodology • Determining the Solubility Rules of Ionic Compounds • Dissolved Oxygen in Surface Water • Le Châtelier's Principle • Nutrients in Aquatic Ecosystems • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms
PERFORMANCE EXPECTATION	HS-ESS2-5.	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. JoVE • Determination of Moisture Content in Soil • Dissolved Oxygen in Surface Water • Nutrients in Aquatic Ecosystems • Proton Exchange Membrane Fuel Cells • Turbidity and Total Solids in Surface Water • Water Quality Analysis via Indicator Organisms

PERFORMANCE EXPECTATION	HS-ESS2-6.	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. JoVE • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Purification of a Total Lipid Extract with Column Chromatography • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment • Using GIS to Investigate Urban Forestry
PERFORMANCE EXPECTATION	HS-ESS2-7.	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth. JoVE • An Overview of Alkenone Biomarker Analysis for Paleothermometry • An Overview of bGDGT Biomarker Analysis for Paleoclimatology • Conversion of Fatty Acid Methyl Esters by Saponification for Uk'37 Paleothermometry • Extraction of Biomarkers from Sediments - Accelerated Solvent Extraction • Purification of a Total Lipid Extract with Column Chromatography • Removal of Branched and Cyclic Compounds by Urea Adduction for Uk'37 Paleothermometry • Sonication Extraction of Lipid Biomarkers from Sediment • Soxhlet Extraction of Lipid Biomarkers from Sediment
STRAND	NGSS.HS-ESS.	EARTH AND SPACE SCIENCE
TITLE	HS-ESS3.	Earth and Human Activity
		Students who demonstrate understanding can:
PERFORMANCE EXPECTATION	HS-ESS3-1.	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human

		activity. **JoVE** **• Biofuels: Producing Ethanol from Cellulosic Material** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Dissolved Oxygen in Surface Water** **• Igneous Intrusive Rock** **• Igneous Volcanic Rock** **• Lead Analysis of Soil Using Atomic Absorption Spectroscopy** **• Measuring Tropospheric Ozone** **• Nutrients in Aquatic Ecosystems** **• Proton Exchange Membrane Fuel Cells** **• Tree Identification: How To Use a Dichotomous Key** **• Tree Survey: Point-Centered Quarter Sampling Method** **• Turbidity and Total Solids in Surface Water** **• Using GIS to Investigate Urban Forestry**
PERFORMANCE EXPECTATION	**HS-ESS3-2.**	**Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.** **JoVE** **• Biofuels: Producing Ethanol from Cellulosic Material** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Fractional Distillation** **• Igneous Intrusive Rock** **• Proton Exchange Membrane Fuel Cells** **• Raman Spectroscopy for Chemical Analysis**
PERFORMANCE EXPECTATION	**HS-ESS3-3.**	**Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.** **JoVE** **• Biofuels: Producing Ethanol from Cellulosic Material** **• Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy** **• Electrophoretic Mobility Shift Assay (EMSA)** **• Lead Analysis of Soil Using Atomic Absorption Spectroscopy** **• Measuring Tropospheric Ozone** **• Proton Exchange Membrane Fuel Cells** **• Self-report vs. Behavioral Measures of Recycling** **• Tree Identification: How To Use a Dichotomous Key** **• Tree Survey: Point-Centered Quarter Sampling Method** **• Using GIS to Investigate Urban Forestry**
PERFORMANCE EXPECTATION	**HS-ESS3-4.**	**Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.**

		JoVE • Bacterial Growth Curve Analysis and its Environmental Applications • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Measuring Tropospheric Ozone • Proton Exchange Membrane Fuel Cells • Raman Spectroscopy for Chemical Analysis • Using GIS to Investigate Urban Forestry
PERFORMANCE EXPECTATION	HS-ESS3-5.	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. JoVE • Biofuels: Producing Ethanol from Cellulosic Material
PERFORMANCE EXPECTATION	HS-ESS3-6.	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Dissolved Oxygen in Surface Water • Introduction to Mass Spectrometry • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Making a Geologic Cross Section • Measuring Tropospheric Ozone • Nutrients in Aquatic Ecosystems • Proton Exchange Membrane Fuel Cells • Tree Identification: How To Use a Dichotomous Key • Tree Survey: Point-Centered Quarter Sampling Method • Turbidity and Total Solids in Surface Water • Using GIS to Investigate Urban Forestry • Water Quality Analysis via Indicator Organisms
STRAND	NGSS.HS-ETS.	ENGINEERING DESIGN
TITLE	HS-ETS1.	Engineering Design
		Students who demonstrate understanding can:
PERFORMANCE EXPECTATION	HS-ETS1-1.	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. JoVE • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy

		• Dissolved Oxygen in Surface Water • Lead Analysis of Soil Using Atomic Absorption Spectroscopy • Measuring Tropospheric Ozone • Nutrients in Aquatic Ecosystems • Proton Exchange Membrane Fuel Cells • Turbidity and Total Solids in Surface Water
PERFORMANCE EXPECTATION	**HS-ETS1-3.**	**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.** **JoVE** • Biofuels: Producing Ethanol from Cellulosic Material • Determination Of Nox in Automobile Exhaust Using UV-VIS Spectroscopy • Measuring Tropospheric Ozone • Proton Exchange Membrane Fuel Cells • Using GIS to Investigate Urban Forestry