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To the

Utah 2018 Science with Engineering Education Standards (SEEd) Grade 8

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To the
Utah SEEd Standards for Grade 8

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Table of Contents

SE = Student Edition TE = Teacher's Edition
Digital Resources: The symbol > indicates a click to reach each digital asset on the Realize platform.

A Correlation of Elevate Science Grades 6-8 Modules ©2019
To the
Utah SEEd Standards for Grade 8

Utah SEEd Standards Grade 8	Elevate Science Grades 6-8 Modules ©2019
8.1 Matter and Energy Interact in the Physical World The physical world is made of atoms and molecules. Even large objects can be viewed as a combination of small particles. Energy causes particles to move and interact physically or chemically. Those interactions create a variety of substances. As molecules undergo a chemical or physical change, the number of atoms in that system remains constant. Humans use energy to refine natural resources into synthetic materials.	
8.1.1 Develop a model to describe the scale and proportion of atoms and molecules. Emphasize developing atomic models of elements and their numbers of protons, neutrons, and electrons, as well as models of simple molecules. Topics like valence electrons, bond energy, ionic complexes, ions, and isotopes will be introduced at the high school level.	**SE/TE:** **Structure and Properties of Matter** Hands-On Lab: uInvestigate, 4 Model It!: Molecules and Atoms, 9 Evidence-Based Assessment, 36-37 **Atoms and Chemical Reactions** Model It!: Models of an Atom, 9 Hands-On Lab: uInvestigate, 10 Lesson 1 Check, 13 uEngineer It!: When Particles Collide, 37 Topic Review and Assess, 56-57 **Realize™ Digital Resources:** **Structure and Properties of Matter:** **Introduction to Matter** >Lesson 1>Interactivity: What Makes Up Matter; > Interactivity: Molecules and Extended Structures; > uInvestigate Lab: Modeling Atoms and Molecules **Atoms and Chemical Reactions** Atoms and the Periodic Table> Lesson 1> Interactivity: Build an Atom

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8.1.2 Obtain information about various properties of matter, evaluate how different materials' properties allow them to be used for particular functions in society, and communicate your findings. Emphasize general properties of matter. Examples could include color, density, flammability, hardness, malleability, odor, ability to rust, solubility, state, or the ability to react with water.	**SE/TE:** **Structure and Properties of Matter** Matter, 5-7 Physical and Chemical Properties, 6-7 Reading Check: Infer, 7 Quest Check-In, 12, 32 uEngineer It!: Gathering Speed with Superconductors, 33 **Atoms and Chemical Reactions** Physical Properties of Metals, 33 Interactivity, 50, 75 Plan It!: Acid or Base, 52 **Realize™ Digital Resources:** **Structure and Properties of Matter:** **Introduction to Matter** >Lesson 1> Career Video: Museum Conservator **Atoms and Chemical Reactions:** **Atoms and the Periodic Table** >Lesson 3>Enrichment: All That Glitters Is Not Gold >Lesson 5>Quest Check-In Lab: Solving the Mystery

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8.1.3 Plan and conduct an investigation and then analyze and interpret the data to identify patterns in changes in a substance's properties to determine whether a chemical reaction has occurred. Examples could include changes in properties such as color, density, flammability, odor, solubility, or state.	**SE/TE:** **Structure and Properties of Matter** Math Toolbox: Densities of Unknown Substances, 20 Math Toolbox: Conservation of Mass, 29 Math Toolbox: Energy in Chemical Reactions, 31 Quest Check-In, 32 **Atoms and Chemical Reactions** Hands-On Lab: uConnect, 64 Hands-On Lab: uInvestigate, 82 Evidence-Based Assessment, 110-111 uDemonstrate Lab: Evidence of Chemical Change, 112-115 **Realize™ Digital Resources:** **Structure and Properties of Matter: Introduction to Matter** >Lesson 3>Inquiry Warm-Up Lab: Is a New Substance Formed?; >Virtual Lab: What's the Matter with My Chocolate?; > uInvestigate Lab: Physical and Chemical Changes; > Interactivity: Properties of Matter

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8.1.4 Obtain and evaluate information to describe how synthetic materials come from natural resources, what their functions are, and how society uses these new materials. Examples of synthetic materials could include medicine, foods, building materials, plastics, and alternative fuels.	**SE/TE:** **Atoms and Chemical Reactions** Connect It!, 98 Synthetic Materials, 99-102 Accidental Synthetics, 101 The Impact of Synthetic Materials, 103-104 Literacy Connection: Evaluate Information, 103 Reading Check: Evaluate Information, 104 Lesson 4 Check, 105 Quest Check-In, 105 Topic Review and Assess, 108-109 **Realize™ Digital Resources:** **Atoms and Chemical Reactions:** **Chemical Reactions** >Lesson 4>Interactivity: Describe the Impact of Synthetics; Video: Producing Useful Materials; >Interactivity: The Impact of Synthetics; > Quest Check-In Lab: Heat It Up or Ice It Down

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8.1.5 Develop a model that uses computational thinking to illustrate cause and effect relationships in particle motion, temperature, density, and state of a pure substance when heat energy is added or removed. Emphasize molecular-level models of solids, liquids, and gases to show how adding or removing heat energy can result in phase changes, and focus on calculating the density of a substance's state.	**SE/TE:** **Structure and Properties of Matter** Math Toolbox: Temperature and Density of Water, 19 Quest Kickoff: How can you use solids, liquids and gases to lift a car?, 44-45 Model It!: Crystalline and Amorphous Solids, 50 Lesson 1 Check, 54 Model It!: Dry Ice, 63 Model It!: Developing Models, 71 How Pistons Work, 74 Evidence-Based Assessment, 80-81 uDemonstrate Lab: Melting Ice, 82-85 **Energy Transfer** Model It!, 58 **Atoms and Chemical Reactions** Quest Check-In, 47 **Realize™ Digital Resources:** **Structure and Properties of Matter** **Solids, Liquids, and Gases** > Lesson 1> uInvestigate Lab: Properties of Matter > Lesson 2> Interactivity: Particle Motion and States of Matter; > Worksheet: States of Matter; > uInvestigate Lab: Mirror, Mirror; > Interactivity: Thermal Energy and Changes of State > Lesson 3> Interactivity: Hot Air Balloon Ride

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8.1.6 Develop a model to describe how the total number of atoms does not change in a chemical reaction, indicating that matter is conserved. Emphasize demonstrations of an understanding of the law of conservation of matter. Balancing equations and stoichiometry will be learned at the high school level.	**SE/TE:** **Atoms and Chemical Reactions** Model It!: Formation of Ammonia, 92 Law of Conservation of Mass, 94-95 Evidence-Based Assessment, 110-111 **Realize™ Digital Resources:** **Atoms and Chemical Reactions:** **Chemical Reactions** >Lesson 3> Interactivity: Conservation of Matter; >Video: Modeling Chemical Reactions; >uInvestigate Lab: Is Matter Conserved?: >Interactivity: Model the Conservation of Mass
8.1.7 Design, construct, and test a device that can affect the rate of a phase change. Compare and identify the best characteristics of competing devices and modify them based on data analysis to improve the device to better meet the criteria for success.	**SE/TE:** **Structure and Properties of Matter** Quest Kick-Off, 44-45 Quest Findings, 81 **Energy Transfer** Quest Kickoff: How can you keep hot water from cooling down?, 52-53 uEngineer It!: Shockwave to the Future, 69 **Realize™ Digital Resources:** **Structure and Properties of Matter:** **Solids, Liquids, and Gases** >Lesson 1> Quest Check-In Interactivity: Design Your Lift >Lesson 2> Quest Check-In Interactivity: Lift Your Car

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8.2 Energy is Stored and Transferred in Physical Systems Objects can store and transfer energy within systems. Energy can be transferred between objects, which involves changes in the object's energy. There is a direct relationship between an object's energy, mass, and velocity. Energy can travel in waves and may be harnessed to transmit information.	
8.2.1 Use computational thinking to analyze data about the relationship between the mass and speed of objects and the relative amount of kinetic energy of the objects. Emphasis should be on the quantity of mass and relative speed to the observable effects of the kinetic energy. Examples could include a full cart vs. an empty cart or rolling spheres with different masses down a ramp to measure the effects on stationary masses. Calculations of kinetic and potential energy will be learned at the high school level.	**SE/TE:** **Energy Transfer** Math Toolbox: Mass, Speed, and Kinetic Energy, 16 Calculating Kinetic Energy, 16 Lesson 2 Check, 20 **Realize™ Digital Resources:** **Energy Transfer:** **Energy** >Lesson 2>Interactivity: Interpret Kinetic Energy Graphs; >Virtual Lab: Skate or Fly!; Video: Kinetic Energy and Potential Energy; >Interactivity: Racing for Kinetic Energy
8.2.2 Ask questions about how the amount of potential energy varies as distance within the system changes. Plan and conduct an investigation to answer a question about potential energy. Emphasize comparing relative amounts of energy. Examples could include a full cart vs. an empty cart or rolling spheres with different masses down a ramp to measure the effects on stationary masses. Calculations of kinetic and potential energy will be learned at the high school level.	**SE/TE:** **Energy Transfer** Potential Energy, 17-19 Gravitational Potential Energy, 18 Lesson 2 Check, 20 Kinetic and Potential Energy, 34 Model It!: Transformation and Transfer, 35 Energy Transformation and Transfer, 35 Lesson 4 Check, 39 Topic Review and Assess, 42-43 Evidence-Based Assessment, 44-45 uDemonstrate Lab: 3, 2, 1...Liftoff!, 46-49 **Forces** Gravitational Potential Energy, 40 Model It!: Develop Models, 41 Topic Review and Assess, 44-45 **Realize™ Digital Resources:** **Energy Transfer** Energy> Lesson 2> uInvestigate Lab: Energy, Magnetism, and Electricity; Enrichment: Kinetic or Potential Energy?

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8.2.3 Engage in argument to identify the strongest evidence that supports the claim that the kinetic energy of an object changes as energy is transferred to or from the object. Examples could include observing temperature changes as a result of friction, applying force to an object, or releasing potential energy from an object.	**SE/TE:** **Energy Transfer** Kinetic and Potential Energy, 34 Reading Check, 35 Lesson 4 Check, 39 uDemonstrate Lab: 3, 2, 1…Liftoff!, 46-49 Evidence-Based Assessment, 82-83 **Realize™ Digital Resources:** **Energy Transfer** **Energy** >Topic Launch> uConnect Lab: What Would Make a Card Jump? >Lesson 4> Interactivity: Energy Transformations; >Interactivity: Taking It to the Extreme; >Enrichment: The Energy of a Comet
8.2.4 Use computational thinking to describe a simple model for waves that shows the pattern of wave amplitude being related to wave energy. Emphasize describing waves with both quantitative and qualitative thinking. Examples could include using graphs, charts, computer simulations, or physical models to demonstrate amplitude and energy correlation.	**SE/TE:** **Waves and Information Technologies** Hands-On Lab: uInvestigate, 8 Math Toolbox: Wave Properties, 10 Lesson 1 Check, 11 Hands-On Lab: uInvestigate, 18 Types of Interference, 18-19 Lesson 2 Check, 22 Math Toolbox: Decibel Levels, 30 Math Toolbox: Applying Ohm's Law, 70 Case Study: Super Ultra High Definition!, 86-87 **Realize™ Digital Resources:** **Waves and Information Technologies:** **Waves and Electromagnetic Radiation** >Lesson 1> Interactivity: Modeling Waves; > Interactivity: Making Waves; > Worksheet: Making Waves; > Interactivity: Describe Properties of Waves >Lesson 2> Interactivity: Model Wave Interactions >Lesson 3> Inquiry Warm-Up Lab: Amplitude and Loudness

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8.2.5 Develop and use a model to describe the structure of waves and how they are reflected, absorbed, or transmitted through various materials. Emphasize both light and mechanical waves. Examples could include drawings, simulations, and written descriptions of light waves through a prism; mechanical waves through gas vs. liquids vs. solids; or sound waves through different mediums.	**SE/TE:** **Waves and Information Technologies** Hands-On Lab: uInvestigate, 24, 27, 40 Quest Kick-Off, 2-3 Check-In, 11, 42, 53 Plan It!: Develop Models, 16 uEngineer It!: Say "Cheese!", 23 Model It!: Develop Models, 27 Lesson 3 Check, 33 Model It!: Polarizing Glasses, 37 Model It!: Fun with Mirrors, 50 Topic Review and Assess, 54-55 Evidence-Based Assessment, 56-57 **Realize™ Digital Resources:** **Waves and Information Technologies:** **Waves and Electromagnetic Radiation** >Lesson 2>Interactivity: Use Models to Describe Wave Behavior; >Enrichment: Mapping with Sonar >Lesson 5>Interactivity: Describe the Behavior of Light; >uInvestigate Lab: Light Interacting with Matter

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8.2.6 Obtain and evaluate information to communicate the claim that the structure of digital signals are a more reliable way to store or transmit information than analog signals. Emphasize the basic understanding that waves can be used for communication purposes. Examples could include using vinyl record vs. digital song files, film cameras vs. digital cameras, or alcohol thermometers vs. digital thermometers.	**SE/TE:** **Waves and Information Technologies** Signals and Information, 77-79 Hands-On Lab, 77 From Wired to Wireless: Compare and Contrast, 79 Analog and Digital Signals, 80-82 Video, 80 Analog to Digital Processing: Develop Models, 81 Hands-On Lab: uInvestigate, 82, 94 Transmitting Signals, 83-84 Quest Check-In, 85, 96 Lesson 2 Check, 85 Case Study: Super Ultra High Definition!, 86-87 Connect It!, 88 Roger That!: Connect to Technology, 92-93 Advantages of Digital Signals, 94-95 Lesson 3 Check, 96 Extraordinary Science: Beam Me Up!, 97 Topic Review and Assess, 98-99 Evidence-Based Assessment, 100-101 uDemonstrate Lab: Over and Out, 102-105 **Realize™ Digital Resources:** **Waves and Information Technologies** **Information Technologies** >Lesson 2> Class Discussion: Clocks; > Interactivity: Analog and Digital Signals >Lesson 3> Interactivity: Film Cameras and Digital Cameras; > Interactivity: Technology and Communication; > Interactivity: Signal Reliability; >Virtual Lab: Super Spy! >Video: Communication and Technology

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8.3 Life Systems Store and Transfer Matter and Energy Living things use energy from their environment to rearrange matter to sustain life. Photosynthetic organisms are able to transfer light energy to chemical energy. Consumers can break down complex food molecules to utilize the stored energy and use the particles to form new, life-sustaining molecules. Ecosystems are examples of how energy can flow while matter cycles through the living and nonliving components of systems.	
8.3.1 Plan and conduct an investigation and use the evidence to construct an explanation of how photosynthetic organisms use energy to transform matter. Emphasize molecular and energy transformations during photosynthesis.	**SE/TE:** **Relationships Within Ecosystems** Hands-On Lab: uInvestigate, 4, uEngineer It!: Engineering Artificial Photosynthesis, 13 **Realize™ Digital Resources:** **Relationships Within Ecosystems** **Cell Processes** >Topic Launch> Quest Kickoff: Problem in the Greenhouse >Lesson 1>Interactivity: Making Food for Cells; uInvestigate Lab: Energy from the Sun; > Quest Check-In Interactivity: Photosynthesis in the Greenhouse >Topic Close>Quest Findings: Reflect on the Problem in the Greenhouse
8.3.2 Develop a model to describe how food is changed through chemical reactions to form new molecules that support growth and/or release energy as matter cycles through an organism. Emphasis is on describing that during cellular respiration molecules are broken apart and rearranged into new molecules, and that this process releases energy.	**SE/TE:** **Relationships Within Ecosystems** Releasing Energy: Figure 2, 18 Model It!, 19 Lesson 2 Check, 22 Topic Review and Assess, 24-25 uDemonstrate Lab: Cycling Energy and Matter, 28-31 **Realize™ Digital Resources:** **Relationships Within Ecosystems:** **Cell Processes** >Lesson 2> Inquiry Warm-Up Lab: Cellular Respiration; >Interactivity: Making Energy for Cells; >uInvestigate Lab: Exhaling Carbon Dioxide; > Interactivity: Energy to Food and Food to Energy

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8.3.3 Ask questions to obtain, evaluate, and communicate information about how changes to an ecosystem affect the stability of cycling matter and the flow of energy among living and nonliving parts of an ecosystem. Emphasize describing the cycling of matter and flow of energy through the carbon cycle.	**SE/TE:** **Relationships Within Ecosystems** Connect It!, 56 Literacy Connection: Determine Central Ideas, 60 The Carbon and Oxygen Cycles, Figure 4, 60-61 Lesson 3 Check, 64 Interactions Between Cycles of an Ecosystem, 114 **Cycles Influencing Weather and Climate** Case Study: The Carbon Cycle, 124-125 Evidence-Based Assessment, 138-139 uDemonstrate Lab: An Ocean of a Problem, 140-143 **Realize™ Digital Resources:** **Relationships Within Ecosystems** **Ecosystems** >Lesson 3> Interactivity: Cycles of Matter; > Video: Cycles of Matter; >Interactivity: Earth's Recyclables; >Quest Check-In Interactivity: Matter and Energy in a Pond; >Enrichment: Carbon and the Ocean

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8.4 Interactions with Natural Systems and Resources Interactions of matter and energy through geologic processes have led to the uneven distribution of natural resources. Many of these resources are nonrenewable, and per-capita use can cause positive or negative consequences. Global temperatures change due to various factors, and can cause a change in regional climates. As energy flows through the physical world, natural disasters can occur that affect human life. Humans can study patterns in natural systems to anticipate and forecast some future disasters and work to mitigate the outcomes.	
8.4.1 Construct a scientific explanation based on evidence that shows that the uneven distribution of Earth's mineral, energy, and groundwater resources is caused by geological processes. Examples of uneven distribution of resources could include Utah's unique geologic history that led to the formation and irregular distribution of natural resources like copper, gold, natural gas, oil shale, silver, and uranium.	**SE/TE:** **Changing Earth and Human Activity** Coal Formation and Distribution, 59 Petroleum Formation and Distribution, 61 Distribution of Uranium, 63 Lesson 1 Check, 65 Case Study: Phosphorus Fiasco, 82-83 Water on Earth, 85-87 Lesson 4 Check, 90 Quest Check-In, 90 Topic Review and Assess, 92-93 Evidence-Based Assessment, 94-95 **Realize™ Digital Resources:** **Changing Earth and Human Activity: Distribution of Natural Resources** >Lesson 1>Interactivity: Distribution of Fossil Fuels; >Quest Check-In Interactivity: Surviving on Fossil Fuels >Lesson 4>Interactivity: Distribution of Water Resources >Topic Close>Quest Findings: Reflect on Boomtowns

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8.4.2 Engage in argument supported by evidence about the effect of per capita consumption of natural resources on Earth's systems. Emphasize that these resources are limited and may be non-renewable. Examples of evidence include rates of consumption of food and natural resources such as freshwater, minerals, and energy sources.	**SE/TE:** **Energy Transfer** Case Study: US Energy Consumption, 40-41 **Changing Earth and Human Activity** Case Study: Phosphorous Fiasco, 82-83 Quest Check-In, 90, 133 Lesson 3 Check, 133 Reading Check: Identify, 89 Topic Review and Assess, 92-93 Connect It!, 104 Reading Check: Develop an Argument, 110 Lesson 1 Check, 111 Literacy Connection: Cite Textual Evidence, 129 Literacy Connection: Draw Evidence, 139 Lesson 4 Check, 144 Topic Review and Assess, 146-147 Evidence-Based Assessment, 148-149 uDemonstrate Lab: Washing Away, 150-153 **Realize™ Digital Resources:** **Changing Earth and Human Activity:** **Distribution of Natural Resources** >Lesson 4>Poll: Drinkable Water; >Interactivity: Distribution of Water Resources; Interactivity: Water Worth; Enrichment: Keeping Water Clean **Human Impacts on the Environment** >Lesson 1> Inquiry Warm-Up Lab: Growth Spurt; >Interactivity: Modern Life; >uInvestigate Lab: Doubling Time >Topic Close> Quest Findings: Reflect on Trash Backlash

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8.4.3 Design a solution to monitor or mitigate the potential effects of the use of natural resources. Evaluate competing design solutions using a systematic process to determine how well each solution meets the criteria and constraints of the problem. Examples of uses of the natural environment could include agriculture, conservation efforts, recreation, solar energy, and water management.	**SE/TE:** **Changing Earth and Human Activity** Reading Check: Integrate with Visuals, 117 Plan It!: Community Considerations, 125 uEngineer It!: Changing Climate Change, 135 Hands-On Lab: uInvestigate, 136, 142 Plan It!: Reducing Waste in Factories, 143 Reading Check: Write Explanatory Texts, 143 uEngineer It!: From Wastewater to Tap Water, 145 **Relationships Within Ecosystems** Design It!: Ecological Restoration, 117 Lesson 4 Check, 118 **Realize™ Digital Resources:** **Changing Earth and Human Activity** **Human Impacts on the Environment** > Topic Launch> uConnect Lab: Finding a Solution for Your Pollution >Lesson 2> Interactivity: Air Pollution and Solutions; >Quest Check-In Lab: Trash versus Water >Lesson 4> Quest Check-In Lab: Reducing Waste >Topic Close>Quest Findings: Reflect on Trash Backlash

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8.4.4 Analyze and interpret data on the factors that change global temperatures and their effects on regional climates. Examples of factors could include agricultural activity, changes in solar radiation, fossil fuel use, and volcanic activity. Examples of data could include graphs of the atmospheric levels of gases, seawater levels, ice cap coverage, human activities, and maps of global and regional temperatures.	**SE/TE:** **Cycles Influencing Weather and Climate** Volcanic Eruptions: Cause and Effect, 117 Math Toolbox: Ice Age Cooling Cycles, 118 Recent Climate Change, 119-122 Humans and Global Warming: Cite Evidence, 120-121 Lesson 2 Check, 123 Impact of Rising Temperatures, 127-130 Cascading Effects of Climate Change, 131 Topic Review and Assess, 136-137 **Earth Systems** Model It!: Sea Ice and Climate, 8 Global-to-Local: When the Ice Melts, 11 Global to Local: A New Mass Extinction?, 181 **Changing Earth and Human Activity** Pollution, 64 Connect It!, 112 Hands-On Lab: uInvestigate, 112, 114 Reading Check: Cite Textual Evidence, 115 **Realize™ Digital Resources:** **Cycles Influencing Weather and Climate: Climate** >Lesson 1> uInvestigate Lab: Classifying Climates >Lesson 2>Interactivity: In the Greenhouse; > Interactivity: Human Impact on Climate Change; >Interactivity: Climate Change Q & A >Lesson 3> Video: Effects of a Changing Climate; >uInvestigate Lab: Thermal Expansion of Water

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8.4.5 Analyze and interpret patterns of the occurrence of natural hazards to forecast future catastrophic events, and investigate how data are used to develop technologies to mitigate their effects. Emphasize how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow prediction, but others, such as earthquakes, may occur without warning.	**SE/TE:** **Cycles Influencing Weather and Climate** How to Predict Weather, 31-33 Learning from Weather Maps, 34-35 Lesson 4 Check, 36 Watching the Clouds Go By, 37 Case Study: The Case of the Runaway Hurricane, 48-49 **Earth Systems** Hands-On Lab: uInvestigate, 120 uEngineer It!: Designing to Prevent Destruction, 131 **Changing Earth and Human Activity** Quest Kickoff: How can I design and build an artificial island?, 2-3 Quest Check-In, 12, 20 uEngineer It!: Ground Shifting Advances, 13 Case Study: Buyer Beware!, 32-33 uDemonstrate Lab: Materials on a Slope, 48-51 **Realize™ Digital Resources:** **Cycles Influencing Weather and Climate** **Weather in the Atmosphere** >Lesson 4>Class Discussion: Weather Prediction Woes; >Interactivity: Using Air Masses to Predict Weather; >uInvestigate Lab: Tracking Weather; >Interactivity: Weather Predicting >Lesson 5>Virtual Lab: Hurricane Season; >uInvestigate Lab: Predicting Hurricanes; >Interactivity: Tinkering with Technology